		Volume 54, Issue 2, January 2013	ISSN 0191-8869
PERSONALITY AND INDIVIDUAL DIFFERENCES			
AN INTERNATIONAL JOURNAL OF RESEARCH INTO THE STRUCTURE AND DEVELOPMENT OF PERSONALITY, AND THE CAUSATION OF INDIVIDUAL DIFFERENCES			
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Contents:			
General Articles		147	The International Society for the Study of Individual Differences (ISSID)
A.M. Abdel-Khalek		149	Personality dimensions and religiosity among Kuwaiti Muslim college students
S.P. Mullen, N.P. Gothe and E. McAuley		153	Evaluation of the factor structure of the Rosenberg Self-Esteem Scale in older adults
R.J. Snowden, R. Craig and N.S. Gray		158	Detection and recognition of emotional expressions: Effects of traits of personality disorder and gender
K.M. Beaver, J.P. Wright, B.B. Routwell, J.C. Barnes, M. DeLisi and M.G. Vaughn		164	Exploring the association between the 2-repeat allele of the MAOA gene promoter polymorphism and psychopathic personality traits, arrests, incarceration, and lifetime antisocial behavior
I. Tsaousis and S. Kazi		169	Factorial invariance and latent mean differences of scores on trait emotional intelligence across gender and age
C. Pocnet, J. Rossier, J.-P. Antonietti and A. von Gunten		174	Personality features and cognitive level in patients at an early stage of Alzheimer's disease
T. Icekson and A.M. Pines		180	Positive perception: A three dimensional model and a scale
M. Zeidner and H. Ben-Zur		187	Personal resources at the juncture of culture and life satisfaction
<i>[Continued on outside back cover]</i>			
<small>Person. Individ. Diff. is indexed/abstracted in: ASSIA, Curr. Cont. Soc. & Behav. Sci., PASCAL-CNRS Data, Psychol. Abstr., PsycINFO, PsycLIT, Res. Alert, Soc. Sci. Cit. Indx. Also covered in the abstract and citation database SciVerse SCOPUS®. Full text available on SciVerse ScienceDirect®.</small>			
		ISSN 0191-8869 54(2) 147-318 (2013)	
OFFICIAL JOURNAL OF THE INTERNATIONAL SOCIETY FOR THE STUDY OF INDIVIDUAL DIFFERENCES (ISSID)			

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Contents lists available at SciVerse ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Detection and recognition of emotional expressions: Effects of traits of personality disorder and gender

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ARTICLE INFO

Article history:

Received 30 April 2012

Received in revised form 20 July 2012

Accepted 11 August 2012

Available online 15 September 2012

Keywords:

Facial expressions

Psychopathy

Borderline Personality Disorder

ABSTRACT

A problem in the processing of emotions has long been thought to be strongly associated with the aetiology and maintenance of personality disorders. Previous research has demonstrated a hyposensitivity to the faces expressing fear in those high on the traits of psychopathy, while patients with BPD have been shown to be hypersensitive to expressions in general. However, many previous studies could be explained by a bias in reporting particular expressions rather than a change in sensitivity to these expressions. Using two tasks, the present study examined both the detection and the recognition of four emotional expressions (anger, happy, sad, and fear) in a community sample of males and females. Measures of self-reported psychopathy and Borderline Personality traits were administered. The results showed marked gender differences. Psychopathy was negatively related to performance in both the detection and recognition of fear, but only for males. Borderline Personality traits were positively related to overall performance in the recognitions task, but only for females. The results suggest strong differences in the role that emotional processing might play between the genders.

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1. Introduction

A problem in the processing of emotions has long been thought to be strongly associated, or even causal, to the aetiology and maintenance of Personality Disorders. In some individuals there appears to be a hypersensitivity or over-reaction to emotional material, and this is often found in those with a diagnosis of Borderline Personality Disorder (BPD). On the other hand, some individuals appear to have a hyposensitivity or under-reaction to emotional material and are described as cold or callous. These features are often associated with a diagnosis of psychopathy (Hare, 2003).

One particular stimulus, the human face, is of obvious interest as dysfunction in the ability to read expressions would lead to problems in social interactions that are the hallmark of Personality Disorders.

1.1. Psychopathy and facial affect recognition

Several studies have suggested that psychopaths have a deficit in recognizing expressions of fear and/or sadness (e.g., Blair et al., 2004). However, many others find a more general deficit (e.g., Hastings, Tangney, & Stuewig, 2008), or find deficits for other expres-

sions such as disgust (Kosson, Suchy, Mayer, & Libby, 2002), do not find any deficits (e.g., Glass & Newman, 2006), or even find enhanced abilities in adults (Habel, Kuhn, Salloum, Devos, & Schneider, 2002) and boys with callous/unemotional traits (Woodworth & Waschbusch, 2008). Recent attempts at meta-analysis appear to support the notion that problems in the recognition of the emotions of fear and sadness are associated with psychopathy (Marsh & Blair, 2008; Wilson, Juodis, & Porter, 2011). To date, very few studies have considered possible gender differences in psychopathy and facial affect recognition (see Eisenbarth, Alpers, Segre, Calogero, & Angrilli, 2008). Given the increasing evidence of gender differences in the expression of psychopathy (e.g., O'Leary, Taylor, & Eckel, 2010) this is an area that needs addressing.

1.2. Borderline personality and facial affect recognition

As BPD is characterised by interpersonal dysfunction, BPD may have impaired perception of emotional expressions. Levine, Marziali, and Hood (1997) showed that BPD patients were less accurate at identifying negative emotions such as anger, fear and sadness, but found no deficit for identifying positive expressions. Deficits have also been reported by Minzenberg, Poole, and Vinogradov (2006) and Bland, Williams, Scharer, and Manning (2004).

Linehan (1993) suggested that there is an increased emotional vulnerability in BPD and this produces a heightened sensitivity to emotional stimuli, especially negative emotions. Wagner and

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Linehan (1999) found that individuals with BPD had a heightened sensitivity to fear compared to control participants. Lynch et al. (2006) showed that BPD patients identified emotions at reduced intensity of the expression compared to control participants. Fertuck et al. (2009) found enhanced ability to identify expressions using only the eyes for those with BPD.

The majority of people diagnosed with BPD are female. Hence, previous studies of facial expressions have used predominantly female samples. At present, therefore, there are no known gender differences between facial affect processing and BPD.

1.3. Personality and Personality Disorder

Personality Disorders are currently diagnosed by the DSM (-IV) as categorical. However, most researchers think of Personality Disorders as extremes on dimensions of personality traits rather than a taxon (e.g., Helzer, Kraemer, & Krueger, 2006), including psychopathy (Coid, Yang, Ullrich, Roberts, & Hare, 2009; Walters et al., 2007). There have, therefore, been attempts to measure particular Personality Disorder traits in community samples. Using a community sample has several advantages over patient populations. Non-patients are far more numerous and are easily accessible. Hence, issues such as gender differences, which are hard to study in clinical populations as they tend to be mainly male (psychopathy) or female (BPD) can be addressed. Levels of medication and/or substance misuse, that might influence task performance, are also far lower in non-clinical samples. Hence, there has been a rise in the number of publications that aim to provide “parallel evidence” to Personality Disorder patients by using Personality Disorder traits questionnaires in community samples. This is the approach we have taken.

1.4. Recognition and detection of facial affect

Most experiments on facial affect present a single face and the participant has to “label” the expression from a small pool of possibilities (e.g., Kosson et al., 2002). However, this method fails to distinguish between the sensitivity to an expression and a bias in reporting it. For example, if an individual is highly fearful they may see fear in many stimuli (even if it is not there in the stimulus). In an experiment where they are asked to classify expressions they would tend to correctly classify all the ‘fear’ stimuli as fearful, and get a high score for detecting this emotion. However, this is misleading as they also misidentify other stimuli as fearful. What has been measured is a bias to report fearful, rather than a genuine sensitivity to it (this bias may also be of interest). In the paradigms where faces of increasing emotion are presented (e.g., Blair et al., 2004) the same biases will make the participant press earlier in the sequence.

In the domain of psychophysics the problem of bias versus sensitivity is normally tackled via either signal detection theory, or by the use of ‘forced-choice’ methodologies (Graham, 1989). In a forced-choice experiment a signal is always present on each trial, and the participant must make some decision about this signal (e.g., ‘it occurred on the left’). By forcing a choice the participant is not able to express their bias as to ‘when’ or ‘if’ to report a signal. Further, the ‘choice’ to be made (e.g., left vs. right) is orthogonal to any experimental manipulation (e.g., fearful vs. neutral face).

In the present study we use both the “traditional” method of presenting a single face and having the participant choose which expression was present (Recognition of Emotional Face Task; REFT) and a new task that aims to eliminate any bias in responding to one particular emotion. In this new task, the Detection of Emotional Face Task (DEFT), four faces are presented, three with neutral expressions and one with an emotional expression (see Fig. 1) and the participant must choose which has the emotional expres-

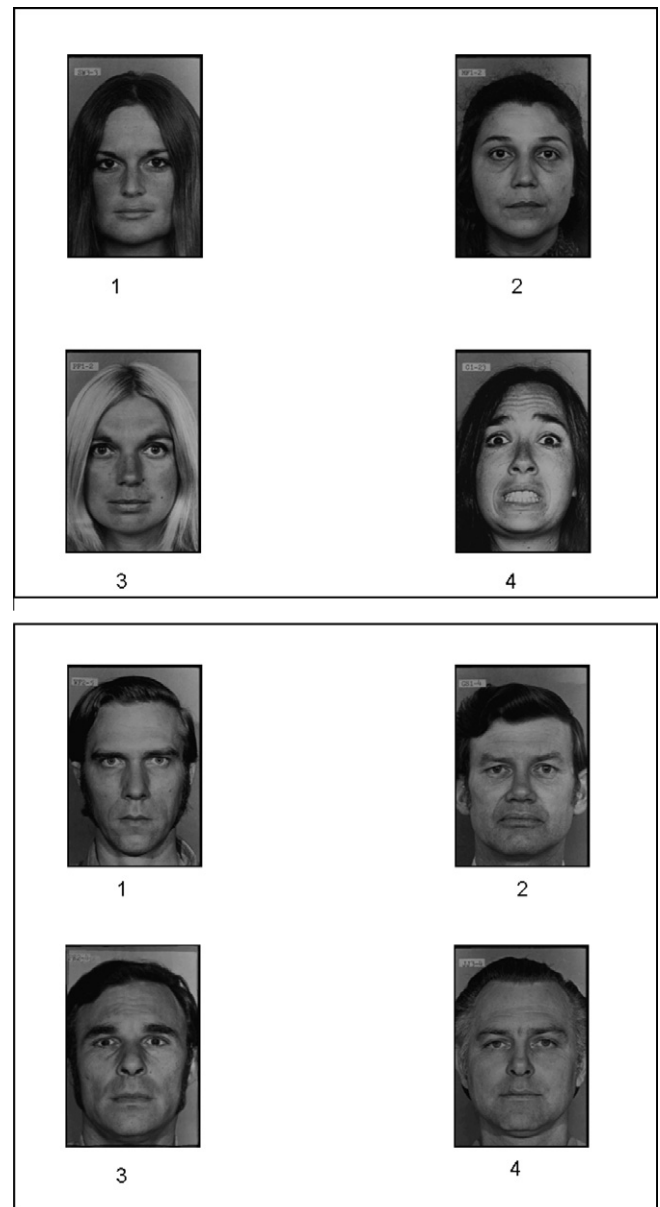


Fig. 1. Two examples of trials from the DEFT. In the upper part of the figure a practice trial is shown where the emotional expression (fear) is presented at 100% expression in image 4. The lower part of the figure shows the stimulus for a real trial, where the expression (sad) is presented at only 40% expression (image 3).

sion. The person does not have to state which expression is present, hence, biases in reporting different types of expression are eliminated.

1.5. The present study

We measured sensitivity to four types of facial expression – happy, sad, fear, and angry – using the REFT and the DEFT. We also obtained measures of traits of psychopathy using the Psychopathic Personality Inventory (PPI-R; Lilienfeld & Widows, 2005) and traits of BPD using the Borderline Personality Questionnaire (BPQ; Poreh et al., 2006). We obtained a balanced and reasonably large sample from each gender.

We hypothesised that the scores on the PPI-R would be negatively related to scores on the emotional face tasks when they depicted the expression of fear. We further hypothesised that scores on the BPQ would be positively related to scores on the face pro-

cessing tasks. Finally, as the literature is either mute or somewhat inconsistent on the issue of possible gender differences, we examined the data separately for each gender group, but with no specific hypotheses as to the pattern of results.

2. Methods

2.1. Participants

Participants were 150 undergraduate students (76 female) recruited from a UK University, with a mean age of 21.0 years ($SD = 3.5$). They were an opportunity sample recruited via word of mouth and were not paid for their participation.

2.2. Measures

2.2.1. Psychopathic Personality Inventory – revised

The PPI-R is a 154 item self-report measure of psychopathy (Lilienfeld & Fowler, 2006). Each question is answered on a four-point scale of 1 (False), 2 (Mostly False), 3 (Mostly True), and 4 (True). The PPI-R produces a global psychopathy score and scores for the PPI-I (Fearless Dominance) and PPI-II (Self-centred Impulsivity) scales. The scales of the PPI-R have good internal consistency ($\alpha = 0.78–0.92$) and test–retest reliability ($r = 0.82–0.95$) (Lilienfeld & Fowler, 2006).

2.2.2. The Borderline Personality Questionnaire

The BPQ (Poreh et al., 2006) is an 80 item self-report measure of the traits of Borderline Personality Disorder designed around the DSM criteria. It provides a dimensional view of Borderline Personality Disorder symptoms and can be used with both patient populations and community samples. It has good internal consistency ($\alpha = 0.92$) and test–retest reliability (0.92) – Chanen et al. (2008). Recent analysis of the scale in a population similar to the one used here supported the notion of a one-dimensional structure (Fonseca-Pedrero et al., 2011) and so only the overall score was examined in this study.

2.2.3. Detection of Emotional Face Task

In the DEFT four faces are presented at a time, one of these is emotional and the other three neutral (see Fig. 1a). Individual face pictures were 5.8 cm wide and 6.5 cm in height and the four faces were arranged in a rectangle of side 22 cm and 15.6 cm in height.

The stimuli were taken from Ekman and Friesen's (1976) series of pictures of facial affect. For each target individual there were five pictures showing different expressions; neutral, happiness, sadness, anger, and fear. Eight target individuals were selected; four male and four female targets. Each of these individuals' emotional expressions was morphed with their matching neutral expression. Pilot experiments showed that a 40% morph of the expression provided an appropriate level of sensitivity (approximately midway between chance performance and 100% correct).

We used four emotional expressions (happy, sad, fear, and anger). The main experiment consisted of 128 trials (four expressions * four positions * eight actors). Each stimulus was presented for 2000 ms and the observer was allowed to make any eye-movements they required. Hence, they could use eye-movements to foveate each stimulus for approximately 500 ms. The stimuli were then removed and the screen prompted them to make a four-alternate forced-choice response as to the position of the emotional face. Note that the participant was not allowed to respond before the end of the 2000 ms stimulus presentation. This ensures that all participants see the stimuli for the same amount of time, otherwise those that are impulsive in their decision making might actually view the stimulus for less time. Before the main

experiment, the participant was given eight practice trials where we used an emotional expression of 100% (as in Fig. 1a).

2.2.4. Recognition of Emotion Face Task

The REFT aimed to mimic typical experiments relating to expression recognition (e.g., Kosson et al., 2002; Wagner & Linehan, 1999) where a single face is presented and the participant has to say what expression was presented. We used the same stimuli as the DEFT but presented a single face in the centre of the screen for 500 ms. After this period, a prompt screen asked the participant to make a four-alternate forced-choice response as to the expression (happy, sad, fear, or anger). Again, 128 trials were run in the main experiment, and this was preceded by eight practice trials that used 100% expressions.

2.3. Procedure

Participants completed the two questionnaires and the two emotional face tasks (order of events was counterbalanced across participants).

2.4. Data screening

Data were visually screened for any outliers and for their approximation to a normal distribution. Data from one participant (male) was removed as his response on the BPQ was over 3 SDs above the mean score. All other data met the assumptions of a normal distribution and so all analyses used parametric tests. Correlations were compared using the methods described by Steiger (1980).

3. Results

3.1. Personality measures

Scores for the personality measures are shown in Table 1, and their relationships are shown in Table 2.

Table 1
Scores on personality variables.

		BPQ	PPI total	FD	SCI
Male	<i>M</i>	16.96	305.07**	124.64**	146.90**
	<i>SD</i>	10.46	38.18	21.61	23.21
Female	<i>M</i>	16.49	264.99	107.16	130.55
	<i>SD</i>	10.90	34.13	19.32	22.86

Note: BPQ = Borderline Personality Questionnaire (Poreh et al., 2006); PPI = Psychopathic Personality Inventory (Lilienfeld & Widows, 2005); FD = Fearless Dominance scale of PPI; SCI = Self-Centred Impulsivity scale of PPI.

** Groups differ significantly at $p < .01$.

Table 2
Correlations between personality variables.

		FD	SCI	BPQ
PPI total	All	.76**	.82**	.26**
	Male	.72**	.79**	.32**
	Female	.70**	.81**	.25*
FD	All	–	.30**	–.07
	Male	–	.19	–.08
	Female	–	.19	–.10
SCI	All	–	–	.54**
	Male	–	–	.59**
	Female	–	–	.53*

Note: BPQ = Borderline Personality Questionnaire (Poreh et al., 2006); PPI = Psychopathic Personality Inventory (Lilienfeld & Widows, 2005); FD = Fearless Dominance scale of PPI; SCI = Self-Centred Impulsivity scale of PPI.

* Correlations are significant at $p < .05$.

** Correlations are significant at $p < .01$.

Table 3
Mean performance on the DEFT and REFT task as a function of gender.

		DEFT scores				
		Total	Anger	Fear	Happy	Sad
Male	M	66.23	13.54	17.86	19.76	11.07
	SD	14.45	4.45	4.49	4.87	3.84
Female	M	61.47	13.66	17.28	20.00	10.54
	SD	17.74	3.56	4.31	4.23	3.86
		REFT scores				
Male	M	70.57	14.07	15.41	25.19	15.91
	SD	10.89	4.68	4.31	4.07	4.74
Female	M	69.84	14.12	15.67	24.61	15.45
	SD	10.08	4.82	3.67	4.35	4.43

Table 4
Correlations between PPI-R and BPQ scores and performance on the DEFT and REFT task.

		Male – DEFT				
		Total	Anger	Fear	Happy	Sad
BPQ		-.16	-.04	-.21	-.12	-.17
PPI total:		-.07	-.10	-.20 [*]	.01	.06
FD		.07	.05	-.07	.09	.18
SCI		-.16	-.17	-.23 [*]	-.04	-.07
		Female – DEFT				
BPQ		.07	.07	.07	-.02	.08
PPI-R total:		-.03	-.05	.00	-.09	.07
FD		-.06	.08	-.05	-.06	.03
SCI		.07	.04	.09	.00	.08
		Male – REFT				
BPQ		-.05	-.03	-.19	.02	.06
PPI total:		-.19	.00	-.28 ^{**}	-.10	-.10
FD		-.12	.01	-.19	.00	-.12
SCI		-.17	-.03	-.24 [*]	-.12	-.04
		Female – REFT				
BPQ		.20 [*]	.02	.21 [*]	.18	.09
PPI total:		.04	-.01	.09	-.05	.07
FD		.04	-.03	.07	-.05	.10
SCI		.07	.02	.08	.02	.06

Note: BPQ = Borderline Personality Questionnaire (Poreh et al., 2006); PPI = Psychopathic Personality Inventory (Lilienfeld & Widows, 2005); FD = Fearless Dominance scale of PPI; SCI = Self-Centred Impulsivity scale of PPI.

^{*} Groups differ significantly at $p < .05$.

^{**} Groups differ significantly at $p < .01$.

3.2. Performance measures

Performance on the emotional face tasks is tabulated in Table 3. Overall, mean performance was 61.8 for the DEFT and 70.2 for the REFT, which is near the middle of the possible range (maximum = 132, chance = 32). It was also found that there was a strong correlation for performance on the two tasks ($r = 0.54$, $p < .001$).

Performance for the individual expressions ranged from 11.1 (DEFT: Sad faces) to 25.2 (REFT: Happy faces). Hence, overall, the results do not have severe floor or ceiling effects that might obscure any individual differences in performance.

3.3. Relationship between personality measures and performance measures

Table 4 gives the relationships between the various personality and performance measures. Our first hypothesis was that psychopathy would be negatively related to the processing of the fear expressions. For the male participants, this result appears well supported. Examination of the two subscales of psychopathy showed that both demonstrated negative correlations with fear and that

the measure of Self-Centred Impulsivity was significantly correlated with performance on both tasks. For female participants, we did not find any significant correlations between psychopathy and performance on the fear trials. The difference in correlations between the males and females was found to be statistically significant for the REFT ($p < .05$) but not for the DEFT.

Our second hypothesis was that BPQ scores would be positively related to performance. For the male participants, there is no sign of such a result, and most of the (non-significant) correlations were actually negative. However, for the female participants, nearly all the correlations were positive, and those for the REFT total score and for the REFT fear score reached conventional levels of significance ($p < .05$). The difference in correlation coefficients between males and females on the fear task were significant ($p < .05$).

4. Discussion

The results show partial support for the two hypotheses we tested: that psychopathy is associated with a deficit in processing a fearful facial expression, and that BPD is associated with a heightened ability to process emotional facial expressions in general. For each hypothesis, we found that the association was gender specific, with psychopathy traits being related to deficits in males but not females, and BPD traits being associated with heightened processing in females but not males.

4.1. Detection versus recognition

The present study examined both the ability to detect an emotional face (from non-emotional faces) using the DEFT and the ability to label emotion faces correctly using the REFT task. We used the DEFT task as many previous experiments showing a relationship between psychopathy and a deficit in the processing of facial expressions might be related to a bias in responding. It is also possible that some psychopaths are impulsive (Snowden & Gray, 2011) and might respond with less sensory evidence than a less impulsive person. Examination of Table 4 shows that the pattern of results is highly similar across the two tasks suggesting that the two tasks measure ostensibly similar constructs and suggests that the inability to process fearful expressions is a genuine change in the sensitivity for this expression, rather than a bias in responding.

4.2. Psychopathy and fear expression processing

The finding of a deficit in the processing of fearful expressions has been found in several studies of psychopathic individual (Marsh & Blair, 2008; Wilson et al., 2011). The vast majority of these studies used all male samples from correctional settings. Our study confirms this in a non-clinical sample (see also Montagne et al., 2005) and supports the use of measures of sub-clinical psychopathy to help elucidate the processes linked to psychopathic behaviours, and to provide paralleling evidence to clinical studies.

There is increasing evidence that psychopathy has at least two underlying subfactors (Hare, 2003). Few previous studies have considered which of these might be related to expression processing deficits. The two recent meta-analyses of this topic (Marsh & Blair, 2008; Wilson et al., 2011) do not explore this issue. The PPI-R also has two subscales – Fearless Dominance and Self-Centred Impulsivity – though the relationship between these two factors and the factors identified by the PCL-R is not simple (Copestake, Gray, & Snowden, 2011). In the present study, there was clear evidence that the Self-Centred Impulsivity factor was related to the fear processing deficit. For the Fearless Dominance component the evidence for a deficit was not statistically significant. However, the

correlations were negative and did not differ significantly from the Self-Centred Impulsivity factor. Hence, our experiment did not give a clear cut answer to the question of whether one component of psychopathy is more related to the deficit than any other. Larger samples and multiple measurements of psychopathy would be needed to give more definitive answers. We note that in other studies of affective processing, such as in the modulation of the startle response, the scale of Fearless Dominance appears to be more important than that of SCI (e.g., Benning, Patrick, & Iacono, 2005).

The results from the female sample showed no sign of any association between psychopathy and fear expression processing. Recent meta-analyses of the issue either do not mention the issue of gender (Wilson et al., 2011) or state that gender did not moderate the effects found (Marsh & Blair, 2008). However, the present authors' own review of the literature found few studies that used female samples and this may explain why it did not appear to have a moderating effect in this analysis. Two more recent studies have used female samples. Fairchild, Stobbe, van Goozen, Calder, and Goodyer (2010) examined young females with conduct disorder but did not find any deficit in their abilities on a facial expression task. The same task did produce a deficit for male participants with similar disorders (Fairchild, van Goozen, Calder, Stollery, & Goodyer, 2009). Del Gaizo and Falkenbach (2008) used the PPI to measure psychopathy in a sample of undergraduates (68% female). They found that the PPI was *positively* related to performance on fear recognitions tasks, though they did not perform separate analyses for the male and female participants. Hence, there appears to be preliminary evidence that females do not show a negative relationship between fear expression processing and psychopathy.

4.3. BPD and processing emotional expressions

As reviewed in the Section 1, the evidence for changes in the processing of emotional expressions for those with BPD is very mixed. The present study did find some evidence of a heightened processing of expression in general (and for fear in particular), though it should be noted that the effect size is small. Further, this effect was not apparent for the male sample where non-significant but negative correlations were apparent. These positive findings support the use of sub-clinical measures of BPD to help elucidate the processes linked to BPD-type behaviours and provide parallel evidence to clinical studies.

We could find no other study that has looked at the issue of BPD as a trait measure with respect to the processing of expressions. Therefore, our finding of a heightened level of performance as a function of BPD traits in women is, we think, unique.

Previous studies of facial expressing processing in patients with BPD have either exclusively studied a female population (Bland et al., 2004; Wagner & Linehan, 1999) or one with a very high percentage of females (88%: Minzenberg et al. (2006); 85%: Lynch et al. (2006); 87%: Fertuck et al. (2009)). Hence, there has been no useful data with respect to males with Borderline Personality Disorder. Our data clearly suggests that future studies should examine data from the two genders separately.

4.4. Limitations

The study has several limitations. First, the use of undergraduate students and trait measures of personality disorder does not mean these results will extend to clinical populations. It is also possible that any gender differences may be related to differences in overall levels of psychopathy. For example, if the fear processing deficit only occurs at reasonably high levels of trait psychopathy it may have been missed in the lower scoring female group. However, preliminary analysis of our data did not find any differences

when the males were split into low versus high scoring groups. Second, the studies used just four expressions. Further work could begin to explore other expressions of interest (e.g., disgust). Third, the stimuli used were static and it will be of interest to see if similar results are produced with dynamic, and perhaps more ecologically, valid stimuli.

Acknowledgements

The following students also helped in the gathering of data: Lizzie Frost, Katie Evans, Ellie Corney, Hannah Coulson, Helen Freer, Hannah Dobson, Laura Hine, George Mackenzie, Victoria Lloyd, Heulwen Jones, Megan Jenkins, Scott Rogers, Meg Davis, Brian O'Ceallaigh, Natalie Richards, Kerry Middleton, Nadia McAloon, Jess Wyer, Bethan Hughes, Emily Jones, Becca Emerson, Rebecca Cook, and Tabitha Rees.

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