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Facial emotion recognition, guilt and sub-clinical psychopathic traits: an exploration of mediation effects

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Abstract Psychopathic traits are associated with a variety of emotional difficulties, including poor facial emotion recognition (FER) and reduced capacity to experience guilt. However, the potential mechanisms through which FER and low guilt-proneness are related to the development of psychopathic traits are not well understood. Using a non-clinical sample ($N=747$), this study investigated the relationship between psychopathic traits, FER ability and guilt-proneness by exploring two alternative mediation models investigating: (a) the mediating effect of FER ability on the relationship between psychopathic traits and guilt-proneness, and (b) the mediating effect of psychopathic traits on the relationship between FER ability and guilt-proneness. FER ability did not significantly mediate the relationship between psychopathic traits and guilt-proneness. However, psychopathic traits did partially mediate the relationship between FER and guilt-proneness for the sad, angry, fearful and disgusted expressions. These findings suggest that psychopathic traits are related to a disruption in typical affective processing and the development of pro-social moral self-conscious emotions.

Keywords Emotion perception · Moral self-conscious emotions · Psychopathy · Facial emotion recognition · Guilt · Guilt-proneness

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Introduction

Psychopathy is a developmental disorder marked by a lack of emotional depth, callous treatment of others and anti-social behaviour (Brook et al. 2013; Hare 2003). Reduced empathy is a well-established correlate of psychopathy (Wai and Tiliopoulos 2012), as is poor facial emotion recognition (FER) (Blair et al. 2004; Dawel et al. 2012; Hastings et al. 2008; Marsh and Blair 2008) and low guilt-proneness (Tangney et al. 2011) both in clinical and non-clinical populations. However, the potential mechanism through which FER and guilt-proneness are related to the development of psychopathic traits is not well understood.

Facial displays of emotion serve as potent reinforcers which help to shape the socially desirable behaviour of others (Blair 1995). Distress cues, such as expressions of fear and sadness, are thought to act as aversive stimuli which discourage individuals from engaging in harmful interpersonal behaviours (Blair 2003). In line with this suggestion, several researchers have proposed that the FER impairments associated with psychopathy directly result from a neurobiological deficit which impairs the ability of psychopathic individuals to comprehend the emotions of others (Blair 2006; Gao and Raine 2010; Kiehl et al. 2004; Shamay-Tsoory et al. 2010). The Integrated Emotion Systems Model (IES) proposed by Blair (1995, 2006), links psychopathy to early dysfunction of the amygdala leading to a specific impairment in processing of the sad and fearful emotional expressions (Blair 1995, 2001). Blair (2006) contends that this impairment means that psychopathic individuals do not experience the distress of others as aversive, and thus fail to learn to refrain from engaging in harmful behaviours. However, a meta-analysis by Dawel and colleagues (2012) found that psychopathic traits are associated with deficits in recognising a wider range of

emotions, which is inconsistent with the predictions of the IES and suggests that the affect deficits in psychopathy may be more pervasive than a specific impairment in recognising distress cues only (Decety et al. 2014).

A separate line of research suggests that people with high psychopathic traits feel less guilty following interpersonal transgressions as compared to people with low psychopathic traits (Tangney et al. 2011). Guilt is a pervasive social emotion that often arises following interpersonal transactions (Baumeister et al. 1994) and is important for the regulation of social behaviours and the self (Beer et al. 2003). Notably, the tendency to be guilt-prone has been shown to have far-reaching implications for a range of psychosocial variables including general capacity for empathy, perspective taking ability, and the propensity to experience feelings of other-oriented compassion and concern (Tangney 1991; Tangney and Dearing 2002). Given the adaptive nature of guilt-proneness in typically developing individuals, it is not surprising that a negative relationship between psychopathic traits and guilt-proneness has been demonstrated in both sub-clinical (Mullins-Nelson et al. 2006; Salekin et al. 2014) and clinical samples (Tangney et al. 2011).

Despite research which demonstrates the relationships between psychopathic traits, FER ability and guilt-proneness, the potential mechanism through which FER and guilt-proneness are related to the development of psychopathic traits is not well understood. One possibility is that poor FER ability is the *precursor* to an interpersonal style marked by low guilt-proneness, which in extreme cases may lead to the development of psychopathic traits. That is, psychopathic individuals are simply unable to recognise the distress signals presented by others, and thus escape any aversive reaction (such as guilt) which would otherwise act to modify antisocial behaviour (Blair 2006). The large body of literature on FER deficits in psychopathy supports this view. In addition, research from typically developing populations shows accurate FER ability is positively correlated with guilt-proneness, and thus facilitates the development of a more empathetic and socially adaptive other-oriented interpersonal style (Treeby et al. 2015).

An alternative possibility is that the core deficit in psychopathy exists at the level of the internal emotional response to affective stimuli (Rolls 1999), meaning that psychopathic individuals can objectively *perceive* distress expressions, however fail to experience an implicit aversive *emotional reaction* (Cima et al. 2010). In support of this view, individuals with clinical psychopathy and high psychopathic traits have demonstrated intact cognitive perspective-taking abilities (Anastassiou-Hadjicharalambous and Warden 2008; Blair et al. 1996; Dolan and Fullam 2004; Hansen et al. 2008; Richell et al. 2003). However, it should be noted that contradictory findings do exist

in both clinical (Brook and Kosson 2013), and non-clinical samples (Ali and Chamorro-Premuzic 2010). Psychopathic individuals have also been shown to perform within normal limits on cognitive theory of mind (ToM) tasks, but perform poorly on affective ToM tasks (Hare 1999; Shamay-Tsoory et al. 2010). They have also been found to perform within normal limits on the 'Reading the Mind in the Eyes' task when they are explicitly instructed to focus on the eyes of other target people (Dadds et al. 2006). This evidence suggests that psychopathic individuals may indeed be able to objectively perceive the emotions of others, but remain unaffected by the emotional content of these interactions (Decety and Moriguchi 2007).

Further investigation into the abilities that potentially underlie the empathy dysfunction in psychopathy is necessary to better understand the phenomenology of the disorder, and to inform interventions for this population. A possible line of research is the investigation of psychopathic traits, FER and guilt-proneness in sub-clinical populations in which individuals present with varying degrees of these traits (Sellbom and Verona 2007; Skeem et al. 2003). If psychopathic individuals are spared from feeling guilty because they are poor at identifying the emotions of others, it could be expected that better FER ability in these individuals would mediate the relationship between psychopathic traits and guilt. Conversely, if the deficit is not one of perception but rather an impairment of the internal emotional reaction in response to the emotional cues of others, then better FER ability would not necessarily lead to a more guilt-prone affect style. In this case, it may be that higher psychopathic traits are reflective of greater impairment in the neural circuitry responsible for the inherent emotional reaction to distress cues, and thus the degree of psychopathic traits would mediate the relationship between FER ability and guilt-proneness. That is, psychopathic traits may act as a proxy measure in these individuals of the breakdown in the implicit emotional reaction that is triggered in typically developing individuals when they see the distress of others.

The current study

The current study sought to explore the interrelationships between FER, guilt-proneness and psychopathic traits using a large non-clinical sample. Given the research from typically developing populations that suggests that FER accuracy contributes to a guilt-prone emotional response style (Treeby et al. 2015), we hypothesised that there would be an overall positive relationship between FER ability and guilt-proneness in our sample. Also in line with existing research, we predicted that psychopathic traits would be negatively correlated with both FER ability (Dawel et al. 2012; Marsh and Blair 2008) and guilt-proneness (Tangney

et al. 2011). Given the limited available data exploring the interrelationships between these variables, and the exploratory nature of our study, we aimed to further clarify the relationships between guilt, FER and psychopathic traits by investigating two alternative mediation models. The first model sought to investigate the mediating effects of FER ability on the relationship between psychopathic traits and guilt-proneness, and the second to examine the mediating effects of psychopathic traits on the relationship between FER and guilt-proneness. In light of evidence from studies suggesting that high psychopathic traits may not preclude the ability to be able to objectively recognise facial emotion (Hare 1999; Shamay-Tsoory et al. 2010), we predicted that the degree of psychopathic traits would mediate the relationship between FER and guilt-proneness to a greater extent than FER ability would mediate the relationship between psychopathic traits in guilt-proneness. Given the discrepancies in the literature with regard to expression-specific deficits, we analysed the expressions of sadness, anger, fear, disgust and happiness separately. In line with the rationale of the IES model, we expected that any mediation effect would be greatest for the fearful and sad expressions.

Method

Participants

The sample consisted of 747 participants, 22.8% ($n=170$) of whom were male. The mean age of the participants was 25.95 years ($SD=10.5$, range 18–84 years). The sample included participants from various racial and ethnic backgrounds with 66.8% ($n=499$) Caucasian, 10.6% ($n=79$) Asian, 8.2% ($n=61$) Hispanic, 3.9% ($n=29$) African, and 10.58% ($n=79$) were from 'other' racial backgrounds. A total of 81.7% of the sample were university students ($n=610$). The remaining 18.3% ($n=137$) of participants were not students, and were recruited from the community.

Measures

Levenson self-report psychopathy scale LSRPS; (Levenson et al. 1995)

The LSRPS is a self-report instrument developed for use in non-institutionalised populations. The LSRPS has 26-items that participants answer on a 4-point Likert scale (1=disagree strongly to 4=agree strongly), with some items reversed to control for response set. A sample item from the primary psychopathy scale (LSRPS I) is: 'for me, what's right is whatever I can get away with'. A sample item from the secondary psychopathy scale (LSRPS II) is: 'I find

myself in the same kinds of trouble, time after time'. In the current study, the LSRPS I and LSRPS II scores were summed to provide a total psychopathy score. The mean scores were 27.13 ($SD=7.19$), 20.54 ($SD=4.77$) and 47.67 ($SD=10.22$) for the primary, secondary and total scales respectively. These scores are comparable to those previously reported by Levenson et al. (1995) in a non-clinical sample. In the present sample, Cronbach's alpha values were 0.85 for LSRPS I, 0.73 for LSRPS II and 0.89 for total psychopathy.

Test of self-conscious affect-3: short version (TOSCA-3 Tangney et al. 2000)

The TOSCA-3 is a scenario-based measure that yields indices of shame-proneness, guilt-proneness, externalisation and detachment/unconcern. Only the guilt-proneness scale was used in the current study. Respondents were presented with a series of 11 negative scenarios that they may encounter in day-to-day life. A sample scenario from the TOSCA-3 is: 'You make a big mistake on an important project at work. People were depending on you, and your boss criticizes you.' The response options that follow this scenario are: 'You would feel like you wanted to hide' (shame response), You would think: 'I should have recognized the problem and done a better job' (guilt response), 'You would think your boss should have been more clear about what was expected of you' (externalisation response), and You would think: 'Well, nobody's perfect' (detached/unconcerned response). Respondents are required to rate their likelihood of each response on a five-point scale ranging from 'not likely' (1) to 'very likely' (5). In the current study, the mean score for the guilt-proneness scale was 46.00 ($SD=6.25$). This is comparable to the mean TOSCA-3 guilt-proneness score of 45.59 ($SD=4.96$) previously reported by Treeby and Bruno (2012). In the present sample, the Cronbach alpha value was 0.78 for guilt-proneness.

Montreal Set of Facial Displays of Emotion (MSFDE; Beaupré and Hess 2005)

The MSFDE is a standardised set of pictures of facial emotion which has been widely used in facial emotion recognition research (Adams et al. 2006; Beaupré and Hess 2005). The set contains expressions of anger, sadness, happiness, fear, disgust and shame. Each expression is displayed at five different levels of intensity (20, 40, 60, 80 and 100%). In order to limit the number of images participants were required to view, and to minimise drop-out, the current study selected only Caucasian (male and female) models from the MSFDE set. Stimuli were presented via computer as greyscale images. All participants viewed a

total of 84 images (14 images of each emotion, with two of each emotion presented at 60, 80 and 100% intensity; and four of each emotion presented at 20 and 40% intensity). A greater number of low intensity stimuli were employed in order to increase overall task difficulty and to reduce potential ceiling effects. Participants were required to select the appropriate emotion label for each image depicted from six options provided. Scores across each level of intensity for all expression types were summed to provide a total score for each emotion expression.

Data analysis and power

The sample size was determined to be sufficient based on a power analysis for a multiple regression with two predictors conducted in G*Power (Faul et al. 2007). Using an alpha of 0.05, a power of 0.80 and a small effect size, the desired sample size was 485. Fritz and MacKinnon (2007) present empirical estimates of sample sizes for power in mediation analyses. For mediation analyses using bias-corrected bootstrapping, and with small a and b paths, Fritz and MacKinnon suggest that a sample of 462 is required for 0.80 power.

Separate mediation models were analysed to explore: (a) the mediating effect of FER on the relationship between psychopathic traits and guilt-proneness, and (b) the effect of psychopathic traits on the relationship between FER and guilt-proneness. In order to evaluate if FER ability would mediate the relationship between degree of psychopathic traits and guilt-proneness, a total of five mediation models were analysed, with guilt-proneness as the dependent variable, psychopathic traits as the predictor and FER accuracy (for each expression) as the mediator. In order to evaluate if the degree of psychopathic traits would mediate the relationship between FER accuracy and guilt-proneness, a further five mediation models were analysed with guilt-proneness as the dependent variable, FER accuracy (for each expression) as the predictor and psychopathic traits as the mediator. The analyses yielded the direct effects of the predictor on the moderator and on the dependent variable and the indirect effect of the predictor on the dependent variable through the moderator.

Indirect effects were examined using bias-corrected bootstrapping. Bias corrected 95% confidence intervals (CI) were estimated for each indirect effect, and CI's exclusive of zero indicated significant mediation (Preacher and Hayes 2008). Bias-corrected bootstrapping extends the mediation approach popularised by Baron and Kenny (1986), however offers greater statistical power for determining specific indirect effects as compared to Baron and Kenny's causal steps approach (Preacher and Hayes 2008). In the present analyses, bias-corrected bootstrapping using 5000 resamples was performed using the SPSS macro *Process* (Version 2.16; Hayes 2013).

Procedure

Approval to conduct the study was obtained from the University Human Research Ethics Committee (Reference: FHEC13/R71). Data were collected using an anonymous, secure, self-administered on-line survey. Participants were recruited via email, with addresses obtained from the University psychology participant database. A social media campaign was promoted via psychology research interest pages, and printed advertising was posted around the campus. Potential participants were directed to a website on which the study was described in a Plain Language Statement. Following consent, participants were invited to complete non-identifiable demographic information as well as the LSRPS, TOSCA-3 and MSFDE measures.

Table 1 Descriptive statistics for the Levenson self-report psychopathy scale (LSRPS), the test of self-conscious affect-3 (TOSCA-3) and the Montreal set of facial displays of emotion (MSFDE)

Variable	M	SD	M % correct
LSRPS			
Total psychopathy	47.67	10.22	
TOSCA-3			
Guilt	46.00	6.25	
MSFDE			
Sad	10.35	2.68	73.93
Anger	10.58	2.20	75.57
Fear	7.07	1.85	50.50
Disgust	9.03	2.86	64.50
Happy	12.45	1.55	88.93

$N = 747$. *LSRPS* Levenson self report psychopathy scale, *TOSCA-3* Test of self conscious affect-3. Increasing scores on the LSRPS scale indicates higher levels of psychopathic traits. Increasing scores on the TOSCA-3 subscale indicates greater levels of guilt-proneness

Table 2 Pearson's correlations between psychopathy, for accuracy and guilt-proneness

	Psychopathy	Guilt
Sadness	−0.12**	0.15**
Anger	−0.18**	0.19**
Fear	−0.15**	0.14**
Disgust	−0.18**	0.17**
Happiness	−0.08*	0.09*
Psychopathy		−0.50**

$N = 747$

* = correlation is significant at the 0.05 level (2 tailed); ** = correlation is significant at the 0.01 level (2-tailed)

Table 3 Direct and indirect effects of psychopathic traits on guilt-proneness with FER accuracy as mediator

Mediator: sadness

	b	SE	t	p	R^2 (p)
Psy to sad (a path)	−0.03	0.01	−3.41	**0.01**	
Sad to guilt (b path)	0.20	0.07	2.68	**<0.01**	
Psy to guilt (c path)	−0.31	0.02	−15.84	**<0.01**	
Psy to guilt through sad (c')	−0.30	0.02	−15.45	**<0.01**	0.26 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Effect	SE	Lower CI	Upper CI
Total indirect effect of psy on guilt through sadness	−0.01	0.01	−0.02	0.00

Mediator: anger

	b	SE	t	p	R^2 (p)
Psy to anger (a path)	−0.04	0.01	−5.05	**<0.01**	
Anger to guilt (b path)	0.28	0.09	3.05	**<0.01**	
Psy to guilt (c path)	−0.31	0.02	−15.84	**<0.01**	
Psy to guilt through Anger (c')	−0.30	0.02	−15.11	**<0.01**	0.26 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of psy on guilt through anger	−0.01	0.00	−0.02	**0.00**

Mediator: fear

	b	SE	t	p	R^2 (p)
Psy to fear (a path)	−0.03	0.01	−4.07	**<0.01**	
fear to guilt (b path)	0.22	0.11	2.02	**0.04**	
Psy to guilt (c path)	−0.31	0.02	−15.84	**<0.01**	
Psy to guilt through fear (c')	−0.30	0.02	−15.40	**<0.01**	0.25 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of psy on guilt through fear	−0.01	0.00	−0.01	0.00

Mediator: disgust

	b	SE	t	p	R^2 (p)
Psy to disgust (a path)	−0.05	0.01	−5.08	**<0.01**	
Disgust to guilt (b path)	0.18	0.07	2.62	**0.01**	
Psy to guilt (c path)	−0.31	0.02	−15.15	**<0.01**	
Psy to guilt through disgust (c')	−0.30	0.02	−15.15	**<0.01**	0.26 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of psy on guilt through disgust	−0.01	0.00	−0.02	0.00

Table 3 (continued)

Mediator: happiness

	b	SE	t	p	R² (p)
Psy to happy (a path)	−0.01	0.01	−2.18	**<0.01**	
Happy to guilt (b path)	0.20	0.13	1.59	0.11	
Psy to guilt (c path)	−0.31	0.02	−15.84	**<0.01**	
Psy to guilt through happy (c')	−0.30	0.02	−15.68	**<0.01**	0.25 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of psy on guilt through happy	0.00	0.00	−0.01	0.00

$N = 747$. Boldface represents significant results. Results are shown for models with FER accuracy as the mediators, guilt-proneness as the dependant variable and psychopathic traits as the predictors. Unstandardized regression coefficients are reported for direct and indirect effects. Bootstrap analyses with 5000 resamples with replacement were used.

CI 95% confidence interval, *FER* facial emotion recognition, *psy* psychopathic traits, *guilt* guilt-proneness, *SE* standard error

Results

The recruitment process yielded a full sample of 747 individuals. Preliminary investigation of the assumptions underlying our analyses revealed some minor deviations from normality, however this was considered to have limited effect on the data due to the large sample size (Tabachnick and Fidell 2007). Several outliers were also noted, although given that these values fell within the possible ranges of the respective measures, they were not due to data entry errors and were left in the data set. Inspection of the 5% trimmed means for the relevant variables indicated that the retention of these outliers did not significantly affect the data. A descriptive summary of the data is presented in Table 1, and correlations between variables are provided in Table 2.

In line with expectations, significant, small to medium positive correlations were found between guilt-proneness and each expression (Table 2), with the largest effect for the anger expression. These results indicate that for all expressions, increasing FER accuracy was related to a greater tendency to be guilt-prone. Psychopathic traits were moderately negatively correlated with guilt proneness, indicating that higher psychopathic traits were related to lower guilt-proneness. Significant, small to medium negative correlations were found between psychopathic traits and each expression (Table 2), with the largest effects for the anger and disgust expressions. These results indicate that increasing psychopathic traits were related to poorer FER accuracy.

When considering the mediating effects of FER on the relationship between psychopathic traits and guilt-proneness, no mediation effect was found for any expression (Table 3). In all cases, the relationship between psychopathic traits and guilt was only marginally weakened by the inclusion of FER, and the total indirect effects for all expressions were non-significant.

When considering psychopathic traits as the mediator between FER and guilt-proneness significant, partial mediation effects were found for the sad, angry, fearful and disgusted expressions (Table 4). Partial mediation was indicated as although the relationship between FER accuracy and guilt-proneness was weakened with the inclusion of psychopathic traits, the relationship between FER accuracy and guilt-proneness remained statistically significant for these expressions. The total indirect effects for sadness, anger, fear and disgust were all significant (Table 4). No mediation effect was found for the happy expression. Of the expressions considered with significant mediation effects, anger and fear demonstrated the equal largest indirect effects, indicating that psychopathic traits mediated the relationship between anger and guilt, and fear and guilt to a greater extent as compared to the other expression. The next largest indirect effects were for the disgusted and sad expressions respectively.

Discussion

This study sought to investigate the interrelationships between FER, guilt-proneness and psychopathic traits by exploring two alternative mediation models investigating: (a) the mediating effect of FER ability on the relationship between psychopathic traits and guilt-proneness, and (b) the mediating effect of psychopathic traits on the relationship between FER ability and guilt-proneness. Consistent with expectations and past research (Treeby et al. 2015), we found a positive relationship between FER ability and

Table 4 Direct and indirect effects of FER on guilt-proneness with psychopathic traits as mediator

Predictor: sadness

	b	SE	t	p	R^2 (p)
Sad to psy (a path)	−0.47	0.14	−3.41	**<0.01**	
Psy to guilt (b path)	−0.30	0.02	−15.45	**<0.01**	
Sad to guilt (c path)	0.34	0.08	4.03	**<0.01**	
Sad to guilt through psy (c')	0.20	0.07	2.68	**0.01**	0.26 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Effect	SE	Lower CI	Upper CI
Total indirect effect of sad on guilt through psy	0.14	0.04	**0.06**	**0.23**

Predictor: anger

	b	SE	t	p	R^2 (p)
Anger to psy (a path)	−0.84	0.17	−5.05	**<0.01**	
Psy to guilt (b path)	−0.30	0.02	−15.11	**<0.01**	
Anger to guilt (c path)	0.53	0.10	5.16	**<0.01**	
Anger to guilt through psy (c')	0.28	0.09	3.05	**<0.01**	0.26 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of anger on guilt through psy	0.25	0.06	**0.14**	**0.37**

Predictor: fear

	b	SE	t	p	R^2 (p)
Fear to psy (a path)	−0.82	0.20	−4.07	**<0.01**	
Psy to guilt (b path)	−0.30	0.02	−15.40	**<0.01**	
Fear to guilt (c path)	0.46	0.12	3.78	**<0.01**	
Fear to guilt through psy (c')	0.22	0.11	2.02	**0.04**	0.26 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of fear on guilt through psy	0.25	0.06	**0.12**	**0.38**

Predictor: disgust

	b	SE	t	p	R^2 (p)
Disgust to psy (a path)	−0.65	0.13	−5.08	**<0.01**	
Psy to guilt (b path)	−0.30	0.02	−15.15	**<0.01**	
Disgust to guilt (c path)	0.38	0.08	4.80	**<0.01**	
Disgust to guilt through psy (c')	0.18	0.07	2.62	**0.01**	0.26 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of disgust on guilt through psy	0.19	0.04	**0.12**	**0.28**

Table 4 (continued)

Predictor: happiness

	b	SE	*t*	*p*	R² (*p*)
Happy to Psy (a path)	−0.53	0.24	−2.18	**0.03**	
Psy to guilt (b path)	−0.30	0.02	−15.68	**<0.01**	
Happy to guilt (c path)	0.36	0.15	2.47	**0.01**	
Happy to guilt through psy (c')	0.20	0.13	1.59	**0.01**	0.24 (<0.01)

Bootstrap results for indirect effects

	Bootstrap estimate			
	Estimate	SE	Lower CI	Upper CI
Total indirect effect of happy on guilt through psy	0.16	0.08	0.00	0.32

N = 747. Boldface represents significant results. Results are shown for models with psychopathic traits as the mediator, guilt-proneness as the dependant variable and FER accuracy for each emotion as the predictors. Unstandardized regression coefficients are reported for direct and indirect effects. Bootstrap analyses with 5000 resamples with replacement were used

CI 95% confidence interval, *FER* facial emotion recognition, *psy* psychopathic traits, *guilt* guilt-proneness, *SE* standard error

guilt-proneness. While the magnitude of the relationship between FER and guilt-proneness was relatively modest, these findings add to the growing body of literature which suggests that accurate emotion perception is crucial for the development of other-oriented concern and prosocial interaction (Corden et al. 2006). Also consistent with expectation and past research (Dawel et al. 2012), we found significant, negative correlations between FER ability and psychopathic traits for all expressions, suggesting that the increasing level of psychopathic traits are related to greater impairments in accurately identifying a range of facial expressions.

The models which investigated FER as the mediator between psychopathic traits and guilt-proneness were all non-significant. These results suggest that for those with high psychopathic traits, better FER ability does not necessarily facilitate a more guilt-prone interpersonal style. These findings are inconsistent with the idea that individuals with high psychopathic traits escape from feelings of guilt because they are simply unable to recognise when their actions cause distress in others.

Conversely, psychopathic traits were found to significantly partially mediate the relationship between FER ability and guilt-proneness for the sad, angry, fearful and disgusted expressions. These findings, taken with the insignificant mediation models using FER as the mediator, are consistent with the suggestion that individuals with high psychopathic traits may be able to objectively understand the emotions of another person; however this awareness fails to initiate any feelings of other oriented concern (Cima et al. 2010).

Partially consistent with the predictions, the equal largest indirect effects were found for the fearful and angry expressions, however in contrast to expectations; the smallest significant indirect effect was for the sad expression. No significant mediation effect for psychopathic traits was found when considering the relationship between the happy expression and guilt-proneness. The delineation between negative (i.e. sadness, anger, fear and disgust) and positive (i.e. happiness) affect in our study is interesting. This may suggest that the deficient affective mechanism in psychopathy is one that preferentially responds to the pain, distress or suffering of others, possibly akin to the impaired aversive reaction as described by the IES (Blair 2006), or via other means. This lack of an implicit emotional reaction in response to the pain of others in psychopathy could conceivably impair the development of important moral self-conscious emotions such as guilt (Prinz 2008) that would otherwise thwart the development of the socially deleterious behaviours so often associated with psychopathy.

Limitations

There are several limitations in the current study that should be noted. Firstly, given the cross-sectional and correlational nature of our data, the current results in and of themselves preclude firm conclusions regarding the temporal relationships between the variables (Winer et al. 2016). Also, this study was based on a non-clinical sample and relied entirely on self-report personality measures, rather than interview data and clinician-administered rating scales. As such, it should not be assumed that the conclusions drawn from our sample will extend to clinical and forensic samples. Although the MSFDE stimuli set has been widely used in FER research, and is generally well validated, the accuracy discrepancy across the different expressions may have masked some relationships with psychopathic traits,

particularly with regard to the fearful expression. Finally, psychopathic traits only partially mediated the relationship between FER and guilt-proneness. This indicates that other important variables are acting upon this relationship, and it is possible that other potential mediators may provide alternative explanations regarding this relationship.

Conclusions

In summary, FER ability was positively related to guilt-proneness. Psychopathic traits were negatively related to FER ability for all expressions, and to guilt-proneness. FER ability did not significantly mediate the relationship between psychopathic traits and guilt-proneness. However, psychopathic traits were found to partially mediate the relationship between FER and guilt-proneness for all expressions other than happiness, with the greatest indirect effects found for the fearful and angry expressions.

Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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