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DECODING OF FACIAL EXPRESSION OF EMOTION IN CRIMINAL PSYCHOPATHS

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To examine whether psychopaths exhibit specific deficits in nonverbal emotional processing, 20 criminal psychopaths, 23 criminal nonpsychopaths, both groups identified with Hare's (2003) Psychopathy Checklist-Revised, and 25 noncriminals completed the facial affect recognition test developed by Philippot et al. (1999). All participants were males. The criminal psychopaths and nonpsychopaths were confined in a high-security prison. Forty slides were presented on a computer screen, each representing a male or a female actor portraying facial expressions of happiness, anger, sadness, fear, or disgust. Facial stimuli varied in emotional intensity (0%, 30%, 70%, and 100%). Overall, both criminal groups were less accurate than controls in decoding facial expression of emotion. Analysis of covariance showed that this effect is accounted for by differences in level of education of the participants. While criminal nonpsychopaths did not differ from criminal psychopaths in term of overall accuracy, they were less accurate for amygdalian emotion than for nonamygdalian ones. Criminal psychopaths' performance, however, was not affected by the amygdalian nature of the facial display. This pattern of results is opposed to the Blair's amygdalian hypothesis.

Psychopathic men present failures to regulate inappropriate behaviors, to experience the normal range of emotions, and to form meaningful interpersonal ties (Cleckley, 1941; Hare, 1991). Cleckley (1941) stated that "emotional ingredients are absent or negligible" in psychopaths; their affective reactions would be limited in both intensity and in duration across emotions. This statement has profoundly influenced the conception of psychopathy both for clinicians and for researchers. Following Cleckley, many

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researchers have regarded the emotional deficit in psychopathy as more fundamental than its antisocial component (e.g., Hare, 1998; Patrick, 1994; Steuerwald & Kosson, 2000). Some laboratory explorations have been consonant with Cleckley's observations. In particular, research on the autonomic correlates of emotion in classical conditioning has shown that psychopathic men display less electrodermal activity in anticipation of aversive stimuli (electric shock), compared to nonpsychopathic men (e.g., Blair, 1999; Blair, Jones, Clark, & Smith, 1997; Fowles, 2000; Hare, 1978, 1982). This result has been interpreted as reflecting a lack of anxiety that could affect social learning. It also provides the basis for the low-fear explanation of psychopathy, which suggests that the impaired socialization of psychopaths is related to an attenuated ability to experience fear and, subsequently, to a reduced ability to adjust behavior in response to the negative consequences of past and present behavior.

The controlled use of facial expression of emotion as experimental material offers another interesting opportunity to study differential responding to different classes of emotion. In a recent study (Campanella, Vanhoolandt, & Philippot, 2005), male students with high psychopathic tendencies (established by the Minnesota Multiphasic Personality Inventory-2, MMPI-2) were compared to students with low psychopathic tendencies. Facial expression of emotion from the Ekman & Friesen series were used in an event-related potentials study: Participants were confronted with a visual oddball design, in which they had to detect, as quickly as possible, deviant happy, sad, or fearful faces among a train of standard stimuli (neutral faces). Participants with low psychopathic tendencies were more efficient in detecting emotional deviant faces, whatever their emotional tone. This emotional deficit was neurophysiologically indexed by a decreased N300 component, which is supposed to be particularly sensitive to affective features of stimuli rather than to physical characteristics. In this perspective, Stevens, Charman, and Blair (2001) found that children with psychopathic tendencies identified with the Psychopathy Screening Device were impaired in the recognition of sad and fearful faces but not of angry and happy ones. In that experiment, children with psychopathic tendencies and comparison children were presented with 2 facial expressions and 2 vocal tone sub-tests measuring the ability to name sad, fearful, happy, and angry facial expressions and vocal affects. The children with psychopathic tendencies showed selective impairments in the recognition of both sad and fearful facial expressions and sad vocal tone. However, the two groups did not differ in their recognition of happy or angry facial expressions or fearful, happy, and angry vocal tones. In interpreting their results, Stevens and collaborators suggested that the development of psychopathic tendencies might reflect early amygdala dysfunction, as this brain structure is particularly involved in the processing of fear. It should be stressed, however, that the sample used in the study ($n = 18$) was small, and that is consisted exclusively of children, compromising the generalization of the findings to adults.

In another experiment using a facial-expression decoding task, Blair, Colledge, Murray, and Mitchell (2001) compared the sensitivity of children with psychopathic tendencies identified with the Psychopathy Screening Device to controls. Participants were presented with a progressive cinematic display of a standardized set of facial expressions depicting sadness, happiness, anger, disgust, fear, and surprise. Each consecutive facial stimulus presented greater emotional intensity. The children with psychopathic tendencies required a significantly longer string of stimuli before they could recognized sadness. Moreover, even when the fearful expressions were at full intensity, these children were more likely to mistake them for another expression. Again, in interpreting these data, Blair et al. pointed to the amygdala and empathy impairment explanation of psychopathy. However, one should stress again that these observations were collected on children and not on adults. Since then, published data by the same group (Blair et al., 2004) have confirmed this deficient recognition of fearful and sad affective expressions of emotions in an adult psychopathic population.

Dolan and Fullam (2006) sought to test the Integrated Emotion Systems (IES) model under which a psychopathy-related deficit in sad/fear recognition is suggested. To this end, they examined the relationship between psychopathy, as measured by the Psychopathy Checklist: Screening Version (PCL-SV) and recognition of facial affect by comparing the performance of male criminals with dissocial (antisocial) personality disorder (PD group) and healthy male controls on a morphed face affect-processing task. They found that, within the PD group, high-scorers on the PCL were less accurate than low-scorers at classifying sad facial affect. Moreover, a significant negative correlation emerged between total psychopathy score and sad affect recognition accuracy. However, no specific relationship was observed between affect recognition and the subcomponents of psychopathy. The findings suggest that criminality/antisocial personality may be associated with a deficit in the recognition of aversive cues in others and that this deficit is more severe in psychopathic offenders. The findings lend further support to the IES model.

These interesting results on deficient recognition of affects were however not found by Kosson, Suchy, Mayer, and Libby (2002) who presented criminal adult psychopaths and nonpsychopaths identified with the Hare's (1991) PCL-R with a facial affect recognition test. The test consisted of a series of slides depicting prototypic facial expressions. Three hypotheses regarding hemispheric lateralization anomalies in psychopaths were also tested (right-hemisphere dysfunction, reduced lateralization, and reversed lateralization). The authors reported that psychopaths' deficits were specific to the classification of disgust faces only when participants were required to use their left hand, that is, in conditions designed to minimize the involvement of left-hemisphere mechanisms. Further, contrary to expectations, psychopaths were observed to be better at decoding anger when relying on left-hemisphere resources (i.e., when using their right hand). These authors also examined whether psychopaths exhibit general versus specific deficits in nonverbal emotional processing: Psychopaths proved less accurate than nonpsychopaths at classifying facial affect under conditions fostering reliance on right-hemisphere resources and displayed a specific deficit in classifying disgust. Based on these findings, Kosson et al. concluded that psychopaths presented specific deficits in nonverbal emotional processing. On the base of a large prison sample, Glass and Newman (2006) have examined the reliability of facial affect processing deficits found in psychopathic individuals and whether they could be modified by attentional set. They used a two conditions relating to the identification of number and the localization of emotion words prior to the presentation of facial expression pictures. Contrary to prediction, psychopathic offenders performed as well as controls in both conditions. The authors concluded that the conditions that reveal affective deficits in psychopathic individuals require further specification. Finally, Book, Quinsey, and Langford (2007) recently reported that psychopathy was not associated with a deficit in categorizing emotions. PCL-R was positively correlated with accuracy in judging intensity of emotion (including fear). According to these authors, psychopaths lack feeling for the person in distress while knowing that the individual is distressed.

In sum, research on male psychopaths' recognition of emotional facial expression presents a unique opportunity to investigate potential emotional processing deficits in psychopathy. Unfortunately, existing studies diverge importantly in their methods and results. Some reported a general emotional decoding deficit while others reported specific deficits in decoding facial expressions of fear and sadness, and still others reported deficits associated with disgust expressions and right-hemisphere implication. These discrepant results might be accounted for by methodological differences.

First, some studies were conducted on children, while others were conducted on adults. While developmental studies are certainly useful to investigate the origin and onset of a disorder, they do not constitute the most appropriate approach to determine the exact nature of psychopathy, an adult personality disorder. In this context, firmly establishing potential deficits or biases in an adult psychopaths population seems to be a priority, and data collected on children should not be generalized to adults. In addition, such studies should target groups clearly contrasted on psychopathy, and not merely differing in terms of psychopathic tendencies.

Second, the experimental stimuli differed importantly among studies. Some focused on a limited array of two or three emotions, most used extreme prototypical facial expressions. Not only do such full-blown displays have little ecological validity, but they are also easy to decode and the use of such a material is likely to produce ceiling effects (Hess, Blairy, & Kleck, 1997). Further, such extreme stimuli might have acted as UCs (Öhman, 1996; Öhman & Soares, 1993) and have left little room for individual variance. In the study of psychopathy, the only exception is use of a progressive cinematic display by Blair et al. (2001), but this test was conducted on an adolescent population.

Third, a variety of paradigms have been used: decoding tasks, reaction time tasks, oddball tasks, etc. Each paradigm has its own advantages and limitations. Given the inconsistencies in results observed, the best option presently might be to opt for a straightforward paradigm, directly assessing how psychopaths explicitly decode emotional expressions. Paradigms relying on implicit measures might be more indicated once this preliminary question is settled.

To address this question and limitations, we investigated a group of adult male criminal psychopaths confined in a Belgian state prison with a sensitive facial expression decoding test described in the literature (Philippot et al., 1999) and using a wide array of stimuli in terms of both intensity and emotional nature of the expression. This psychopath group was compared to a group of criminal nonpsychopaths, also confined in a Belgian state prison, and to a control group of noncriminal males. To our knowledge, this is the first test of adult psychopaths' performance in the decoding of facial expression using such a wide and sensitive array of stimuli, with two control groups.

This procedure allows to test several hypotheses proposed in the literature. One concerns the possibility of a global impairment in emotional processing, and thus in the decoding of the facial expression of emotion in terms of accuracy and intensity attributed to the display. Another concerns the possibility of a differential sensitivity to specific emotions. For instance, we examined the hypothesis of an amygdala dysfunction which predicts a specific deficit in the decoding of the facial expression of fear and sadness (see Blair et al., 2001). Finally, as an anosognosy for a deficit in facial expression decoding as been observed in some clinical population (e.g., Philippot et al., 1999), we also investigated whether the three experimental groups differ in the estimation of their decoding performance. Specifically, we asked them to report for each expression the amount of difficulty they experienced in decoding it.

METHOD

PARTICIPANTS

The study's 43 French-speaking male inmate participants were confined to a high-security prison. Participants had been arrested for a variety of offenses, including petty or aggravated theft, robbery, assault and battery, homicide or attempted homicide, kidnapping, forcible confinement, narcotics-related offenses, arms possession, unlawful driving behavior, fraud, possession of stolen goods, and sexual offenses. Prison participants were assigned to either a psychopath group (P, $n = 20$) or a nonpsychopath group (nP, $n = 23$) based on their score on Hare's PCL-R. The P group had PCL-R scores ranging between 25 and 32, and the nP group between 4 and 20. These cut-off scores are consistent with data suggesting that the mean PCL-R score is lower for most European samples compared with North American samples (Cooke, 1996, 1998; Cooke, Michie, Hart, & Clark, 2005; Pham, 1998). As shown in Table 1, the two groups differed on both factors of the PCL-R.

These two prison inmate groups were compared to a control group (C) of 25 noncriminal males with no history of psychiatric or psychopathological disorders and no criminal priors. They were assessed by supplementary questions concerning whether they had previously experienced a psychiatric disorder, or had consulted a psychologist, physician, or other professional, or had received medication for such a disorder. In addition, it was ascertained that none of them had ever been jailed. They were recruited among the technical and maintenance staff of the university within the same age range as the prison inmates, and an attempt was made to find individuals with an education level similar to the one of the prison inmates.

Table 1 shows that the three groups did not differ in terms of age, but that the controls benefited from more years of education than both inmate groups.

STIMULI

The emotional facial stimuli used in this study were developed by Hess and Blairy (Hess & Blairy, 1995; Hess et al., 1997). Specifically, Hess and Blairy selected facial expressions of happiness, anger, sadness, disgust, and fear for two male and two female Caucasian actors from a series of standardized emotional facial expressions (Matsumoto & Ekman, 1988). Based on the neutral face (0% of emotional intensity) and the full-blown emotional facial expression (100% of emotional intensity) of the same actor, and using the computer program Morph 1.0, a series of intermediate expressions differing in emotional intensity by 10% steps was constructed. A set of 4 (intensity: 0%, 30%, 70%, 100%) × 5 (emotions: happiness, anger, sadness, disgust, and fear) × 2 (actor gender) stimuli constituted the stimulus material. The four actor identities were randomly distributed across the 4 × 5 × 2 stimulus design, with the constraint that each actor

TABLE 1. Means of Psychopathy (Psychopathy Checklist Revised, PCL-R), Age, and Years of Education as a Function of Group Status (S.D. in parentheses)

	Psychopath Inmates (n = 20)	**Nonpsychopath Inmates (n = 23)**	**Controls (n = 25)**	
PCL-R Mean	27.25 (2.15)	4.70 (4.62)	n.a.	$F(1,41) = 242.82$, $p < .0001$
PCL-R Range	25–32	4–20	n.a.	n.a.
PCL-R Factor 1	10.50 (2.28)	4.70 (3.52)	n.a.	$F(1,41) = 39.74$, $p < .0001$
PCL-R Factor 2	14.30 (2.96)	4.26 (3.11)	n.a.	$F(1,41) = 116.75$, $p < .0001$
Mean Age	34.00 (10.11)	34.61 (8.81)	35.48 (7.88)	$F(2,65) = .16$, ns.
Mean Years of Education	8.60 (2.39)	8.32 (2.06)	13.88 (3.32)	$F(2,65) = 32.02$, $p < .0001$

was had a similar occurrence. These 40 stimuli were presented in random order on an Apple Macintosh PowerBook 160.

PROCEDURE

The experimenter explained to the participants that their task was to determine the emotions portrayed by a series of stimulus persons. In order to familiarize the participants with the procedure and the use of the computer, they completed two practice trials during which the experimenter answered any questions they might have. Participants then completed the task alone and unassisted.

Following the procedure developed by Philippot et al. (1999), participants rated each expression on seven-point intensity scales for eight emotions: happiness, sadness, fear, anger, disgust, surprise, shame, and contempt. These scales were presented in random order on the computer screen below the facial expression 3 seconds after the face began to be displayed. The face remained on the computer screen until all scales were completed. Thereafter, participants also rated the task difficulty (i.e., how difficult it had seemed to them to guess the emotion portrayed by the specific facial expressions). This scale was included as previous research has shown that some clinical populations present important nonverbal decoding deficits, but are not aware of them and report no greater difficulty in the decoding task than healthy controls (for a review see, Philippot, Douilliez, Pham, Foisy, & Kornreich, 2004). All scales were anchored by Not at All at one extremity and Very Intensely at the other. There was an intertrial interval of 2 seconds between each facial expression. The criminal groups were tested individually in a quite room of the prison and the control group was tested individually in a quite room of the university.

DEPENDENT MEASURES

Three types of dependent measures were recorded: decoding accuracy, emotional intensity, and decoding difficulty. Decoding accuracy was computed for all stimuli but for the ones of 0% of emotional intensity (neutral faces). Decoding accuracy was defined as the observers' ability to correctly infer the posed emotion. An expression was considered as accurately identified when the emotion scale receiving the highest intensity rating on the emotion profile corresponded to the target emotion. An accurately identified expression received a score of 1 and a misidentified expression received a score of 0. These scores were aggregated across stimuli for each emotion by intensity condition. The intensity scores consisted in the average intensities of each emotional scale for each emotion × intensity stimulus condition. Decoding difficulty scores consisted in average intensities ratings of difficulty filled in by the participants for each emotion × intensity stimulus condition.

ANALYSIS OF THE DATA

Data analyses were conducted in three steps. MANOVA were run to compare the groups in terms of (1) decoding accuracy, (2) emotional intensity attributed to facial expressions, and (3) self-rated task difficulty. Post-hoc analyses using the Bonferroni procedure were applied when an effect needed to be specified. In order to control the potential effect of education on the results, we also conducted MANCOVA with years of education as covariate. Earlier data reported by Blair and colleagues (2001) suggested that IQ was positively related, although nonsignificantly, to the ability to recognize the expression of emotion.

RESULTS

DECODING ACCURACY

To assess whether experimental groups differ in their ability to decode emotional facial expressions, a MANOVA with emotion (joy, anger, fear, sadness, and disgust) and intensity (30%, 70%, and 100%) as within-subject factors and group (P, nP, & C) as between-subjects factor was conducted on the accuracy scores. The group effect was significant, $F(2, 65) = 4.61$, $p = .02$. Post-hoc analyses indicated that controls performed better than the two criminal groups. This effect of group was modulated by an interaction with intensity, $F(4, 130) = 2.45$, $p = .05$. Post-hoc analyses revealed that while there were no group differences at 30% expressive intensity level, likely due to a floor effect, C outperformed the two criminal groups for the 70 and 100% expressive intensity levels. This pattern of results is displayed in Table 2.

Of minor relevance for the present question, intensity and emotion main effects were observed, $F(2, 64) = 174.98$, $p = .0001$ and $F(4, 62) = 27.45$, $p = .0001$, respectively. These effects were modulated by the intensity × emotion interaction, $F(8, 58) = 10.27$, $p = .0001$. No other effect reached significance. Post-hoc analyses revealed that (a) decoding accuracy did not differ between the 70 and 100% intensity level conditions, (b) at the 70 and 100% intensity levels, joy facial expressions of emotion (FEE) were more accurately decoded than the other FEE that did not differ among

TABLE 2. Means of Decoding Accuracy as a Function of Group Status, and Stimulus Intensity (S.E. in parentheses)

Stimulus Intensity	Psychopath Inmates ($n = 20$)	Nonpsychopath Inmates ($n = 23$)	Controls ($n = 25$)	Total Sample
30%	.33c (.13)	.34c (.14)	.38c (.15)	.35 (.16)
70%	.60b (.18)	.66b (.19)	.79a (.20)	.68 (.16)
100%	.70b (.22)	.69b (.19)	.84a (.20)	.74 (.16)
Total	.55 (.13)	.56 (.14)	.67 (.15)	

Note. Means with different subscripts differ at $p < .05$ in between groups comparisons.

each other, all being above chance level, and (c) at the 30% intensity level, decoding accuracy was highest for happiness, sadness was higher than disgust, that in turn was higher than anger and fear, the two latter not differing from chance level.

Correlations between years of education and decoding accuracy scores revealed some weak associations for anger, $r(67) = .29$, $p < .02$, disgust, $r(67) = .25$, $p < .04$, and sadness, $r(67) = .29$, $p < .02$. The association between education and accuracy only appeared at the 70 and 100% intensity level, (correlation with total accuracy at 70% intensity level: $r(67) = .29$, $p < .02$ and at 100% intensity level: $r(67) = .36$, $p < .002$). Therefore, a 3 (intensity) × 5 (emotion) × 3 (group) MANCOVA with year of education as covariate was computed on the accuracy scores. In that analysis, no effect involving group reached significance.

Correlations between the psychopathy scores (Factors 1 and 2, and total score of the PCL-R) and decoding accuracy scores were computed in the criminal samples. None reached significance.

EMOTIONAL INTENSITY ATTRIBUTED TO FACIAL EXPRESSIONS

A MANOVA with emotion (joy, anger, fear, sadness, and disgust), intensity (0%, 30%, 70%, and 100%) and emotion scale (joy, anger, fear, sadness, disgust, surprise, shame, and contempt) as within-subject factors and group (P, nP & C) as between-subjects factor was computed on emotion intensity ratings. No effects involving group were observed.

SELF-RATED TASK DIFFICULTY

A MANOVA with emotion (joy, anger, fear, sadness, and disgust) and intensity (0%, 30%, 70%, and 100%) as within-subject factors and group (P, nP & C) as between-subjects factor was computed on self-rated task difficulty. The stimulus intensity effect proved significant, $F(3, 63) = 12.25$, $p = .0001$: Participants reported more difficulties with 0 and 30% intensity stimuli than with 70 and 100% ones. Directly relevant for the present question, this effect was modulated by a Stimulus intensity × Group interaction, $F(6,128) = 2.33$, $p = .04$. The pattern of results is displayed in Table 3. Post-hoc analyses revealed that C reported more difficulties in the 0% stimulus intensity condition than both criminal groups and that P reported less difficulties in the 100% intensity condition than both other groups. The emotion effect also reached significance, $F(4, 62) = 5.62$, $p = .001$. It was modulated by an Emotion × Stimulus intensity interaction, $F(12, 54) = 3.64$, $p = .0001$. Overall, post-hoc analyses revealed that joy and disgust were judged as less difficult to decode, and that stimulus intensity had less impact on decoding difficulty for sadness and fear than for the other emotions.

No correlations were observed between the self-rated difficulty scores and years of education. Similarly, in the criminal samples, no correlations

TABLE 3. Means of Self-Rated Difficulty as a Function of Group Status, and Stimulus Intensity (S.D. in parentheses)

Stimulus Intensity	Psychopath Inmates (*n* = 20)	Nonpsychopath Inmates (*n* = 23)	Controls (*n* = 25)	Total Sample
0%	2.91b (.24)	2.65b (.22)	3.38a (.21)	2.98 (.13)
30%	3.06a (.28)	2.90a (.26)	3.36a (.25)	3.11 (.15)
70%	2.54a (.24)	2.59a (.23)	2.68a (.22)	2.61 (.13)
100%	2.22b (.23)	2.56a (.21)	2.70a (.20)	2.49 (.12)
Total	2.68 (.23)	2.67 (.21)	3.03 (.20)	

Note. Means with different subscripts differ at $p < .05$ in between groups comparisons.

were observed between the psychopathy scores (Factors 1 and 2, and total score of the PCL-R) and self-rated difficulty scores.

BLAIR'S AMYGDALA HYPOTHESIS

Finally, we directly tested the amygdala dysfunction hypothesis proposed by Blair et al. (2001). According to this hypothesis, psychopaths are specifically impaired in processing facial expressions of sadness and fear but not of happiness, anger, and disgust. We aggregated decoding accuracy scores for sadness and fear (amygdalian emotion score) and those of happiness, anger, and disgust (nonamygdalian emotion score). A 2 (amygdalian vs. nonamygdalian emotion) × 3 (group) MANOVA revealed significant effects for emotion, $F(1, 65) = 21.87$, $p = .001$, amygdalian emotion being less accurately decoded, and for group, $F(2, 65) = 4.77$, $p = .02$, C being more accurate than both criminal groups. These effects were modulated by an Emotion × Group interaction, $F(2, 65) = 3.64$, $p = .04$. This interaction remained significant when only the two criminal groups were considered in a subsequent MANOVA, $F(1, 41) = 4.36$, $p = .05$. The pattern of results is displayed in Table 4. Post-hoc revealed that both criminal groups performed worst than C for amygdalian emotions. However, for nonamygdalian emotions, P were outperformed by the Np and C. In addition while no differences appeared between amydgalian and nonamygdalian emotions for P, nP were less accurate for amygdalian emotions than for nonamyg-

TABLE 4. Means of Decoding Accuracy as a Function of Group Status, and Emotional Nature of the Stimulus (S.E. in parentheses)

Emotional Nature of the Stimulus	Psychopath Inmates (*n* = 20)	Nonpsychopath Inmates (*n* = 23)	Controls (*n* = 25)
Amygdalian	.51bI (.15)	.46bI (.19)	.64aI (.20)
Nonamygdalian	.57bI (.13)	.63abI (.14)	.70aI (.15)

Note. Means with different alphabetical subscripts differ at $p < .05$ in between groups comparisons. Means with different Roman numerical subscripts differ at $p < .05$ in between emotions comparisons.

dalian ones. This pattern of results is opposed to the Blair's hypothesis predictions. Finally, it should be noted that the Emotion × Group interaction disappeared in a MANCOVA using the PCL-R total score as covariate, computed on the criminal samples only. Thus the differences between P and nP in their differential capacity to decode amygdalian versus nonamygdalians emotion can be accounted for by their level of psychopathy.

DISCUSSION

In this study, we investigated the possibilities of general or specific deficits or biases in psychopaths' decoding of facial expression of emotion in terms of accuracy, intensity of expression, and perceived task difficulty. We also examined specifically the hypothesis of an amygdala dysfunction proposed by Blair et al. (2001) and its partial confirmation of Dolan and Fullam (2006).

Regarding decoding accuracy, the present results indicate that both criminal groups (psychopaths and nonpsychopaths) are less accurate than normal controls. This difference, however, is accounted for by the difference in term of years of education between the criminal and noncriminal groups. It should also be noted that no group differences appeared in terms of emotional intensity attributed to the facial displays. Thus, our observation of lack of difference between criminal psychopaths and nonpsychopaths in term of overall accuracy is congruent with the observation of Kosson et al. (2002) and Glass and Newman (2006). It should be stressed that these studies and our study have been conducted on a criminal adults population. Studies of Blair and colleagues (2001) that have reported differences in facial expression decoding of sadness and fear in psychopathy have been conducted on children or adolescent noncriminal populations.

Further, it should be stressed that the statistical power was satisfactory or high for the effects contrasting criminal nonpsychopaths and psychopaths on decoding accuracy. Indeed, according to a power analysis, to obtain a difference in overall decoding accuracy level between the criminal nonpsychopaths and psychopaths groups significant at the $p = .05$, the sample size should have been of more than 11.130 participants in each group. This lack of difference is especially remarkable given that the FEE decoding test used is particularly sensitive: A large set of FEE was used, varying in terms of intensity and of emotion, and a wide array of judgment items was proposed to participants. With the exact same procedure, we have successfully evidenced FEE decoding deficits in alcoholics, just after a detoxification cure, as well as after a long-term abstinence (Philippot et al., 1999; Kornreich et al., 2001). We thus believe that the present results are not due to a lack of sensitivity of the instruments and procedures used.

Yet, we observed that both criminal groups were less accurate than the noncriminal control group. This raises the possibility that the differences reported by studies conducted on children or adolescent populations are tapping an individual difference that would be more predictive of a criminal career than of psychopathy itself. However, this interpretation should be considered very cautiously, given that the difference we observed can be accounted for by the level of education.

Interesting differences between the psychopath and nonpsychopath criminal groups emerged when specifically contrasting amygdalian emotions (sadness and fear) to nonamygdalian emotions (happiness, anger, and disgust). While the amygdalian nature of the emotion did not effect upon criminal psychopaths'accuracy, it modulated significantly criminal nonpsychopaths' accuracy: Criminal nonpsychopaths were more accurate than criminal psychopaths in decoding nonamygdalian emotions, but no differences emerged regarding amygdalian emotions. In addition, a covariance analysis attested that these differences in accuracy between the two criminal groups were fully accounted for by their difference in term of psychopathy. In sum, psychopathy does indeed modulate the ability to decode amygdalian (sadness and fear) versus nonamygdalian emotions (happiness, anger, and disgust). It should be noted that the pattern of the modulation observed in the present study is not consistent with the one reported by Blair et al. (2001). Indeed, while we observed in nonpsychopaths the amygdalian modulation predicted by Blair for psychopaths, we did not observe such modulation in psychopaths.

Again, it should be stressed that previous observations of Blair and collaborators have been made on children presenting psychopathic tendencies. Not denying the intrinsic interest of such observations, our results, together with those of Kosson et al. (2002) calls for caution in applying those observations to adults, and even more to criminal adults.

For now, our reading of the literature is that there are no evidences of a severe, clinically significant, bias, or impairment in the processing of emotional facial expression that would be proper to adult criminal psychopaths. First, the differences evidenced by Kosson et al. (2002) were observed only under conditions in which participants were constraint to rely solely on their right hemisphere, and the deficit was very specific to some emotions. Second, in the present study, no strong differences were evidenced in the criminal groups—only a small difference when considering nonamygdalian emotions. However, this latter difference is contradictory to previous evidence (Blair et al., 2001). Although not being able to reject the null hypothesis does not ascertain that there are no differences in reality, one can infer from the available evidences that it is unlikely that psychopathy is characterized by a strong explicit bias in FEE decoding. If such explicit bias exists, it might be moderate and have little clinical significance. This contention raises important questions for our understanding of facial expressions of emotion processing, and more generally, of emotional processing in male adult psychopaths. As stated by Kosson et al. (2002), psychopath impairments might be subtle and very specific. Moreover, the conditions that reveal affective deficits in psychopathic individuals require further specification (Glass & Newman, 2006). This contrasts with the caricature of psychopaths as emotional misers sometime made in the literature. The general emotional poverty argument proposed by Cleckley (1941) may be not completely accurate. In this perspective, Book et al. (2007) proposed the notion of “callous empathy”: Psychopaths lack feeling for others while understanding their mental states.

The three groups perceived differently the difficulty of the task. Overall, the healthy controls, who present superior performance in decoding accuracy, tended to report more difficulties, especially for weak intensity emotions. In contrast, the criminal participants, and particularly the psychopaths for high intensity displays, reported less difficulties, while their objective performance was lower than that of controls. Obviously, the criminal groups, and especially the psychopaths, did not perceive that they suffer from a deficit in decoding facial expression of emotion. To the contrary, compared to normal controls, they over-estimated their ability.

The present study presents certain limitations. First, while optimal for estimating decoding accuracy, the design of the facial-expression decoding test does not allow for controlling reaction time. We agree with Kosson et al. (2002) that the absence of response latency data precludes examination of whether the poorer accuracy demonstrated by criminal groups is a function of faster—more impulsive—responses to affective stimuli. Although response latency indices are generally more sensitive when accuracy is higher, speed-accuracy tradeoffs in this task remain possible. It would also be congruent with the greater confidence in their performance displayed by the criminal groups on task difficulty ratings.

Second, unlike Kosson et al. (2002), we did not assess the possibility of hemispheric asymmetry. Kosson et al. suggested that, psychopaths are less accurate than nonpsychopaths on facial affect recognition, only under conditions designed to promote reliance on right-hemisphere resources.

Finally, future research should control for co-morbidity and especially alcoholism diagnoses in criminals and noncriminals. We do not believe, however, that co-morbidity might account for the present pattern of results, as there is little association between psychopathy and other disorders form the axis I of the DSM. Indeed, among a mixed sample of 123 men coming from either Belgian high security prison or a Belgian forensic hospital; i.e., a population similar to the one investigated in the present study, Pham, Malingrey, Ducro, and Saloppé (2007) found that the total score of the PCL-R was not associated with axis-1 disorders with the exceptions of conduct disorder (.42), drug abuse (.31), and pathological game (.27). The relation with alcohol abuse was not significant (.16). Similarly, among a forensic psychiatric sample of 80 men, Hart and Hare (1989) found that psychopathy was either unassociated or negatively associated with most axis-I mental disorders other than substance use disorders. It should be noted that the present pattern of results is very different from the one observed for alcoholics. Indeed, using the same procedure as the present one, Philippot et al. (1999) found that chronic alcoholics presented three deficits in the interpretation of facial expression: They over-estimated the intensity of the emotion felt by their interactants, presented a systematic bias by over-attributing emotions of anger and contempt, and were unaware of their nonverbal deficits. The only common feature between these observations on alcoholics and the present observation on psychopaths is the lack of awareness of the deficit.

REFERENCES

Blair, R.J.R. (1999). Responsiveness to distress cues in the child with psychopathic tendencies. *Personality and Individual Differences, 27*, 731–739.

Blair, R. J., Colledge, E., Murray, L., & Mitchell, D. G. (2001). A selective impairment in the processing of sad and fearful expressions in children with psychopathic tendencies. *Journal of Abnormal Child Psychology, 29,* 491–498.

Blair, R.J.R., Jones, L., Clark, F., & Smith, M. (1997). The psychopathic individual: A lack of responsiveness to distress cues? *Psychophysiology, 34,* 192–198.

Blair, R.J.R., Morris, J. S., Frith, C. C., Perrett, D. I., & Dolan, R. J. (1999). Dissociable neural responses to facial expressions of sadness and anger. *Brain, 122,* 883–893.

Blair, R., Mitchell, D., Peschardt, K., Colledge, E., Leonard, R., Shine, J., et al. (2004). Reduced sensitivity to others' fearful expressions in psychopathic individuals. *Personality and Individual Differences, 37*, 1111–1122.

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

Campanella, S., Vanhoolandt, M. E., & Philippot, P. (2005). Emotional deficit in subjects with psychopathic tendencies as assessed by the MMPI-2: An event-related potentials study. *Neuroscience Letters, 373*, 26–31.

Cleckley, H. (1941). *The mask of sanity.* St. Louis, MO: Mosby.

Cooke, D. J. (1996). Psychopathic personality in different cultures: How much do we know? What do we need to find out? *Journal of Personality Disorders, 10*, 23–40.

Cooke, D. J. (1998). Psychopathy across cultures. In D. J. Cooke, A. E. Forth, & R. D. Hare (Eds). *Psychopathy: Theory, research and implications for society* (pp. 13–45). NATO ASI Series. Dordrecht: Kluwer Academic Publishers.

Cooke, D. J., Michie, C., Hart, S. D., & Clark, D. (2005). Searching for the pan-cultural core of psychopathic personality disorder. *Personality and Individual Differences, 39,* 283–295.

Dolan, M., & Fullam, R. (2006). Face affect recognition deficits in personality-disordered offenders: Association with psychopathy. *Psychological Medecine, 36,* 563–1569.

Glass, S. J., & Newman, J. P. (2006). Recognition of facial affect in psychopathic offenders. *Journal of Abnormal Psychology, 115,* 815–820.

Hare, R. D. (1978). Electrodermal and cardiovascular correlates of psychopathy. In R. D. Hare & D. Shalling (Eds.), *Psychopathic behavior: Approaches to research* (pp. 107–142). Chicester, UK: Wiley.

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

Hare, R. D. (1991). *The Hare psychopathy checklist—revised.* Toronto, Ontario, Canada: Multi-Health Systems.

Hare, R. D. (2003). *The Hare psychopathy checklist—revised* (2nd ed.). Toronto, Ontario, Canada: Multi-Health Systems.

Hare, R. D. (1998). Psychopathy, affect and behavior. In D. J. Cooke, A. E. Forth, & R. D. Hare (Eds). *Psychopathy: Theory, research and implications for society* (pp.105–137). NATO ASI Series. Dordrecht: Kluwer Academic Publishers.

Hart, S. D., & Hare, R. D. (1989). Discriminant validity of the psychopathy checklist in a forensic psychiatric population. *Psychological Assessment: A Journal of Consulting and Clinical Psychology, 1*, 211–218.

Hess, U., & Blairy, S. (1995). *Set of emotional facial stimuli.* Montréal, Canada: Department of Psychology, Université du Québec à Montréal.

Hess, U., Blairy, S., & Kleck, R. E. (1997). Intensity of emotional facial expression and decoding accuracy. *Journal of Nonverbal Behavior, 21*, 241–257.

Kornreich, C., Blairy, S., Philippot, P., Hess, U., Noël, X., Streel, E., et al. (2001). Deficits in recognition of emotional facial expression are still present after mid to long-term abstinence in alcoholics. *Journal of Studies on Alcohol, 62*, 533–542.

Kosson, D. S., Suchy, Y., Mayer, A. R., & Libby, J. (2002). Facial affect recognition in criminal psychopaths. *Emotion, 2*, 398–411.

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

Matsumoto, D., & Ekman, P. (1988). *Japanese and Caucasian facial expressions of emotion and neural faces.* San Francisco: San Francisco State University.

Öhman, A. (1996). Preferential preattentive processing of threat in anxiety: Preparedness and attentional biases. In R. M. Rapee (Ed.). *Current controversies in the anxiety disorders.* New York: Guilford Press.

Öhman, A., & Soares, J.J.F. (1993). On the automatic nature of phobic fear: Conditioned electrodermal responses to masked fear-relevant stimuli. *Journal of Abnormal Psychology, 102*, 121–132.

Patrick, C. J. (1994). Emotion and psychopathy: Startling new insights. *Psychophysiology, 31,* 319–330.

Pham, H. T. (1998). Evaluation psychométrique du questionnaire de la psychopathie de Hare auprès d'une population carcérale belge. *L'Encéphale, 24*, 435–441.

Pham, H. T, Malingrey, F., Ducro, C., & Saloppé, X. (2007). Psychopathie et troubles mentaux graves chez les patients internés. *Annales Médico-Psychologiques, 165*, 511–516.

Philippot, P., Douilliez, C., Pham, T., Foisy, M.-L., & Kornreich, C. (2004). Facial expression decoding deficits in clinical populations with interpersonal relationship dysfunctions. In R. Riggio, & R. S. Feldman (Eds.), *Application of nonverbal behavior.* Lauwrence Erlbaum Associates.

Stevens, D., Charman, T., & Blair, R. J. (2001). Recognition of emotion in facial expressions and vocal tones in children with psychopathic tendencies. *Journal of Genetic Psychology, 162*, 201–211.

Steuerwald, B. L., & Kosson, D. S. (2000). Emotional experiences of the psychopath. In C. B. Gacono (Ed.), *The clinical and forensic assessment of the psychopath: A practitioner's guide* (pp. 111–135). Hillsdale, NJ: Erlbaum.