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Categorization and evaluation of emotional faces in psychopathic women
Author links open overlay panelHedwig Eisenbarth a, Georg W. Alpers a, Dalia Segrè b, Antonino Calogero c, Alessandro Angrilli b d
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Abstract
Psychopathic individuals have been shown to respond less strongly than normal controls to emotional stimuli. Data about their ability to judge emotional facial expressions are inconsistent and limited to males. To measure categorical and dimensional evaluations of emotional facial expressions in psychopathic and non-psychopathic women, 13 female psychopathic forensic inpatients, 15 female non-psychopathic forensic inmates and 16 female healthy participants were tested in an emotion-categorizing task. Emotional facial expressions were presented briefly (33 ms) or until buttonpress. Participants were to classify emotional expressions, and to rate their valence and arousal. Group differences in categorization were observed at both presentation times. Psychopathic patients performed worst with briefly presented sad expressions. Moreover, their dimensional evaluation resulted in less positive ratings for happy expressions and less arousal for angry expressions compared with the responses of non-psychopathic and normal subjects. Results shed light on the mechanism possibly underlying the emotional deficits in psychopathic women.

* Previous article in issue
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Keywords
Psychopathy
Female inmates
Emotion detection
Facial expression recognition
1. Introduction
Psychopathy has been characterized as a clinical construct that comprises, amongst other characteristics, antisocial deviance and deficient affect (Hare et al., 1990) that are reflected in shallow affect, lack of empathy, remorse or guilt, and failure to accept responsibility.
According to the Violence Inhibition Model (VIM; Blair, 1995), distress cues do not inhibit aggressive behavior in psychopathic people as they do in healthy people. According to this model, the absent effect of distressing stimuli is due to a failure of the psychopathic individual to decode emotional stimuli. As part of the deficient affect, this decoding deficit can be found in reduced physiological or cortical activations in response to emotional stimuli (i.e., Kiehl et al., 2001, Benning et al., 2005) as well as in reduced behavioral responses. In particular, reactions to stimuli with sad or fearful content evoke weaker reactions in psychopathic persons than in controls (e.g., Levenston et al., 2000, Blair et al., 2001). Nevertheless, reported results vary from no group differences (e.g., Campanella et al., 2005, Glass and Newman, 2005, Kreklewetz and Roesch, 2005) and even better emotion decoding performance of psychopathic participants (Habel et al., 2002) to group differences for specific facial expressions (e.g., Blair et al., 2004, Montagne et al., 2005). The latter studies found impaired emotion categorization in psychopathic participants for negative emotional expressions, but past research included only male participants. To our knowledge, there are so far no data on emotion detection or emotion categorization in psychopathic women; therefore, this study investigates facial affect recognition and evaluations in female psychopaths.
In order to consider most of the aspects of facial picture presentation, we included facial expressions of all seven basic emotions and presented the facial expressions for two different presentation durations. In one block, facial expressions were shown briefly and masked, so as to limit the processing time for decoding the corresponding emotion category and thereby revealing deficits in psychopaths' spontaneous emotion categorization compared with deficits in cognitively elaborated emotion decoding. A condition that did not limit the time to process the stimuli was included in a second block of presentations with ad libitum duration, until participants decided which button they wanted to press.
In addition to this classical categorizing task, based on Ekman's idea of distinct emotions, we also included a dimensional evaluation task based on the model of Russell (Lang, 1979, Posner et al., 2005) by asking subjects to rate their self-perceived valence and arousal levels. The use of these ratings could provide a more detailed picture of the emotion decoding deficit through the dimensional rating. Furthermore, the paradigm combines a quite obvious question on emotion in the valence dimension and a rather indirect question on emotion decoding in the arousal dimension.
In sum, this study examines differences in categorization and evaluation of emotional facial expressions between psychopathic and non-psychopathic women and a female control group.
2. Method

2.1. Design
This study was conducted in a 3 (group: female psychopathic patients, female non-psychopathic patients, and female healthy control participants) × 2 (duration: short picture presentation and ad libitum picture presentation) × 7 (emotion category: afraid, angry, disgust, happy, neutral, sad, surprise) design. The dependent variables were the hit rates and the response latencies as well as the ratings of the stimuli for valence and arousal levels. Age, years of education and age-related intelligence, measured by Raven's Standard Progressive Matrices set A (Raven, 1938), were taken into account as covariates.
2.2. Participants
In this study three groups of participants took part (_n_ = 44). Two groups of female forensic patients were recruited at a forensic hospital in Northern Italy (Ospedale Psichiatrico Giudiziario di Castiglione delle Stiviere).
Patients were inmates in the high security psychiatric facility and were convicted for physical assault or homicide. One more group of healthy control participants was recruited at the University of Padova, and consisted of female employees working at the administration offices of the Faculty of Psychology (_n_ = 16). For the forensic patients the PCL-R scores (Hare et al., 1990) were assessed and two groups were formed, one with scores greater than or equal to 30 (_n_ = 13, _M_ = 31.77, _SD_ = 1.17, range: 30?34), according to the guidelines of Hare et al. (1990), and one with scores below 30 (_n_ = 15, _M_ = 17.40, _SD_ = 6.21, range: 7?28). Patients with psychotic symptoms were excluded. In both patients groups the primary diagnoses of the patients were personality disorders. The distribution of the individual personality disorder diagnoses (histrionic PD, borderline PD, paranoid PD, schizotypical PD and antisocial PD) was not equal due to the priority given to the psychopathy score. Since distributions of Psychopathy Checklist-Revised scores in the normal population are very low, the group of employees was considered to be low on psychopathy.
The three groups differed significantly in age, due to the _a priori_ categorization criterion based on the psychopathy score (_F_(2,41) = 7.08; _P_ = 0.01). The psychopathic patients (_M_ = 33.00; _SD_ = 7.66) were relatively younger and differed significantly from non-psychopathic patients (_M_ = 46.67; _SD_ = 14.88) and from the employees (_M_ = 44.19; _SD_ = 5.19). There were no age differences between non-psychopathic patients and employees.
For the level of education, there was an overall difference between all groups (_F_(2,41) = 8.24; _P_ = 0.01), which revealed the lowest level of education in psychopathic patients (_M_ = 8.15; _SD_ = 3.08) and a higher level in non-psychopathic patients (_M_ = 11.60; _SD_ = 3.70) and employees (_M_ = 13.94; _SD_ = 4.17). Concerning intelligence, the forensic groups did not differ in intelligence measured by age- and education-corrected Raven's scores (_T_(26) = 8.24; _P_ = 0.15) (see Table 1).
Table 1. Numbers of participants, numbers of right-handed/ambidextrous participants, means and standard deviations for age, education and Raven's Standard Progressive Matrices

Empty Cell	Psychopathic patients	Non-psychopathic patients	Employees	Sum
_n_	13	15	16	44
Right-hander/ambidextrous	10/3	14/1	16/0	40/4
Age	33.00 (7.66)	46.67 (14.88)	44.19 (5.19)	41.73 (11.47)
Education	8.15 (3.08)	11.60 (3.70)	13.94 (4.17)	11.43 (4.42)
Intelligence (Raven's)	83.81 (29.55)	99.36 (25.99)	?	92.14 (28.30)

Written informed consent was obtained from all participants. Each participant understood that participation was voluntary and would not result in financial or other gain nor in advantages concerning their imprisonment, and that consent could be withdrawn at any stage of the study.

2.3. Measures

2.3.1. Psychopathy Checklist Revised

The Psychopathy Checklist Revised (PCL-R) contains 20 items on behavioral and personality features. An expert who draws on information from file review and from a semi-structured interview rates all items. The validity and reliability of the PCL-R have been demonstrated repeatedly (Hare, 2003). Harpur and colleagues (1989) proposed a two-factor model, which is the prevailing idea of psychopathy and of the PCL-R. The two factors, psychopathic personality and antisocial behavior, differentiate between personality-related features that are difficult to measure via self-report and behavioral features that correlate highly with antisocial personality disorder symptoms and diagnoses. Another model (Cooke and Michie, 2001) supports three factors derived from factor analyses, namely arrogant and deceitful interpersonal style, deficient affective experience and impulsive and irresponsible behavioral style. Thus, the PCL-R takes into account the pathological behavior as well as the specific personality style of individuals scoring high on psychopathy.

2.3.2. Raven Standard Progressive Matrices

Raven's Standard Progressive Matrices (SPM; Raven, 1938) are a standard measure for intelligence. The SPM comprises two main components of general intelligence in a directly measurable way using robust and directly interpretable procedures. The SPM tests are made up of a series of diagrams or designs with a missing figure that should be selected among others for logical match. Those taking the tests are expected to select the correct part to complete the designs from a number of options printed underneath. By means of this task, both components of intelligence, educative and reproductive ability, can be measured.

2.4. Procedure

Before the experimental session, participants gave written consent for their participation in the study and filled in a questionnaire for demographic variables. The experimental session was conducted on a Laptop via Presentation 9.70 (Neurobehavioral Systems, 2005) and an external keyboard. Pictures of six women and six men from the Karolinska Directed Emotional Faces set (KDEF, Lundqvist et al., 1998) were chosen, each depicting anxious, angry, disgusted, happy, neutral, sad and surprised expressions in size of 20.78° × 7.98° angle of vision. In the first block of trials half of the pictures were presented once in random order for 33 ms and masked by blurred versions of each actor's neutral expression (Adobe Photoshop 6.0, San Jose). In the second block of trials, the remaining pictures were shown until a button press of the participant (ad libitum) was registered. For both blocks the participants had to choose one of seven buttons, labeled with the nouns of all basic emotions (anxiety, anger, disgust, happiness, neutral, sadness and surprise) and neutral that best matched the presented facial expression. The third task was to rate all pictures for valence (How positive or negative was this picture?) and arousal (How arousing was this picture?) on scales ranging from ? 4 to 4 and 1 to 9, respectively. After the experimental task, patients were tested for intelligence with the SPM (Raven, 1938) and received a small gift for their participation.

3\. Results

3.1. Categorization

An analysis of variance (ANOVA) for repeated measures revealed main effects in categorizing accuracy for duration; the accuracy was higher for ad libitum than for briefly presented stimuli (_F_(1,41) = 109.31, _P_ < 0.001) (Fig. 1).

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Fig. 1. Percent of correct responses for ad libitum (A) and briefly (B) presented facial expressions (?? _P_ < 0.050).

Another main effect was found for the emotion category; the most accurate performance was found for happy facial expressions and the least accurate performance for afraid facial expressions (_F_(6,246) = 51.22, _P_ < 0.001). The significant main effect for group showed that the employees were the most accurate, while patients with high psychopathy-scores performed worst (_F_(2,41) = 4.16, _P_ = 0.02) in the categorizing tasks. The trend for an interaction of emotion and group further indicates that these main group differences exist for all emotions except for happy and afraid facial expressions (_F_(12,246) = 1.75, _P_ = 0.08).

Post hoc tests for the interaction between emotion and group revealed significant effects between groups for sad, disgusted, neutral and surprised expressions, but not for happy, afraid or angry ones. Bonferroni-adjusted post hoc analyses for these group effects showed significant differences in categorization of sad expressions between psychopathic patients and employees, of disgusted expressions between non-psychopathic patients and employees, of neutral expressions between psychopathic patients and employees and of surprised expressions between psychopathic patients and employees (see Table 2).

Table 2. Mean percent of correct responses and standard deviations for all conditions and all participant groups; ANOVA results

	Empty Cell	Psychopathic patients	Non-psychopathic patients	Employees	Significance _F_ (_P_)
Short presentation	Afraid	23.08 (16.01)	22.22 (16.27)	22.92 (15.96)	0.01 (0.99)
	Angry	41.03 (26.01)	40.00 (24.23)	41.67 (29.81)	0.02 (0.99)
	Disgust	47.44 (39.00)	35.56 (35.00)	51.04 (25.44)	0.91 (0.41)
	Happy	76.92 (16.01)	81.11 (30.12)	91.67 (10.54)	2.01 (0.15)
	Neutral	53.85 (40.34)	61.11 (39.67)	78.13 (33.18)	1.62 (0.21)
	Sad	19.23 (17.80)	46.67 (31.62)	48.96 (31.90)	4.68 (0.02)
	Surprise	47.44 (31.80)	64.44 (32.65)	81.25 (25.73)	4.56 (0.02)
Ad libitum presentation	Afraid	32.05 (19.79)	32.22 (22.24)	39.58 (32.13)	0.43 (0.66)
	Angry	76.92 (27.67)	85.56 (26.63)	91.67 (14.91)	1.43 (0.25)
	Disgust	52.56 (28.74)	52.22 (29.46)	81.25 (14.75)	6.87 (0.01)
	Happy	93.59 (8.44)	90.00 (23.40)	96.88 (6.72)	0.82 (0.45)
	Neutral	69.23 (32.52)	82.22 (23.96)	96.88 (6.72)	5.30 (0.01)
	Sad	57.69 (24.17)	66.67 (27.46)	72.92 (22.67)	1.35 (0.27)
	Surprise	64.10 (31.80)	75.56 (32.65)	88.54 (26.33)	2.37 (0.11)

Planned contrasts between psychopathic and non-psychopathic patients in the short presentation condition showed significant differences only for sad facial expressions (_T_(26) = 2.77, _P_ = 0.04).

Taking into account the group differences in age and education as well as handedness as covariates, the main effect of group remained significant (_F_(2,38) = 4.00, _P_ = 0.03), whereas the main effects of duration and of emotion were no longer significant. The relevance of age for the effects concerning the categorization task was reflected in the significant main effect of age (_F_(1,38) = 10.50, _P_ = 0.01) as well as in an interaction of duration and age (_F_(1,38) = 4.56, _P_ = 0.04).

3.1.1. False responses

To examine the false responses in the categorization task, we calculated ratios of false positive evaluations and false negative evaluations for each emotion (_?_ (false positive)/_?_ (false negatives)) as a measure of emotion-specific response bias. We again found significant differences between short and ad libitum presentation ($F(1,41) = 29.96$, $P < 0.001$) as well as a trend toward a difference between groups ($F(2,41) = 2.52$, $P = 0.09$), resulting in an interaction of duration, emotion and group ($F(12,246) = 2.74$, $P = 0.01$). Thus, psychopathic patients more often erroneously categorized briefly presented facial expressions as happy with respect to other emotions (mainly surprise, angry, sad and neutral) and with respect to the other groups ($F(2,41) = 5.46$, $P = 0.01$). The ad libitum presented facial expressions (mainly the afraid ones) were more often categorized as angry by psychopathic patients than by employees ($F(2,41) = 2.791$ $P = 0.07$). Non-psychopathic patients more often erroneously categorized ad libitum presented facial expressions (mainly afraid and sad) as surprise compared with employees ($F(2,41) = 3.32$, $P = 0.05$).

3.2. Dimensional evaluation

Subjective evaluations of valence and arousal dimensions in pictures were analyzed for effects of emotion category and group differences as well as for the kind of dimension (valence vs. arousal).

3.2.1. Valence ratings

For emotional valence evaluations we found a main effect of emotion category ($F(6,246) = 77.57$, $P < 0.001$), but no main effect of group nor interaction of emotion category and group. The subjective evaluation of valence showed more negative evaluations for afraid, angry, disgusted and sad facial expressions, more positive evaluations for happy expressions and neutral evaluations for neutral and surprised expressions (see Fig. 2).

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Fig. 2. Means and standard deviations of valence (A) and arousal (B) ratings.

3.2.2. Arousal ratings

The differences between the groups were significant in the arousal ratings (see Fig. 2). Besides a main effect of emotion category ($F(6246) = 15.47$, $P < 0.001$), in terms of more arousal for happy facial expressions and less arousal for neutral facial expressions compared with all other emotional facial expressions, we also found a main effect of group ($F(2,41) = 3.15$, $P = 0.05$), indicating that the psychopathic group perceived all facial expressions less arousing than the three remaining groups.

Bonferroni-corrected post hoc tests showed significant differences in arousal ratings between psychopathic and non-psychopathic patients.

4. Discussion

This study tested the hypothesis that there are differences in emotional facial expression recognition and evaluation between psychopathic and non-psychopathic women as well as a control group of employees. Results showed a decline of categorization accuracy starting from employees, to non-psychopathic patients and psychopathic patients who performed worse in categorizing all emotions, except happy. Nevertheless there were no group differences for categorizing pictures with happy facial expressions, which were recognized quite well, and pictures with fearful expressions, which were categorized very poorly by all participants, independent of presentation duration.

In the categorizing task, psychopathic patients differed in their accuracy from non-psychopathic patients only in one condition: the short presentation of sad facial expressions. This is in accordance with previous results for men (Stevens et al., 2001, Fullam and Dolan, 2006). But this also points to the influence of the presentation duration, which can reduce the time for cognitively evaluating the stimulus. Thus, the impairment in categorizing facial expressions could be reduced to conditions of reduced cognitive elaboration.

More relevant, to our knowledge, this study is the first to report a response bias, showing that the psychopathic group categorized briefly presented angry, sad, surprised and neutral facial expressions as happy; instead they interpreted ad libitum presented afraid expressions as angry. This misclassification directly contributes to the hypothesis that false interpretations of emotional facial expressions could be a relevant factor for antisocial behavior, which is often observed in psychopathic individuals. Moreover, these results could offer an explanation for the Violence Inhibition Model (VIM; Blair, 1995) as follows: if sad or afraid facial expressions are misinterpreted by psychopathic persons as happy or angry stimuli, this information cannot inhibit aggressive behavior.

Results concerning the dimensional evaluation of emotional facial expressions are new and provide more evidence for a reduced subjective activation of psychopathic women in response to emotional expressions. Valence ratings showed no between-groups differences; indeed psychopathic patients rated nearly all emotional facial expressions, especially angry, disgusted, neutral and surprised expressions, as less arousing than students and employees did. These results, together with data from the literature, suggest that there are differences between psychopathic and non-psychopathic inmates also at a subjective level concerning negative emotional contents, not only at a physiological level. The observed impairment in the perception of emotional facial expressions might contribute to advance our knowledge about the altered mechanisms of social interaction, in which psychopathic patients often tend to display clearly antisocial behavior. Consequently, this impairment raises the question whether it could be possible to improve psychopaths' ability to recognize the emotional contents in others' faces via focused training, but additional studies with larger samples are needed.

A further limitation of these results is that we only tested a female sample. Even if men and women with psychopathic attributes are both emotionally impaired (Hamburger et al., 1996, Warren et al., 2003) and, in general, psychopathic women show reduced physiological responses to emotional stimuli (Sutton et al., 2002), the conclusions cannot be directly generalized to psychopathic men. Future research should directly compare male and female psychopaths. Moreover, the group differences in age and intelligence suggest that age- and intelligence-matched samples should be included in future studies, preferably using a correlational approach with self-report measures (see Eisenbarth and Alpers, 2007).

The question remains, why the fearful facial expressions were categorized erroneously by all groups independently of the presentation duration, and at the same time have been rated (as expected) as rather negative and highly arousing. Reasons for this could be that the facial stimuli did not adequately represent an effective prototype of a fearful facial expression or, alternatively, the increased difficulty of attributing the correct emotion because of the high number of categories among which subjects had to choose. However, results of this study confirm the hypothesis that, similarly to psychopathic males, psychopathic women are impaired in the perception of emotional facial expressions.

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systematic search of electronic databases and a subsequent manual search identified 26 studies that included 29 experiments (_N_ = 1376) involving six emotion categories (anger, disgust, fear, happiness, sadness, surprise) across three modalities (facial, vocal, postural). Meta-analyses found evidence of pervasive impairments across modalities (facial and vocal) with significant deficits evident for several emotions (i.e., not only fear and sadness) in both adults and children/adolescents. These results are consistent with recent theorizing that the amygdala, which is believed to be dysfunctional in psychopathy, has a broad role in emotion processing. We discuss limitations of the available data that restrict the ability of meta-analysis to consider the influence of age and separate the sub-factors of psychopathy, highlighting important directions for future research.

* ### Psychopathy and Functional Magnetic Resonance Imaging Blood Oxygenation Level-Dependent Responses to Emotional Faces in Violent Patients with Schizophrenia

2009, Biological Psychiatry

Citation Excerpt :

There are no reports of impairments in the recognition of anger in psychopathic samples (21) or in patients with schizophrenia and high psychopathy scores (27). However, a recent study (54) reported reduced arousal ratings in response to angry faces in a sample of psychopathic women. Our finding that psychopathy traits are inversely correlated with amygdala and prefrontal activation patterns to angry faces warrants further study, as there is evidence that neural responses are modulated by anxiety (55) and psychopathic traits are generally associated with low anxiety levels (56).

Show abstract

Comorbidity between schizophrenia and psychopathy has been noted in violent patients in forensic settings. Both disorders are characterized by deficits in processing sad and fearful emotions, but there have been no imaging studies examining the impact of comorbid psychopathic traits on emotional information processing in violent patients with schizophrenia. We tested the hypothesis that violent patients with schizophrenia who had high psychopathy scores would show attenuated amygdala responses to emotional (particularly fearful) faces compared with those with low psychopathy scores.

Twenty-four violent male patients with schizophrenia were categorized as high/low scorers based on the Psychopathy Checklist: Screening Version. Participants underwent functional magnetic resonance imaging during a block-designed implicit face affect processing task. In a region of interest approach, responses in the amygdala and prefrontal cortex were examined with contrasts between sad/fearful/angry/disgusted faces and neutral faces.

High psychopathy scorers exhibited reduced blood oxygenation level-dependent (BOLD) responses in the amygdala during exposure to fearful faces. Psychopathy scores, particularly the affective facets, correlated negatively with amygdala responses. The BOLD responses in the orbitofrontal cortex were negatively correlated with the lifestyle and antisocial facets of psychopathy during exposure to sad faces. Psychopathy scores were positively correlated with neural activation in amygdala and inferior prefrontal regions for disgust but negatively correlated for anger.

Patients with schizophrenia and high levels of psychopathic traits appear to have blunted amygdala responses to fearful faces. At a dimensional level, psychopathy subfacets show a differential relationship to functioning in amygdala-prefrontal circuitry.

* ### Happy Mouth and Sad Eyes: Scanning Emotional Facial Expressions

2011, Emotion

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