Personality and Individual Differences 55 (2013) 801–804

Contents lists available at SciVerse ScienceDirect

Personality and Individual Differences

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

Executive function as a function of sub-clinical psychopathy

Robert J. Snowden [a,*], Nicola S. Gray [b,c], Sally Pugh [a], Gemma Atkinson [a]

[a] School of Psychology, Cardiff University, Cardiff, UK
[b] Ty Catrin, Pastoral Healthcare, Cardiff, UK
[c] School of Medicine, Swansea University, UK

ARTICLE INFO

Article history:
Received 13 March 2013
Received in revised form 28 May 2013
Accepted 21 June 2013
Available online 17 July 2013

Keywords:
Psychopathy
Executive function
Fearless Dominance
Self-Centered Impulsivity
Object alternation
Spatial alternation
Porteus Maze
Orbitofrontal cortex
Dorsolateral prefrontal cortex

ABSTRACT

Some aspects of executive function are thought to be dysfunctional in psychopathic individuals. We administered a small battery of neuropsychological tests (spatial alternation task, object alternation task, and Porteus Maze) to two samples of college students and obtained a measure of psychopathy via a self-report questionnaire. Psychopathic traits were related to the tests of object alternation and Porteus Maze but not to the spatial alternation task. Our results support the hypothesis of orbitofrontal cortex (OFC) dysfunction with sparing of dorsolateral prefrontal cortex (DLPFC) in psychopathy and provide a downward extension of this theory to sub-clinical levels of psychopathy.

1. Introduction

The concept of psychopathy refers to a constellation of personality traits and behaviours characterised by a lack of remorse, a lack of emotionality, impulsivity, and poor decision making. In turn, the concept is linked to antisocial behaviour, violence, and poor treatment prognosis (Hare & Neumann, 2008). The link between psychopathy and possible frontal lobe dysfunction arose from observations of similarities between individuals with acquired frontal lobe damage and those with psychopathy (Harlow, 1848).

Neuropsychological investigations of psychopathy have often, however, shown no sign of executive function impairment (e.g., Hare, 1984; Hart, Forth, & Hare, 1990). The reasons for this may be manifold but there appears to be an emerging theory that tasks that are associated with the function of the orbitofrontal cortex (OFC) are compromised in psychopaths, whereas those that are associated with dorsolateral prefrontal cortex (DLPFC) are unaffected. Lapierre, Braun, and Hodgins (1995) showed that tests associated with OFC function (Go/NoGo task; Porteus Maze Test) produced large differences between psychopathic and control offender groups, whilst those associated with DLPFC function (Wisconsin Card Sort Test) did not. Blair et al. (2006) examined the spatial alternation (SA) task and the object alternation task (OA) in psychopaths. These two tasks appear very similar as both involve using the previous response to guide response selection on the next trial. Nevertheless, the OA appears to require intact OFC function, whilst the SA requires intact DLPFC function (Mishkin, Vest, Waxler, & Rosvold, 1969). In line with the OFC deficit hypothesis, psychopaths showed increased errors on the OA task but not the SA task (see also Mitchell, Colledge, Leonard, & Blair, 2002).

A common concern in the study of adult individuals with psychopathy is that their lifestyle, which often includes a range of risk and sensation seeking behaviours, may be responsible for differences in brain function and/or executive function. In particular, the excess use of drugs and alcohol can alter executive function, including many of the tasks mentioned above as providing evidence in support of the OFC deficit hypothesis (Bolla et al., 2003; Reay, Hamilton, Kennedy, & Scholey, 2006). Therefore, studies of sub-clinical levels of psychopathic traits within community samples may be able to provide "paralleling evidence" to studies of clinical psychopathy. However, to date, there have been few studies that have tested neuropsychological functioning of sub-clinical psychopathy. We have taken a small battery of tests that have been shown to be related to clinically defined psychopathy and tested to see if performance is related to self-reported psychopathy in a sample of college students. It is also expected that the effects of chronic drug or alcohol abuse may be less likely to be present than a clinical sample. In Experiment 1 we looked at the Object and the

* Corresponding author. Tel.: +44 2920874937.
E-mail address: snowden@cardiff.ac.uk (R.J. Snowden).

0191-8869/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.paid.2013.06.016

spatial alternation tasks, whilst in Experiment 2 we looked at the Porteus Maze task.

There is also increasing recognition that psychopathy at a global level is underpinned by a small number of factors, yet there is little data that has addressed which aspects of psychopathy may be related to which neuropsychological dysfunction. The Psychopathic Personality Inventory – Revised (PPI-R; Lilienfeld & Widows, 2005) produces a global psychopathy score and assesses the traits of Fearless Dominance (which involves social potency, immunity to stress, and fearlessness), Self-Centered Impulsivity (which involves impulsiveness, lack of planning, and blame externalisation), and Coldheartedness (which involves a lack of emotion). The questionnaire was developed to place greater emphasis on the personality traits related to psychopathy as compared to the often used clinical measure of psychopathy, the Psychopathy Checklist – Revised (PCL-R; Hare, 2003). The dimensions of Fearless Dominance and Self-Centered Impulsivity have been equated to the PCL-R factors 1 (Interpersonal/Affective) and 2 (Lifestyle/Antisocial) (see Rilling et al., 2007), however other authors have not found a close match between these two conceptualisations of psychopathy (Copestake, Gray, & Snowden, 2011; Hughes, Stout, & Dolan, 2013; Marcus, Fulton, & Edens, 2013).

2. Methods

2.1. Participants

The participants for Experiments 1 and 2 were 90 and 60 undergraduate students (51% and 80% female) respectively. Participants were either given course credit or were paid for their participation. Ethical approval was obtained from Cardiff School of Psychology Ethical Committee.

2.2. Measures

2.1.1. Psychopathic Personality Inventory – Revised

The PPI-R (Lilienfeld & Widows, 2005) is a 154 item self-report measure of psychopathy. Each question is answered on a four-point scale of 1 (False), 2 (Mostly False), 3 (Mostly True), and 4 (True). Participants were presented with written instructions about the PPI-R and how it should be completed. The PPI-R produces a global psychopathy score and scores for the Fearless Dominance, Self-Centered Impulsivity and Coldheartedness scales.

2.1.2. Spatial and object alternation tasks

The tasks were presented on a test apparatus made to the same specifications as Freedman, Black, Ebert, and Binns (1998). This was a frame of 55 cm wide and 65 cm high, anchored to a stimulus board with 2 reinforcement wells 24 cm apart onto which target stimuli were placed. In the OA task the two three-dimensional objects differed in shape and colour; in the SA task the two objects were identical. On the first trial, both spaces/objects were baited with a prize (a paper disc with 'prize' written on it) and the person was therefore correct. On each subsequent trial following a correct response the prize was either located on the other side (for the spatial alternation task) or the other object (for the object alternation task). Following an incorrect response the trial was repeated until the correct response was chosen. This procedure continued until 12 consecutive correct responses were made or 80 trials have been completed. The number of errors was taken as the measure of performance. Other details followed the procedures of Blair et al. (2006).

2.1.3. Porteus Maze

The Vineland revision of the Porteus Maze test (Porteus, 1965) was used to assess impulsive errors in executive functioning. The test consists of ten labyrinths, each one increasing in difficulty. Participants gained a Qualitative score (Q-score), that is intended to reveal any haphazard, impulsive or over-confident habits of action. The higher the Q-score, the more impulsive errors were made (wall crossing, cutting corners, pencil lifts, sinuous course, wrong direction).

2.2. Procedure

The participants first completed the PPI-R and then the two alternation tasks in Experiment 1 or the Porteus Maze task in Experiment 2. The order of the tasks in Experiment 1 was counterbalanced across participants (later analysis showed no effect of this order).

2.3. Data analysis

Data were tested for normality of distribution. The error rates for the SA and OA tasks were not normal due to a large number of people making no errors and there was no transformation that could approximate the normal distribution. Hence, non-parametric statistics were applied whenever these data were involved in the analysis. All other distributions did not deviate from the assumptions of normality and parametric statistics were used for these. Correlations were compared using the methods described by Steiger (1980).

3. Results

3.1. Descriptive statistics

The overall scores on the PPI-R and the neuropsychological tests are shown in Table 1.

3.2. Psychopathy and spatial and object alternation

Results are shown in Table 2. Overall, no significant correlations were found between the global psychopathy score and either the SA or OA task. However, there was a significant correlation between the subfactor of Fearless Dominance and errors in the OA task, but not in the SA task. This difference between these correlations was marginally significant ($p = .05$). The correlation between Fearless Dominance and OA errors was larger than for the Self-Centered Impulsivity and Coldheartedness subscales ($p = .08$; $p = .09$; respectively).

Table 1
Descriptive statistics for the two Experiments. Sample size was $N = 90$ for Experiment 1 and $N = 60$ for Experiment 2.

	Experiment 1		Experiment 2	
	Mean [Median]	SD [IQR]	Mean	SD
PPI-Total	284.0	37.9	281.8	37.2
Fearless Dominance	111.7	20.4	113.3	21.1
Self-centered impulsivity	140.7	21.6	140.7	22.1
Coldheartedness	31.4	5.4	27.9	5.7
SA errors	10.9 [9.0]	8.6 [3–20]	–	–
OA errors	5.0 [3.0]	6.9 [0–7]	–	–
Q-score	–	–	24.6	12.9

Note: IQR = inter quartile range.