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ARTICLES

Implicit affective associations to violence in psychopathic murderers

ROBERT J. SNOWDEN, NICOLA S. GRAY, JENNIFER SMITH, MARK MORRIS and MALCOLM J. MACCULLOCH

ABSTRACT Social cognition about violence was assessed using both implicit and explicit measurements in a group of offenders who had committed murder and in a control group of offenders who had committed other crimes. On an implicit test of social cognition murderers with high psychopathy scores showed a reduced negative association to violence, whilst murderers with low psychopathy scores had an increased negative association to violence compared to the non-murderers (irrespective of their psychopathy score). No differences were found using explicit measurements. We suggest implicit measurements of social cognitions may prove a useful addition to explicit measurement in forensic situations, and shows potential as a future risk assessment tool.

Keywords: psychopathy, Implicit Association Test (IAT), social values, violence, morality, affect, Psychopathy Checklist – Revised (PCL-R).

INTRODUCTION

The reasons and motivations for committing violent actions such as murder are without doubt manifold with contributions from cognitive style,

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neurobiology, genetics and social factors (Davidson, Putnam and Larson, 2000; de Waal, 2000; Widom, 1989). Some murders occur in 'hot-blood' (affective murders) whilst others are deliberately planned for the purpose of gain or revenge (instrumental or predatory murders). A focus upon possible neuropsychological dysfunction has identified that the brains of murderers (not guilty by reason of insanity – Raine, Buchsbaum and LaCasse, 1997; Raine, Buchsbaum, Stanley, Lottenberg, Abel and Stoddard, 1994) have abnormalities. The nature of the brain abnormalities vary with the type of murderer. For example, Raine, Meloy, Bihrle, Stoddard, LaCasse and Buchsbaum (1998) show that those convicted of 'predatory' murder have relatively good prefrontal functioning whilst those who had committed 'affective' murder have reduced prefrontal activity which in turn may fail to control emotion regulation.

The concept of psychopathy is currently conceptualized as having core affective, interpersonal and behavioural features (Cleckley, 1941; Hare, 1991; Hare, 2001). The strong association between psychopathy and offending is seen to be linked with the interpersonal and affective cluster of traits such as grandiosity, callousness, manipulation, lack of empathy, and lack of guilt or remorse (Hare, 1991). These traits of adult psychopathy can be apparent early in childhood (Kosson, Cyterski, Steuerwald, Neumann and Walker-Matthews, 2002), and the aetiology of the syndrome is likely to be a product of complex interactions between genetic factors, organic predispositions and/or acquired organic deficits and social forces (Hare, 2001). Violence in people high in psychopathy tends to be cold-blooded and instrumental (Cornell, Warren, Hawk, Stafford, Oram and Pine, 1996; Porter, Woodworth, Earle, Drugge and Boer, 2003, Woodworth and Porter, 2002) and they often react to the violence they have committed with indifference rather than the distress, remorse and guilt shown by many non-psychopathic offenders (Hare, 2001). On the other hand, not all people with high psychopathy scores are murderers. Many such people appear to function well within society and use their charm, ability to manipulate people and lack of guilt to further themselves (the so-called White Collar Psychopath – Hare, 1999).

Evaluation of beliefs, views, and attitudes towards such matters of violence is not straightforward. Whilst explicit measures can reveal abnormal beliefs in some circumstances (Levenson, Kiehl and Fitzpatrick, 1995; Maxfield, Weiler and Widom, 2000), under conditions where such revelations may not be in their best interests a person may well hide such explicit admissions (Abel, Becker, Mittelman, Cunningham-Rathner, Rouleau and Murphy, 1987; Grubin, 2002; McGovern and Nevid, 1986). It may, of course, be even more difficult in those scoring highly on psychopathy scales as a core feature of psychopathy is pathological lying and the ability to con and manipulate others (Hare, 1991). Faced with such problems when attempting to measure socially stigmatic beliefs social psychologists have developed measures that

do so implicitly (Fazio, Jackson, Dunton and Williams, 1995, Swanson, Rudman and Greenwald, 2001). One popular technique is the Implicit Association Test (IAT – Greenwald, McGhee and Schwartz, 1998). The IAT measures the extent to which two target concepts (e.g. flowers, insects) are associated with two attributes (e.g. pleasant and unpleasant). When highly associated categories (e.g. flower-pleasant and insect-unpleasant) share the same response key performance is fast and accurate. Conversely, when negatively associated categories share a response key (e.g. flower-unpleasant and insect-pleasant) performance is slow and errors increase. Socially stigmatic attitudes (such as those to race, gender, age, obesity, homophobia, etc.) that participants have sought to disguise have been successfully indexed using this technique with appropriate category content (Banse, Seise and Zerbes, 2001; de Jong, Pasman, Kindt and van den Hout, 2001; Greenwald *et al*., 1998; Marsh, Johnson and Scott-Shledon, 2001; Swanson *et al*., 2001; Teachman and Brownell, 2001; Teachman, Gregg and Woody, 2001).

Whilst some people are willing to self-report certain psychopathic traits under some circumstances (Levenson *et al*., 1995; Maxfield *et al*., 2000), the use of implicit measures may also have great utility as the IAT (compared to explicit measures):

(1) is thought to bypass access to conscious control (Greenwald *et al*., 1998) ,
(2) is non-transparent and thus difficult to fake (Banse *et al*., 2001),
(3) may be a better indicator of real-life behaviour than explicit measures (Greenwald *et al*., 1998; McConnel and Leibold, 2001),
(4) is sensitive to clinical change (Teachman and Woody, 2003).

Understanding the reasons someone has murdered may lead us into a better assessment of what future risk this person poses, and what can be done to help them and protect society. This study assessed explicit attitudes to violence, and implicit associations to violence in a population of convicted offenders. Within this population some had committed murder and some had high psychopathy scores. We hypothesized that those murderers who are also high on psychopathy would have an abnormal view of violence, and that this abnormal view of violence might only manifest itself in an implicit measure (even though there was no reason for the offender to dissimulate in this setting). A brief communication of some of these findings has already appeared (Gray, MacCulloch, Smith, Morris and Snowden, 2003).

METHOD

All experimental protocols and data collection methods were given ethical permission by both Grendon Research and Advisory Committee and the

Ethical Committee of the School of Psychology, Cardiff University. All participants gave written informed consent to participate in the experimental procedures, the clinical interviews and for the researchers to have full access to their prison records.

Participants

Participants were recruited from a specialist facility run as a therapeutic community. All offenders were adult male repeat offenders who had been selected by the admission committee at HMP Grendon as having a personality disorder. All consecutive admissions within a 20-month period were asked to participate in the study. Eighteen people refused to participate, seven people left the prison before completion of the experimental tasks and one person did not participate due to illiteracy. This study reports data from 121 offenders. The offenders were divided into two groups according to their offences. Those who had a conviction for murder ($N = 30$), and those who had no conviction for murder ($N = 91$) referred to as the 'other-offence' control group. These other-offences included both violent and sexual offences. Demographic information on these two groups is displayed in Table 1. No participant received any form of medication as this was against the rules of the institution. As a group, the participants had a variety of mental health diagnoses listed in their files, collected over a number of years. Such multiple and conflicting diagnoses are common in people with Personality Disorder and are often of questionable validity. Therefore no attempts to substantiate these separate diagnoses were made as the diagnosis of Personality Disorder was considered primary.

Explicit measures

Explicit measures of attitudes to violence/peace and to flowers/insects were taken using the feeling thermometer, and through semantic differentials. In

Table 1 Demographic and clinical information about the participant groups. Means shown with standard deviations in parentheses.

	Low – Other offender	*Medium – Other offender*	*High – Other offender*	*Low – Murderer*	*Medium – Murderer*	*High – Murderer*
Number	40	34	17	11	13	6
Age	37.0 (10.7)	29.9 (5.0)	31.2 (9.0)	36.8 (8.8)	39.9 (11.2)	32.5 (9.8)
IQ-NART	98.3 (19.7)	98.3 (14.3)	94.1 (16.9)	98.1 (16.5)	94.0 (20.1)	91.5 (18.3)
Convictions	11.4 (13.9)	14.2 (8.7)	16.0 (8.8)	12.2 (8.1)	10.1 (6.5)	10.8 (9.3)

brief the former involves the presentation of a test concept (e.g. peace, violence, flowers and insect) and it being rated on a scale of 0 to 99. One end of the scale (0) is marked with the concept of 'cold/unfavourable' whereas the other (99) is marked with the concept of 'warm/favourable'. The participant makes a mark to indicate where they believe the test concept lies in relationship to the scale. The semantic differential involved the presentation of a target concept (e.g. flower) and 6 Likert scales (scored 1–7) that were labelled at each end (beautiful-ugly, good-bad, pleasant-unpleasant, exciting-unexciting, nice-awful, attractive-unattractive). Participants were instructed to mark the middle of the range if they considered both anchoring adjectives to be irrelevant to the category. The semantic differential was scored by averaging the six items for each concept, scored on a scale ranging from − 3 to + 3 so that scores ranged from − 18 to + 18.

Implicit measures

Two versions of the IAT test were developed. These were termed: (1) Control-IAT (which had the categories of flower-insect) and (2) Violent-IAT (which had the categories of violent-peace). For both of these tasks the affect dimension was pleasant-unpleasant. For each of these tasks 32 words were used. For the control-IAT, eight flower words, eight insect words, eight pleasant words and eight unpleasant words were used. The pleasant and unpleasant words were selected from norms (Bellezza, Greenwald and Banaji, 1986). This version of the task has been used extensively as a control condition by previous researchers (for example, Greenwald *et al*., 1998) although the version used here was abbreviated for clinical purposes. For the violent-IAT, we used the same 16 pleasant-unpleasant words. In addition, we used eight offence-specific (violent) words and eight words related to the concept of peace. In the absence of any norms to aid compilation of these words, the ones used were exemplars that the authors judged would be familiar to a prison population and would be unambiguously classified as belonging to the appropriate category. Pilot evaluations were run to ensure that offenders unanimously rated violent and peaceful words to the appropriate category. A list of these words can be found in Appendix 1. The pleasant/unpleasant words were presented in capital letters, whilst the other words were presented in lower case letters, as per standard IAT methodology (Greenwald *et al*., 1998). Category words were placed below the computer screen (using Velcro strips) corresponding to the correct button to press for that category. Category labels could thus be easily changed with reversal of button response between different stages of the paradigm.

All experiments were administered on an Apple-Mac computer and were controlled by the 'Superlab' software. Responses were taken via a specially built button box, comprising two distinct response buttons that were

relayed to the computer via the keyboard using separate hands for each button. The computer recorded all reaction times (RT) and errors. Words were presented in the centre of the screen, with each letter being approximately 6 mm high (width varied slightly from letter to letter). Thus from the viewing distance of 57 cm each letter subtended a visual angle of 0.6 degrees. All letters were black (0.3 cd/m^2) and were presented on a light background (100 cd/m^2).

Trial blocks

All tasks consisted of the five stages. Stage 1 consisted of 32 trials where each of the 16 attribute words was presented twice in a pseudo-random order, such that all words were presented once before any word was repeated. Stage 2 was identical to stage 1 for the appropriate target words. Stage 3 consisted of 64 trials where each of the 16 attribute and 16 target words were presented twice each in a similar pseudo-random order. Stage 4 was identical to stage 2, save for the reversal of the response buttons. Stage 5 was identical to stage 3 except that the response button for the target dimension remained reversed. As well as the trials mentioned above, each stage also had a short practice phase prior to commencement of the trials proper. For stages 1, 2 and 4 the practice trials consisted of 8 of the attribute or target words chosen at random. For stages 3 and 5, 16 practice trials were presented (consisting of 8 of the target and 8 of the attribute words chosen at random). No data from practice trials was included in the analysis. For half the participants stage 3 consisted of the 'congruent condition' where the expected association (flowers-good or peace-good) were presented, whereas the other participants received the 'incongruent condition' (flowers-unpleasant or peace- unpleasant) at this stage and the congruent condition at stage 5.

Trial details

Each word was presented on the screen and the participant was required to respond as quickly as possible via a button press. Each trial commenced with the presentation of a fixation cross for 70 ms and then the presentation of the test word until the participant responded. The participant's response caused the screen to blank and the next trial commenced 70 ms later. No feedback was given as to the correctness of the response.

Design

For the IAT tasks four independent factors were included in the design. These were (1) IAT condition (congruent vs. incongruent); (2) order

(congruent performed first vs. incongruent performed first); (3) group (murderer versus other-offender control); (4) PCL-R group (High, Medium, Low). Participants were assigned to the order groups on a consecutive basis. The dependent variables were RT and errors of word classification. For the explicit measures we had 3 of the factors above (there was no order factor).

Psychopathy Checklist – Revised (PCL-R)

The PCL-R (Hare, 1991) measures a common kernel of personality traits that can define the disorder of psychopathy. It consists of a 20-item evaluation of psychopathy, which incorporates both interview assessments and file-based information. Each of the 20 items are scored on a three point scale from 0 to 2, where a score of 0 indicates that the item is not present for the individual; a score of 1 indicates that it may be present but that the evidence available is not strong enough to warrant a score of 2; and a score of 2 indicates that the item is definitely present. The possible range of scores on the PCL-R is therefore 0–40. The higher the score obtained the nearer the individual is to the prototypical 'psychopath'. The PCL-R can be broken down into two factors: Factor 1 measures selfish and callous personality and relates mainly to interpersonal and affective traits. Factor 2 measures socially deviant behaviour and past criminality. The PCL-R has excellent inter-rater reliability ($r = 0.90$; Hare, 1991). For 17 of our offenders we obtained ratings from two raters and interclass correlations were very high ($R_{\text{total}} = 0.98$; $R_{\text{Factor1}} = 0.98$; $R_{\text{Factor2}} = 0.97$).

PCL-R scores were obtained by interviews and access to file based information. Interviews and PCL-R scoring was conducted by accredited raters (NSG and JS) who had completed the PCL-R training programme. Interviews lasted from between 1.5 to 3.5 hours. IAT tasks were administered by researchers blind to PCL-R score.

Based on the PCL-R score participants were assigned to groups corresponding to low, medium and high psychopathy. The low group was defined as having a score of 0–19, medium scores were 20–29, and high as 30–40[1] (Hare, 1991; Hart, Kropp & Hare, 1988).

RESULTS

Population statistics

Demographic and clinical information from the murderer and other-offender control group are presented in table 1. Two-way ANOVA on each of the demographic variables (age, IQ and convictions) did not reveal any main effects of offence group, or PCL-R score.

Explicit measures

The results from the semantic differential are presented in Table 2. As expected flowers are given more positive ratings than insects, and peace is given a more positive ratings than violence. The data from each of the tasks (flowers vs. insects and violence vs. peace) was analysed using a three-way analysis of variance (ANOVA) with a within subject factor of target concept (either flowers vs. insects or violence vs. peace) and between subject factors of offence type (murderer vs. other) and psychopathy score (low, medium and high). For the control task (flowers vs. insects) the expected pattern of results was obtained whereby there was a large effect of target concept [($F(1, 115) = 102.4$, $p < 0.001$] but there were no other significant main effects or interactions. For the test task (violence vs. peace) we once again obtained the expected difference between the target concept [($F(1, 115) = 485.8$, $p < 0.001$]. There was also a main effect of offence type [($F(1, 115) = 5.53$, $p < 0.05$], and an interaction between offence type and PCL-R score [($F(2, 115) = 3.94$, $p < 0.05$]. The reasons for these later two results is unclear, however, as they did not involve an interaction with the target concept they were not further analysed.

The results from the feeling thermometer are presented in Table 3. As expected flowers are given more positive ratings than insects, and peace is given a more positive ratings than violence. A three-way ANOVA on the control task (flowers vs. insects) gave the expected pattern of results whereby there was a significant effect of target concept [($F(1, 115) = 65.87$, $p < 0.001$] but no other significant main effects or interactions. Likewise a three-way analysis of variance for the test task (violence vs. peace) gave a significant effect of target concept [($F(1, 115) = 349.3$, $p < 0.001$], but no other significant main effects. The difference score (violence rating minus peace rating) appears to decrease with PCL-R for the other offenders group,

Table 2 Mean scores for the Semantic differential. Scores can range from 24 (favourable) through 0 (neutral) to − 24 (unfavourable).

	Murderer			*Other offender*		
PCL-R	*Low*	*Medium*	*High*	*Low*	*Medium*	*High*
Violence	− 15.2	− 13.2	− 13.0	− 14.6	− 8.6	− 11.2
Peace	12.9	9.6	10.5	12.3	13.6	13.0
Difference score	28.1	22.8	23.5	26.9	22.2	24.2
Flower	12.3	13.7	7.8	10.2	11.9	11.7
Insect	1.0	1.4	− 3.0	− 2.3	− 3.1	0.2
Difference score	11.3	12.3	10.8	12.3	15.0	11.5

Table 3 Mean scores for the Feeling Thermometer scores can range from 0 (unfavourable) to 99 (favourable).

To 99	*Murderer*			*Other offender*		
PCL-R	*Low*	*Medium*	*High*	*Low*	*Medium*	*High*
Violence	19.1	20.8	16.7	12.8	24.5	26.5
Peace	88.6	81.1	89.5	88.3	89.1	73.9
Difference score	69.5	60.3	72.8	75.5	64.6	47.4
Flower	71.4	77.3	74.8	75.5	69.5	69.2
Insect	46.3	46.9	46.7	44.3	45.4	44.7
Difference score	25.1	30.4	28.1	31.2	24.1	24.5

but increase for the murderers group (implying that psychopathic murderers have a very negative view of violence compared to psychopathic non-murderers), however the relevant statistical interactions were not significant.

Implicit measures

In previous experiments using the IAT there have been reports that the order of presentation of the congruent and incongruent conditions may influence the size of the IAT effect (Greenwald *et al*., 1998). In our design we counterbalanced order of presentation, such that half the participants were given the congruent condition first and half the incongruent condition first. Initially we included order in all the analyses of variance. However, order did not reach significance, either as a main effect, or as an interaction in any of the analyses and it was therefore excluded from the analyses presented below.

Violent-IAT

The mean RTs of the two groups (murderers vs. other-offender controls) for the congruent and incongruent conditions are plotted as a function of PCL-R score in Figure 1. The data were subject to a three-way ANOVA with IAT condition (congruent, incongruent) as a within-subject variable, and group (murderer, other-offender control) and PCL-R score (low, medium, high) as between-subjects variables. The result of most interest was the significant three-way interaction between IAT condition, group and PCL-R score [$F(2,115) = 5.54$, $p < 0.005$]. Inspection of Figure 1 suggests the following interpretation of this interaction. There appears to be little effect of PCL-R score on RT except for the murderers in the incongruent condition, where RTs decrease as PCL-R score increases. To further understand this

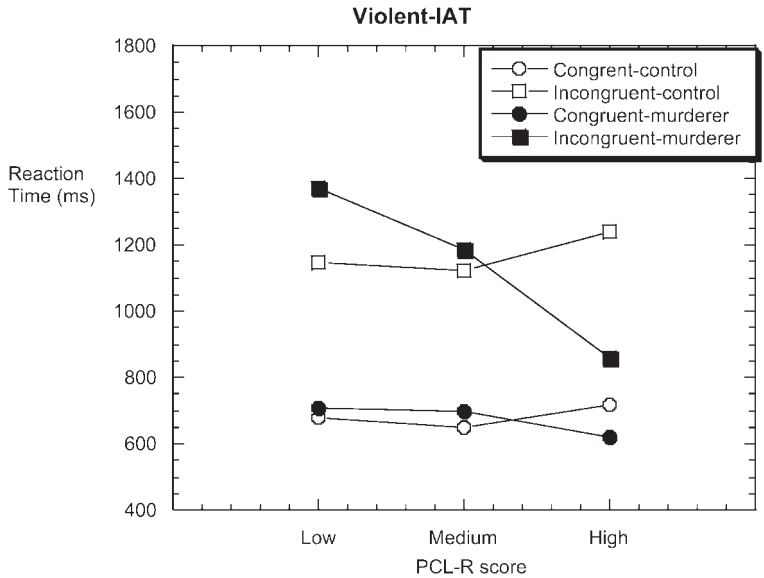

Figure 1 Results of the violent IAT. Reaction time is plotted as a function of PCL-R score with IAT condition (congruent – circles; incongruent – squares) and group (controls – open symbols; murderers – filled symbols) as parameters.

interaction we calculated an IAT score (incongruent RT – congruent RT) for the two groups as a function of PCL-R and this is plotted in Figure 2. The magnitude of the IAT score decreases with PCL-R score for the murderers but not for the other-offender controls. Post-hoc t-tests showed that the IAT score was greater for the murderer group than the other-offender control group in *low* PCL-R scorers [$t(49) = 1.92$, $p < 0.05$; Effect size = 0.86], but was less for the murderer group than the other-offender control group in *high* PCL-R scorers [$t(21) = 2.29$, $p < 0.05$; Effect size = 1.10].

There was a two-way interaction between group and PCL-R score [$F(2,115) = 6.69$, $p < 0.005$]. This appears to be due to an overall decrease in RTs with increasing PCL-R score for the murderers, but not the other-offender controls. However, it should be noted that the bulk of this decrease in RTs is in the incongruent condition and is thus accounted for by the three-way interaction. Likewise, the trend for an interaction between IAT condition and PCL-R score [$F(2,115) = 2.86$, $p = 0.06$] appears to be mainly in the murderer group and so is also a by-product of the three-way interaction. The two-way interaction between IAT condition and group was not significant [$F(1,115) = 0.76$, NS].

There was the expected significant main effect of IAT condition [$F(1,115) = 33.8$ $p < 0.001$], but no effect of group [$F(1,115) = 1.07$, NS] or

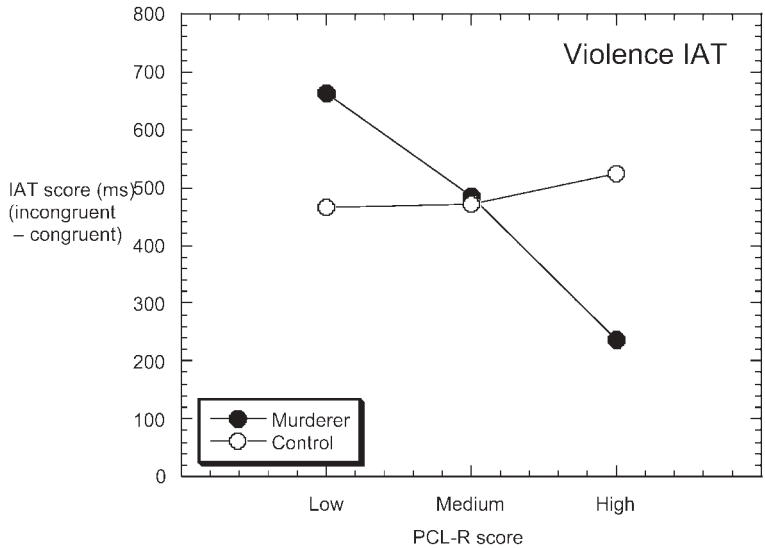

Figure 2 Results of the violent IAT. An IAT score (difference between the incongruent and congruent reaction times) is plotted as a function of PCL-R score with group (controls – open symbols; murderers – filled symbols) as a parameter

PCL-R score [$F(2,115) = 2.27$, NS]. As we found a small difference (but not statistically significant) in age between the murderers and other-offender controls (see Table 1) we also repeated the ANOVA with age as a covariate. The pattern of results reported above did not change and the crucial three-way interaction between IAT condition, group and PCL-R score remained significant [$F(2,113) = 6.12$, $p < 0.005$].

A similar ANOVA of the errors (see Table 4) did not produce any significant interaction effects. The only main effect to reach significance was that of IAT condition where, as expected, more errors were made in the incongruent condition [$F(1,115) = 57.6$, $p < 0.001$] . However, adding age as a covariate eliminated this effect.

In summary, as predicted the violent-IAT score for the violence-peace task is reduced in psychopathic murderers, but is unaffected in both psychopathic and non-psychopathic other-offenders. Surprisingly, the violent-IAT score was significantly increased for murderers with a low PCL-R score, relative to low PCL-R scoring other offenders.

Flower-IAT

The mean RTs of the two groups for the congruent and incongruent conditions are plotted as a function of PCL-R score in Figure 3. The three-

Table 4 Error data (% incorrect response) from both IAT tasks. Means shown with standard deviations in parentheses.

Group	*PCL-R score*	*Violence – Congruent*	*Violence – Incongruent*	*Flower – Congruent*	*Flower – Incongruent*
Murderer	Low	3.0 (2.8)	15.6 (18.6)	11.0 (6.5)	9.3 (14.0)
	Medium	3.0 (3.2)	12.1 (8.9)	9.4 (6.9)	16.5 (16.0)
	High	2.9 (2.3)	14.8 (17.4)	5.7 (8.2)	6.1 (4.8)
Other offender	Low	3.7 (4.1)	10.2 (8.9)	13.2 (6.4)	8.2 (6.2)
	Medium	4.0 (3.4)	10.1 (8.3)	10.8 (7.8)	9.0 (8.6)
	High	4.0 (3.7)	11.5 (12.7)	7.4 (5.9)	7.4 (8.7)

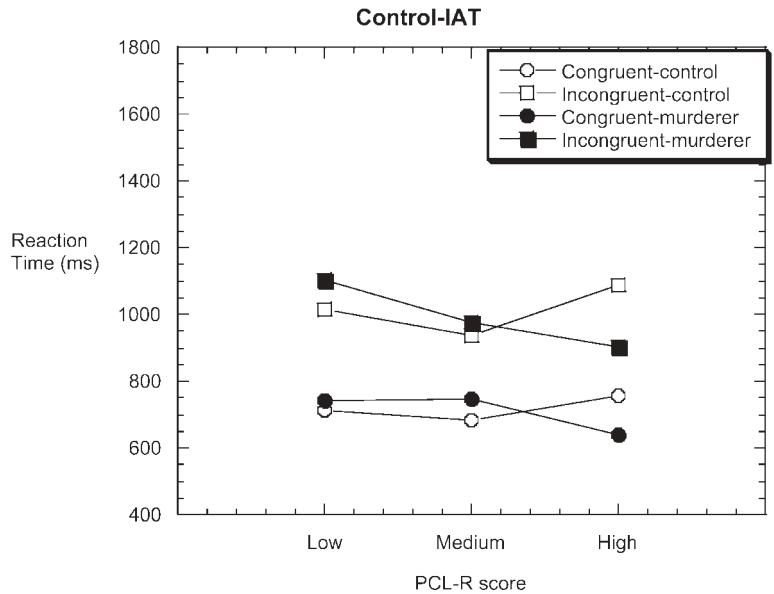

Figure 3 Results of the control (flower/insect) IAT. Conventions are as in Figure 1.

way interaction between IAT condition, group and PCL-R was not significant [$F(2,115) = 1.07$, NS]. For comparison with Figure 2 we have plotted the IAT effect for this control task in Figure 4.

There was no interaction between IAT condition and group [$F(1,115) = 1.22$, NS], nor between IAT condition and PCL-R score [$F(2,115) = 2.05$, NS] nor any interaction between group and PCL-R score [$F(2,15) = 2.65$, NS]. The expected main effect of IAT condition was significant [$F(1,115) = 269.9$, $p < 0.001$] but those of group [$F(1,115) = 1.94$, NS], and PCL-R score [$F(2,115) = 1.69$, NS] were not.

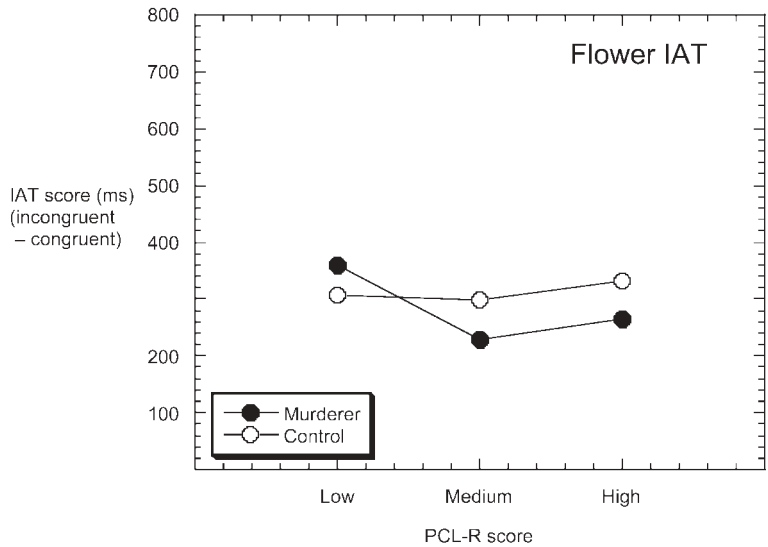

Figure 4 Results of the control (flower/insect) IAT. Conventions are as in Figure 2.

A similar ANOVA of the errors did not produce any significant effects (see Table 4). Adding age as a covariate to either of these ANOVAs did not change this pattern of results.

In summary, as predicted the IAT effect (e.g. the difference between the congruent and incongruent conditions) for the control-IAT was not affected by PCL-R score or type of offence committed[2].

Correlations

The PCL-R score is often used to label an individual as 'psychopathic' or not. For example, a score $\geqslant 30$ is often used (Hare, 1991) as a cut-off point (as used in the previous analysis for the 'high' group) for such a taxonomy. However, using cut-off scores has two distinct disadvantages. Firstly it can lead to some group sizes being worryingly small. For example, our group termed 'psychopathic murderers' consisted of only six people as these individuals are rare. Secondly, the cut-offs are somewhat arbitrary and one would not want to argue that someone with a score of 29 is particularly different from someone with a score of 30. Hence by placing similar individuals into different groups one loses much statistical power. The data were therefore also analysed using PCL-R score as a dimension (from 0–40).

The PCL-R score also consists of two factors (Hare, 1991). Factor 1 measures selfish and callous personality and relates mainly to interpersonal

and affective traits. Factor 2 measures socially deviant behaviour and past criminality. As there are no generally accepted cut-off points to divide people into high or low psychopathy for these factors, the correlation approach is particularly appropriate to these data. Therefore, each of these factors was also correlated against performance on the violent-IAT and control-IAT.

Performance on our IAT requires that the person understands the words being presented. There is therefore the possibility that IQ may affect the obtained scores (though we might expect a roughly equal effect of IQ on both the congruent and incongruent conditions, which in turn would not affect the magnitude of the IAT score). Therefore IQ scores (NART – Nelson, 1982) were also correlated against the IAT performance measures.

The results of the correlations are presented in Table 5 (violent-IAT) and Table 6 (control-IAT). For the violent-IAT the IAT score was negatively correlated with total PCL-R score (in line with the ANOVA) and was likewise negatively correlated with both Factor 1 and Factor 2 of the PCL-R. The reduction in the IAT effect with increasing PCL-R score appears to be due to decreasing RTs in the incongruent condition, and again both total

Table 5 Correlations between IAT performance (incongruent-congruent) with PCL-R score and IQ for the Violent-IAT. Significant correlations (two-tailed) are in bold ($^{*}p < 0.05$, $^{**}p < 0.01$).

	Murderer			*Other offender control*		
	IAT score	*Congruent*	*Incongruent*	*IAT score*	*Congruent*	*Incongruent*
PCL-R total	**− 0.53 ****	− 0.09	**− 0.49 ****	0.03	0.00	0.03
Factor 1	**− 0.49****	− 0.18	**− 0.48 ****	0.03	− 0.07	− 0.00
Factor 2	**− 0.36***	− 0.07	− 0.34	0.02	0.02	0.03
IQ- NART	0.21	− 0.28	0.09	− 0.08	− 0.06	− 0.09

Table 6 Correlations between IAT performance (incongruent-congruent) with PCL-R scores and IQ for the control-IAT). There were no significant correlations.

	Murderer			*Other Offender*		
	IAT score	*Congruent*	*Incongruent*	*IAT score*	*Congruent*	*Incongruent*
PCL-R total	− 0.20	− 0.21	0.09	0.00	− 0.03	− 0.06
Factor 1	− 0.21	− 0.34	− 0.01	− 0.11	0.02	− 0.04
Factor 2	− 0.11	− 0.05	0.11	0.03	− 0.09	− 0.11
IQ- NART	0.10	− 0.29	− 0.04	− 0.05	− 0.12	− 0.11

PCL-R and both PCL-R factors were negatively correlated with incongruent RT. Whilst both Factor 1 and Factor 2 correlate highly with IAT score this may be due to shared variance between the factors (reflecting the fact that both factors measure the same underlying construct of psychopathy). Indeed, as expected, the two factors are correlated (murderer group $r = 0.28$, $p > 0.10$, control group $r = 0.43$, $p < 0.001$). We therefore used partial correlation to investigate the association between Factor 1 and IAT score whilst controlling for Factor 2, and vice versa. The significant negative correlation between Factor 1 and IAT score remained ($r = -0.43$, $p < 0.05$) whilst the correlation between Factor 2 and IAT score was no longer statistically significant ($r = -0.27$, NS). There were no significant correlations for the other-offender control group on the violent-IAT.

For the control-IAT none of measures of performance correlated with the PCL-R measures in either group. IQ score (NART) did not significantly correlate with any of the IAT performance measures on either IAT version.

Explicit and implicit measures compared

Table 7 shows the correlations between the two explicit measures (calculated as the difference score between the violent and peace concepts, and between the flower and insect concepts) and the IAT measure. Unsurprisingly the two explicit measures were highly correlated (*R*'s 0.58 – 0.80), however there was little relationship between the IAT score and the explicit measures.

DISCUSSION

The study measured the implicit affective associations to violence in individuals who have committed murder and found that the murderers who

Table 7 Correlations between IAT scores (incongruent-congruent) and explicit scores (SD for semantic differential, FT for Feeling Thermometer). Significant correlations (two-tailed) are in bold (* $p < 0.05$, ** $p < 0.0.01$, *** $p < 0.001$).

		Murderer		*Other offender*	
		SD	*FT*	*SD*	*FT*
Violent – peace	IAT	0.06	− 0.05	0.06	0.05
	SD	-	**0.72*** **	-	**0.80*** **
Flower – insect	IAT	0.11	0.09	0.25*	− 0.14
	SD	-	**0.58*** **	-	**0.69*** **

were also high in a measure of psychopathy had only small negative associations, whilst murderers who were low on the psychopathy measure had large negative associations. This pattern of results did not occur for the other offenders, nor did it occur on a control task.

It was further hypothesized that the reduced violent-IAT effect would be associated with the type of individual who shows a lack of affect in terms of callousness, lack of empathy and a lack of remorse or guilt for their violent actions, hence Factor 1 of the PCL-R should be more highly associated with a reduced violent-IAT score than Factor 2. Our results show some support for this hypothesis in that Factor 1 was still significantly associated with violent-IAT score after partialling out the influence of Factor 2, whilst the reverse was not the case. However, the resulting partial correlations were only marginally different in magnitude.

There is already a large body of findings about psychopathy (but not specifically psychopathic murderers) that may well be related to the present findings. For example there is a wealth of previous studies on lack of appropriate emotional response in psychopathic offenders (Christianson, Forth, Hare, Strachan, Lidberg and Thorell, 1996; Day and Wong, 1996; Herpertz *et al*., 2001; Intrator *et al*., 1997; Kiehl, Hare, McDonald and Brink, 1999; Patrick, Bradley and Lang, 1993; Williamson, Harpur and Hare, 1991). Likewise others have demonstrated that psychopathic offenders are poor at passive avoidance (Lykken, 1957; Newman and Kosson, 1986) and show abnormal responses to punishment (Hare, Frazelle and Cox, 1978; Lykken, 1957; Newman, 1987). One could speculate that such a lack of emotion and response to punishment would lead to a failure to learn that acting violently is socially unacceptable and unpleasant. Alternatively some authors (e.g. Patterson and Newman, 1993) have suggested that the psychopathic offenders' impulsivity often means they do not stop to pause and reflect upon the consequences of their actions. Thus in the 'incongruent' condition of our experiment such individuals do not slow down their reaction times and thus have a smaller IAT effect. Such a theory should predict an increase in errors in this case and that this would also occur in the control task. We did not find evidence of this. However it maybe that the presentation of the words related to their crimes might increase arousal and therefore create conditions under which such behaviours could occur. Clearly this alternative is very speculative but could be tested further.

The finding that murderers who are not psychopathic have greater IAT scores than the controls was not expected. However, there is accumulating evidence that committing a violent act can act as a traumatic event even to the person committing it. The murders committed by those with high psychopathy scores are often instrumental in nature (Woodworth and

Porter, 2002), with little remorse or guilt following (Hare, 2001). Those with low psychopathy scores are often committed in extreme emotional circumstances and followed by guilt and remorse, with the event seen as traumatic. Indeed, recent research has shown that some murderers develop post-traumatic stress disorder (PTSD) as a consequence of their violent actions (Gray, Carman, Rogers, MacCulloch, Hayward and Snowden, 2003; Kruppa, Hickey and Hubbard, 1995; Papanastassiou, Waldron, Boyle and Chesterman, 2004; Pollock, 1999; Rogers, Gray, Williams and Kitchiner, 2000). This trauma following a violent act may lead the person to see violence as even more unpleasant and hence the effect seen on our violent-IAT.

The IAT provides an implicit measure of the association between two concepts. As such it may constitute a possible cognitive measure of risk of dangerousness. Unlike other non-cognitive measures which tend to be either static or can only increase over time (e.g. age of first offence, number of offences, severity of offence) the IAT can theoretically change with both deterioration in mental state and indeed improvement (e.g. following treatment of whatever form). Obviously, whether the violent-IAT *does* indeed reflect future risk is an empirical question, as is whether the violent-IAT can change over time.

Finally, we believe that whilst we have demonstrated that implicit measures might prove a useful addition to more traditional methods of assessment, there are clearly many outstanding issues. Firstly, we did not observe any influence of PCL-R score in the non-murdering group. This came as a surprise to us as many of this group had also committed violent acts. It may prove fruitful to consider a more specific topology of crime and violence in future studies, with specific consideration to those that appear to use violence often or sadistically. Secondly, our study can not show causality, hence the low violent-IAT scores of the psychopathic murderers may be due factors during and after the murder rather than one in place that may have contributed to it. Thirdly, psychopathic murderers are (thankfully) a rarity and hence the sample size is not as large as we would have wished. Replication and clarification of these results are needed alongside the development of such implicit measurement tools.

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Robert J. Snowden,
School of Psychology, Cardiff University, PO Box 901, Cardiff CF10 3YG, UK
(e-mail: snowden@cardiff.ac.uk)

Nicola S. Gray,
School of Psychology, Cardiff University, PO Box 901, Cardiff CF10 3YG, UK
South Wales Forensic Psychiatric Service, Caswell Clinic, Glanrhyd Hospital, Mid Glamorgan, CF36 4LN, UK

Jennifer Smith,
School of Psychology, Cardiff University, PO Box 901, Cardiff CF10 3YG, UK

Mark Morris,
HMP Grendon, Grendon, Berkshire, UK

Malcolm J. MacCulloch,
South Wales Forensic Psychiatric Service, Caswell Clinic, Glanrhyd Hospital, Mid Glamorgan, CF36 4LN, UK
Department of Psychological Medicine, University of Wales College of Medicine, Heath Park, Cardiff CF14 4XN, UK

Correspondence to Robert J. Snowden

NOTES

1 It has been suggested that the recommended (Hare, 1991) cut-off values of 20 and 30, which were developed from samples of North Americans, are equivalent to values of 15 and 25 respectively for a Scottish sample (Cook and Michie, 1999). We chose to use the more standard North American values as it is not clear as yet whether data from the Scottish sample can be applied to the mainly English offenders of the present study. However, all the analyses that we present using the cut-offs of 20 and 30 were repeated using 15 and 25. The crucial pattern of results is not affected by which cut-offs are used.

2 It might be argued that the trend in the three-way interaction for the control-IAT was in the same direction as the significant three-way interaction for the violence-IAT. However a four-way ANOVA which included task (violent-IAT vs control-IAT) also produced a four-way interaction [$F(2,115) = 3.26$, $p < 0.05$] which remained significant when age and/or NART IQ were added as covariates.

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APPENDIX 1

Unpleasant words	**Pleasant words**
ACCIDENT	*BEAUTIFUL*
CANCER	*GOOD*
DISASTER	*HAPPY*
POLLUTION	*HEALTH*
POVERTY	*HONEST*
SICKNESS	*JOKE*
UGLY	*LAUGH*
VOMIT	*LUCKY*
Violent words	**Peace words**
Attack	*calm*
hit	*dove*
hurt	*peace*
kill	*quiet*
murder	*rest*
stab	*sleep*
strangle	*tranquil*
threaten	*whisper*
Flower words	**Insect words**
crocus	*ant*
buttercup	*cockroach*
daffodil	*flea*
daisy	*greenfly*
orchid	*locust*
rose	*mosquito*
snowdrop	*termite*
tulip	*wasp*