Offenders with antisocial personality disorder show attentional bias for violence-related stimuli

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A B S T R A C T

Offenders with antisocial personality disorder (ASPD) may be characterized by a lack in emotional functioning that manifests in irritability and a lack of remorse. The proposed link between ASPD and negative emotionality led to the question of emotional processing anomalies in ASPD. Furthermore, the effect of childhood maltreatment/abuse on emotional processing was tested in the present study. Violent and sexual offenders with ASPD (n=35), without ASPD (n=34), and healthy non-criminal controls (n=24) were compared in an Emotional Stroop Task (EST) using neutral, negative, and violence-related words. Secondary analyses focused on the effect of psychopathic traits and childhood maltreatment. Offenders with ASPD showed a stronger attentional bias to violence-related and negative words as compared to controls. Comparable results were obtained when grouping offenders to high, medium, and low psychopathic subgroups. Offenders with childhood maltreatment specifically showed stronger violence-related attentional bias than non-maltreated offenders. The data suggest that enhanced attention to violence-related stimuli in adult criminal offenders is associated with adverse developmental experiences and delinquency but to a lesser extent with antisocial or psychopathic traits.

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1. Introduction

Individuals with antisocial personality disorder (ASPD) exhibit a stable tendency towards antisocial behavior and are characterized by increased irritability, impulsiveness, deception, and a failure to conform to social norms (American Psychological Association, 1995; Wittchen et al., 1997). Psychopathy is a construct related to ASPD, and there is an ongoing debate on the relationship between the two constructs. While the diagnosis of ASPD is mainly based on behavior, the diagnosis of psychopathy according to the Psychopathy Checklist (Hare, 2003) also includes interpersonal and affective facets of personality (Ogloff, 2006). In particular, psychopathy has been related to a general lack of empathy and remorse, decreased emotional responding, and increased proneness to antisocial and criminal behaviors (Leistico et al., 2008). Thus, some researchers have argued that psychopathy and ASPD are distinct disorders with a different pathogenesis (Cooke et al., 2004), while others regard psychopathy as a severe form of ASPD (Coid and Ullrich, 2010). However, both ASPD and psychopathy are often diagnosed in forensic samples, with ASPD being diagnosed in up to 50–80% of prison inmates, while only about 10% meet criteria for psychopathy (Hare, 2003).

It has been proposed that negative emotionality, i.e. a disposition to experience negative affective states together with attenuated inhibition of the expression of negative affect might be crucial factors for the development of ASPD (Krueger, 1999). In addition, there is also evidence that the personality facets of psychopathy are negatively associated with negative emotionality (Hicks and Patrick, 2006). However, to date, there are only few studies on the association of ASPD and psychopathy in criminal offenders with altered emotion processing in lexical decision tasks. In one study, offenders with both, ASPD and psychopathy were less sensitive for affective stimuli in a lexical decision task. In contrast, antisocial individuals without psychopathy and delinquent controls showed emotional facilitation (Kosson et al., 2006). Affective processing in psychopaths has also been studied using lexical decision tasks (Intrator et al., 1997; Kiehl et al., 1999; Williamson et al., 1998). One of these studies reported reduced acceleration of reaction times to affective words in psychopaths and reduced amplitudes of late event-related brain potentials associated with the processing of affective words (Williamson et al., 1991)—a result that was confirmed by subsequent observations (Kiehl et al., 1999). Interestingly, a recent study showed differential modulation of processing of negative emotion words in offenders with psychopaths versus offenders...
with ASPD: psychopaths showed blunted responding to negative emotion words, while offenders with ASPD showed enhanced processing of negative words and showed decreased behavioral inhibition (Verona et al., 2012).

Biased attention towards specific stimuli can be investigated with the Emotional Stroop Task (EST). In this task the processing of the affective meaning of a word interferes with the process of naming the color of ink in which the word is printed. Enhanced interference (increased reaction times in color naming) and thus increased executive attention for a specific word category is supposed to reflect the individual strength of the concepts and representations associated with these stimuli. Accordingly, most of the studies in clinical samples so far have shown that patients exhibit enhanced attention for stimuli related to their clinical condition (for a review: Williams et al., 1996). Enhanced salience and attentional bias for specific stimuli is thus regarded as a significant factor in the pathogenesis or maintenance of mental disorders (Mineka and Sutton, 1992; Williams et al., 1996). Recent studies used the EST to investigate biased attention for emotional stimuli in personality disorders (Arntz et al., 2000; Portella et al., 2011; Wingenfeld et al., 2009). Studies using this paradigm in a forensic context reported mixed results. In one study, violent offenders exhibited a significant attentional bias for violence-related words compared to non-criminal controls (Smith and forensic context reported mixed results. In one study, violent offenders showed enhanced attention to violence-related stimuli, which was not found in non-violent offenders (Smith and Waterman, 2004). However, these findings were not replicated in a study comparing pedophiles, rapists, violent and non-violent offenders, and controls from the general population: there were no group differences in attention to negative or even more specifically to violence-related stimuli (Price and Hanson, 2007).

It has been put forward, that in particular offenders with psychopathy and antisocial tendencies show reduced amygdala-dependent emotional arousal to affective stimuli and thus show reduced attentional bias for affective stimuli (Blair and Mitchell, 2009). Accordingly, Mitchell et al. reported reduced attentional distraction in psychopaths compared to non-psychopaths by affective pictures (Mitchell et al., 2006). It is still an open question whether ASPD and psychopathic traits are associated with attentional biases towards affective stimuli in general or are restricted to negative or even more specifically to violence-related stimuli. In the present study, we thus included violence-related words as stimuli to further investigate the specificity of the previously reported attentional bias to negative stimuli reported in criminal offenders. In particular, the present study investigated attentional biases for violence-related and unspecific negative stimuli in violent offenders with ASPD and offenders without ASPD. Based on the literature reviewed above, we hypothesized that offenders with ASPD would show increased emotional distraction by violence-related stimuli in the EST compared to offenders without ASPD. In contrast, psychopathy was expected to be negatively associated with emotional responding and thus a reduced attentional bias towards negative and violence-related stimuli in the EST was expected.

A significant number of sexual and violent offenders report having been abused sexually or physically maltreated as a child (Coxe and Holmes, 2001; McCormack et al., 2002; Mackin et al., 2002)—for a meta-analysis see Jespersen et al. (2009). In non-forensic populations, specific attentional bias for intimacy-related and abuse-related stimuli has been reported repeatedly in adult survivors of sexual abuse and childhood maltreatment (Blake and Weinberger, 2006; Coleman et al., 2008; Field et al., 2001). A recent meta-analysis suggests that the trauma itself rather than a subsequent posttraumatic stress disorder predicts attentional biases towards trauma-related stimuli and that this effect is significantly pronounced in assaultive traumas (Cisler et al., 2011). Thus, in terms of an exploratory analysis, we investigated whether childhood maltreatment might modulate the proposed attentional bias for violence-related words in criminal offenders. In particular, we hypothesized that childhood maltreatment would be associated with increased attention in violence-related stimuli.

2. Methods

2.1. Participants

We included 90 male inmates from a German prison and a forensic-psychiatric hospital. Of this initial sample, 21 offenders were excluded because they fulfilled one or more of the following exclusion criteria: lifetime diagnosis of schizophrenia, attention deficit/hyperactivity disorder, bipolar affective disorder, major depression, dysthymia, neurological disorder, chromosomal anomaly, color-blindness, dyslexia, age over 70, or an IQ below 70. In addition to the remaining 69 offenders, 24 healthy male controls without any previous conviction were recruited from the general population via announcement on the university campus. None of the controls fulfilled any of the exclusion criteria. The age of the participants ranged from 23 to 68 years (M=50.26, S.D.=11.64). All participants were German native speakers.

The study protocol was approved by the institutional review board of the University of Rostock and was carried out in accordance with the Declaration of Helsinki. Before giving their written consent, all participants were informed about the study in detail. All participants received compensation for participating after completion of the study.

2.2. Demographic and clinical assessment

Data concerning socio-demographic information and the criminal history of the offenders were obtained with a standardized questionnaire and a clinical interview. The Sexual Violence Risk-20 assessment (SVR-20; Boer et al., 1997)–which was based on record review and the clinical interview–was used to identify victims of childhood sexual abuse, physical maltreatment or neglect.

All participants underwent the German version of the SCID-I and II (Wittchen et al., 1997). Of the offenders, 35 fulfilled criteria for antisocial personality disorder (ASPD group), whereas 34 did not meet DSM-IV criteria (no-ASPD group), as indicated by the SCID-II interview. None of the controls fulfilled diagnosis for any axis-I or axis-II disorder. Moreover, the Global Assessment of Functioning (GAF) score from the DSM-IV was included. A reduced version of a test of general intelligence for adults (Hamburg–Wechsler Intelligence Test for Adults-Revised; Tewes, 1991) comprising four subtests served to estimate total as well as verbal IQ.

The psychopath checklist-revised (PCL-R) (Hare, 2003) consists of 20 items that assess the severity of psychopathic traits based on a review of case files and a semi-structured clinical interview. In addition to the total score, the PCL-R provides subscales on two scales: Factor 1 comprises affective and interpersonal personality traits and Factor 2 relates to socially deviant behavior styles. The PCL-R was applied by a trained clinical psychologist (K.V.) using both file review and interview information. Based on these ratings, offenders were allocated to subgroups of high (PCL-R score ≥ 25; n=11), medium (PCL-R score 16–24; n=35) and low (PCL-R score 0–15; n=23) psychopathic traits (Coole and Miche, 1999; Pham et al., 2003).

2.3. Emotional Stroop Task (EST)

An emotional version of the Stroop Task (for a review, see Williams et al., 1996) was used that contained violence-related, negative, and neutral words matched on word length (see Appendix). At the beginning of each trial, a white fixation cross appeared for 800 ms in the center of the black screen of a standard laptop computer. Then, the participant was shown the target word written in red, yellow, blue or green in the upper half of the screen. After 1000 ms, a color word printed in white was presented additionally in the lower half of the screen. The participants were asked to decide as quickly as possible whether the ink color of the target stimulus corresponded with the color word by pressing one of two buttons. Half of the trials were congruent (i.e., ink color and color word were the same), half were incongruent. If the participant needed more than 2000 ms to respond, the two stimuli disappeared and the trial was counted as an error. In order to measure carry-over-effects (Frings et al., 2010; McKenna and Sharma, 2004), buffer trials (rows of ‘X’) were added as target stimuli to each word category. In total, there were 120 trials (72 words and 48 buffer trials).

Before averaging reaction times (RTs), outliers were removed by excluding RTs < 300 and > 1500 ms. Bias scores were calculated by subtracting the mean reaction time (RT) toward neutral words from the mean RT of each of the emotional word categories. Thus, positive values represent an enhanced emotional
interference related to the specific category of emotional stimuli. On average, participants would have been quicker then to categorize the target stimulus within emotional trials than during neutral trials. In addition, the mean RT difference of the violence-related and the negative words served as content-specific bias score, as proposed by Smith and Waterman (2003). Prior to the EST, participants performed 48 practice trials identical to the buffer trials (with rows of 'X' as target stimuli). These trials were analyzed as a cognitive comparison task.

2.4. Statistical analysis

Data analysis was carried out using SPSS 19 (SPSS Inc., Chicago, IL, USA). For all tests, the significance level was \( p < 0.05 \). Socio-demographic and clinical data were analyzed with one-way analyses of variance (ANOVA) tests. Student's \( t \) tests or \( \chi^2 \) tests in case of violation of the assumption of normal distribution non-parametric tests were used instead.

Stroop task data were analyzed using multivariate and repeated-measures ANOVA. Effect sizes are reported in terms of partial squared eta \( (\eta^2) \). For post hoc tests, Bonferroni-corrected \( p \)-values are reported \( (p_{\text{corr}}) \). In order to test the linear associations between PCL-R and interference scores, Pearson's product-moment correlation coefficient was employed. Equality of variances was checked using Levene's \( F \) test. The Greenhouse-Geisser correction was used in case of unequal variances.

3. Results

3.1. Demographic and clinical group characteristics

Table 1 presents demographic, clinical, and offense-related characteristics of the study groups. Age and IQ were comparable across groups, although the controls reported a significantly higher educational level than the two offender groups (\( \chi^2 = 38.75, p < 0.001 \)). The three groups differed with regard to GAF \( (p < 0.001) \) which was highest in the control group. Substance misuse and/or dependence \( (\chi^2 = 23.90, p < 0.001) \) was highest in the ASPD group. With regard to the index offense, the two offender groups were comparable \( (\chi^2 = 7.02, p = 0.14) \). The ASPD group exhibited significantly higher PCL-R scores \( (\text{PCL-R factor 2, PCL-R sum: } p < 0.001) \) than the no-ASPD group.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>ASPD group ( (n = 35) )</th>
<th>no-ASPD group ( (n = 34) )</th>
<th>Controls ( (n = 24) )</th>
<th>Statistics</th>
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<tr>
<td>Age</td>
<td>M, S.D.</td>
<td>M, S.D.</td>
<td>M, S.D.</td>
<td>F, d.f., p</td>
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<tr>
<td></td>
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<td>49.90, 13.18</td>
<td>51.78, 10.81</td>
<td>0.28, 2, 90, 0.76</td>
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<td></td>
<td>101.74, 12.96</td>
<td>101.97, 10.86</td>
<td>99.96, 8.72</td>
<td>0.26, 2, 90, 0.77</td>
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<td></td>
<td>102.06, 14.83</td>
<td>101.50, 10.97</td>
<td>101.67, 7.71</td>
<td>0.02, 2, 90, 0.98</td>
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<tr>
<td></td>
<td>62.46, 9.72</td>
<td>67.06, 11.78</td>
<td>88.00, 5.73</td>
<td>52.71, 2, 90, &lt;0.001</td>
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<tr>
<td>PCL-R factor 1</td>
<td>8.00, 3.41</td>
<td>6.41, 3.38</td>
<td>3.77, 1.67</td>
<td>43.68, 1.67, &lt;0.001</td>
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<td>PCL-R factor 2</td>
<td>12.06, 3.72</td>
<td>6.44, 3.32</td>
<td>29.37, 1.67</td>
<td>38.8, 8, &lt;0.001</td>
</tr>
<tr>
<td>PCL-R sum</td>
<td>21.66, 5.90</td>
<td>14.38, 5.22</td>
<td>23.9, 2</td>
<td>2.9, 0.001</td>
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<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>( \chi^2 )</td>
<td>d.f., p</td>
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<td>38.8, 8, &lt;0.001</td>
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<td>1 (3)</td>
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<td>handicapped</td>
<td>20 (58)</td>
<td>21 (61)</td>
<td>3 (12)</td>
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<td>Secondary</td>
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<td>8 (24)</td>
<td>16 (67)</td>
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<td>2 (6)</td>
<td>5 (21)</td>
<td></td>
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<tr>
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<td>13 (38)</td>
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<tr>
<td>Rape</td>
<td>10 (29)</td>
<td>4 (12)</td>
<td></td>
<td></td>
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<tr>
<td>Manslaughter</td>
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<td>4 (12)</td>
<td></td>
<td></td>
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<tr>
<td>Murder</td>
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<td>7 (21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robbery</td>
<td>4 (11)</td>
<td>6 (17)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: HAWIE, Hamburg-Wechsler Intelligence Test for Adults; GAF, Global Assessment of Functioning; PCL-R, Psychopathy Checklist Revised.

3.2. Group comparison regarding ASPD

In the cognitive comparison task, incongruent trials were performed significantly slower than congruent trials \( (F_{1,90} = 139.10, p < 0.001, \eta^2_{\text{par}} = 0.61) \). This cognitive Stroop effect was comparable for the ASPD, no-ASPD, and control group (main effect of group, group-by-condition interaction: n.s.).

In the EST, incongruent trials were also performed significantly slower than congruent trials in general \( (F_{1,90} = 122.39, p < 0.001, \eta^2_{\text{par}} = 0.58) \) indicating the classical Stroop effect of color-word-interference.

Averaged raw reaction times for congruent and incongruent trials \( (F, 2,90) \) were subject to a repeated measure ANOVA. Although offenders seemed to show increased RTs compared to controls, this difference was not statistically significant \( (F_{2,90} = 1.19, p = 0.31, \eta^2_{\text{par}} = 0.026) \).

Bias scores \( \text{(see Table 2, lower part)} \) were analyzed using univariate ANOVAs. A significant group difference emerged with regard to the violence-related bias score \( (I–III; F_{2,90} = 3.32, p < 0.05, \eta^2_{\text{par}} = 0.069) \) and a trend with regard to the negative bias score \( (I–III; F_{2,90} = 2.48, p = 0.09, \eta^2_{\text{par}} = 0.052) \). The content-specific bias score \( (I–II) \) was comparable between groups. Post hoc tests revealed that the significant effect as well as the trend was attributable to the difference between offenders with ASPD and controls (violence-neutral: \( p_{\text{corr}} = 0.039 \); negative-neutral: \( p_{\text{corr}} = 0.087 \))—see supplementary Table S1. On average, the control group showed the shortest RTs whereas the ASPD group had the longest RTs. Contrary to expectation, RTs were in general shorter for negative than for neutral words \( (F_{2,180} = 6.31, p < 0.005, \eta^2_{\text{par}} = 0.065) \).

In order to investigate the effect of word valence more closely, repeated measures ANOVAs were used to compare both experimental conditions \( (i.e., \text{for congruent and incongruent trials}) \) with regard to violence-related and negative bias scores. A significant main effect of experimental condition emerged \( (F_{1,90} = 8.42, p < 0.01, \eta^2_{\text{par}} = 0.086) \) indicating that enhanced interference was found with congruent trials only. The significant effect of group
The status ($F_{2,90}=3.64, p<0.05, \eta^2_{p}=0.075$) was subjected to further analyses (see Fig. 1 for details).

Groups differed significantly in terms of congruent violence-related ($F_{2,90}=3.70, p<0.05, \eta^2_{p}=0.076$) and negative bias scores ($F_{2,90}=4.86, p<0.05, \eta^2_{p}=0.097$). Post hoc tests showed that the ASPD group displayed significantly more attention to violence-related ($p_{corr}=0.031$) and negative stimuli ($p_{corr}=0.007$) than controls with regard to congruent trials, whereas offenders without ASPD took an intermediate position—see supplementary Table S2. Contrary to controls, both offender groups showed a different response pattern to congruent compared to incongruent trials.

Neither raw reaction times nor bias scores of the added buffer trials differed significantly between groups. In general, RTs to incongruent buffer trials were longer than to congruent trials ($F_{1,90}=94.24, p<0.001, \eta^2_{p}=0.51$) and buffer trials following violence-related words elicited longer RTs ($M=730.82$ ms, $S.D.=159.38$) than those following negative ($M=697.23$ ms, $S.D.=138.83$) or neutral words ($M=697.35$ ms, $S.D.=144.89$), $F_{2,180}=13.41, p<0.001, \eta^2_{p}=0.13$.

### 3.3. Group comparison based on PCL-R scores

Comparable results were obtained when participants were grouped according to their PCL-R scores. The group differences found for congruent trials (violence-related bias: $F_{3,89}=3.15, p<0.05, \eta^2_{p}=0.096$; negative bias: $F_{3,89}=3.29, p<0.05$).
25 of the offenders were identified as victims of childhood abuse, maltreatment or neglect (maltreated group). Multivariate ANOVAs revealed that the maltreated group showed a trend towards an increased violence-related bias \(F_{1,67} = 3.92, p = 0.052, \eta^2_{\text{par}} = 0.055\) as well as significantly stronger content-specific bias \(F_{1,67} = 6.06, p < 0.05, \eta^2_{\text{par}} = 0.083\) than the non-maltreated offenders. The groups of maltreated and non-maltreated participants did not differ significantly with respect to negative bias (see Fig. 3).

When analyzing congruent and incongruent trials separately, we found that group differences in violence-related and content-specific bias scores were attributable to the incongruent condition (violence-related: \(F_{1,67} = 4.46, p < 0.05, \eta^2_{\text{par}} = 0.062\); content-specific: \(F_{1,67} = 8.36, p < 0.01, \eta^2_{\text{par}} = 0.11\)).

With regard to the buffer trials, no significant group differences emerged. In the cognitive comparison task (classical Stroop task), groups did not differ either (group versus condition interaction: n.s.).

4. Discussion

In the present study, we investigated whether offenders diagnosed with antisocial personality disorder (ASPD) differed from non-ASPD offenders or from healthy controls in their performance in an EST using violence-related and negative words. Offenders with ASPD showed a significantly stronger attentional bias towards violence-related words compared to healthy controls. This effect was selective for the experimental condition (negativity: \(F_{1,67} = 4.46, p < 0.05, \eta^2_{\text{par}} = 0.062\); content-specific: \(F_{1,67} = 8.36, p < 0.01, \eta^2_{\text{par}} = 0.11\)).

With regard to the buffer trials, a strong main effect of word valence occurred indicating that trials following violence-related words elicited longer RTs than those following the other two categories. This result emphasizes the relevance of carry-over effects (Fringis et al., 2010; McKenna and Sharma, 2004) and leads to the question if blocked presentation of categories would have revealed stronger effects as proposed by Phaf and Kan (2007). However, there were no group differences with regard to buffer trials.

The analysis comparing offenders with high, medium, and low psychopathic traits based on PCL-R scores revealed a similar pattern. In contrast to the hypothesis of attenuated emotional responding in psychopaths (Blair and Mitchell, 2009) and in contrast with previous findings (Williamson et al., 1991), participants with high PCL-R scores showed significantly greater attentional bias towards violence-related stimuli in congruent trials than controls. Within the whole group of offenders, there was no linear association in terms of a linear correlation between PCL-R scores and attentional bias scores. The only significant difference was found by comparing offenders with high psychopathy traits to non-offenders.

Tackled together, the pattern found in the analyses regarding ASPD and psychopathic traits suggests that both, a history of delinquency and criminal offenses and a personality structure characterized by antisocial and psychopathic traits might additively contribute to an increased strength of violence-related cognitive representations, which are reflected by the observed increased attentional bias for violence-related stimuli in the EST. Moreover, the finding that the group without ASPD took an intermediate position between the ASPD group and controls regarding the violence-related bias is consistent with the view of a continuous transition from non-criminal functioning to delinquent ASPD (Trull and Durrant, 2005).

The exploratory analysis related to childhood maltreatment revealed effects, which are consistent with studies using intimacy-related (Blake and Weinberger, 2006) or abuse-related stimuli in non-forensic populations (Coleman et al., 2008; Field et al., 2001). Offenders who had experienced childhood abuse, maltreatment or neglect displayed a stronger interference than non-maltreated offenders when color-naming violence-related words. It has to be noted that the violence-related stimuli in the present study were not specifically related to childhood abuse. As no participant met the diagnostic criteria for PTSD in the present study, this finding further supports the idea that PTSD is not a necessary condition for violence-related bias following trauma exposure (Cisler et al., 2011). Notably, biased attention in maltreated offenders appeared to be specific for violence-related stimuli as the content-specific bias score (increased RTs to violence-related compared to negative stimuli) was significantly higher in maltreated offenders.

It should be noted that there were no group differences in the classical Cognitive Stroop Task in the present study. This was evident for the comparison regarding ASPD, psychopathic traits, as well as childhood maltreatment.

The first limitation of the present study refers to the EST used. Although we carefully matched the stimuli for average word length, there are other stimuli characteristics that should be controlled for in future studies, e.g. imaginability, frequency of...
use, and orthographic neighborhood (cf. Larsen et al., 2006). In addition, the experimental version of the EST used in the present study is not directly comparable to previous studies, as we used a combination of color–word interference and additional interfering emotional words. Future studies could also vary stimulus material, for example by using words related to the individual index offense or non-verbal, more arousing stimuli, such as affective pictures or sounds. With regard to the secondary (mal-treatment) analyses, an intimacy-related word category could be included in future studies. In addition sexual and physical abuse and emotional neglect should be assessed more thoroughly.

Another limitation is the lack of representativeness of the present study sample for the whole population of criminal offenders or individuals with ASPD, as a modest sample of highly criminal offenders was investigated. Inter-rater reliability of the PCL-R scores was not available in the present study and should be explicitly obtained in future studies. Incorporating additional dimensional measures of psychopathy (e.g. self-report questionnaires) in offenders and controls in future studies could possibly elucidate the contribution of psychopathic traits. In addition, carefully controlling for confounding factors, such as Axis-I diagnoses or including clinical control groups might be a promising approach in future studies to explore the specificity of the findings.

In sum, criminal offenders with ASPD differed from healthy non-criminal controls in terms of an enhanced inference in an EST involving violence-related and unspecific negative words. In offenders diagnosed with ASPD the presentation of violence-related words interfered with the cognitive process of color-matching, compared to healthy community controls. A secondary analysis, grouping offenders based on their PCL-R scores, revealed a similar pattern. In addition, we found that offenders with a history of childhood maltreatment showed specifically stronger violence-related interference than non-maltreated offenders. The latter finding suggests that the possible impact of traumatic childhood experiences on emotional processing and on the strength of cognitive representation of violence-related stimuli in adulthood.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.psychres.2012.11.005.

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