Master's thesis
Psychopathy: Anxiety or Attention deficit?
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Abstract

The influential low-fear hypothesis (LFH) theorizes that psychopathy is related to the inability to experience fear. Recent data challenged these insights and indicated that fear capacity may in fact be intact. The lack of emotional responding resulted from a deficit in the ability to process peripheral (e.g., fear-eliciting) information when engaged in goal-directed behaviour (Response Modulation Hypothesis; RMH). For example, while non-psychopathic individuals were faster to discriminate words from non-words when they were threatening (emotion facilitation), psychopathic individuals did not show such emotion facilitation in the lexical decision task (LDT). This study contributed to the aetiological debate on psychopathy. We examined the emotion-attention interaction in psychopathic individuals by varying attentional focus in an LDT, towards or away from the threatening nature of the stimuli or with no manipulation of attentional focus. The sample consisted of 47 male offenders. Psychopathy was approached dimensionally and assessed with the Youth Psychopathic Traits Inventory. The low-fear hypothesis predicts lack of emotion facilitation, irrespective of the attentional focus. The RMH predicts that such deficit is only present when threat is outside of the focus of attention, and that psychopathic individuals should display normal emotion facilitation during an LDT when directly attending emotional stimuli. The findings did not support the hypotheses. We did not find a general emotion facilitation deficit across all conditions, as would be apparent from an interaction effect of Word Category x Psychopathy. We did not find psychopathic individuals emotion facilitation to depend on their attentional focus, as would be apparent from a three-way interaction effect of Word Category x Psychopathy x Condition. These results should be taken with caution since the observed power in our study was very low.

Keywords: Psychopathy, Low-fear hypothesis (LFH), Response modulation hypothesis (RMH), Conditioning, Attention

Introduction

It is estimated that about one percent of the general population would receive high scores on psychopathic measures, these individuals are characterized by having a high degree of emotional deficits and often fail to inhibit impulsive behavior (Dawel, O’Kearney, McKone, & Palermo, 2012). Psychopathy is characterized by interpersonal (e.g., pathological lying), affective (e.g., shallow affect), impulsive (e.g., irresponsibility), and antisocial components (e.g., criminal versatility) (Hare & Neumann, 2008). According to Hare, psychopathic individuals are the most destructive and dangerous members of society (Moreira, Almeida, Pinto, & Favero, 2014). Psychopathy was found to be a good predictor of violent recidivism (Hildebrand, Hesper, Spreen, & Nijman, 2005). The aetiology of psychopathy remains a subject of debate (Smith & Lilienfeld, 2015; Newman, & Baskin-Sommers, 2016). Understanding the aetiology of psychopathy will help to understand the heterogeneous construct of psychopathy and provide insight into overlapping pathways with other psychopathologies (Smith & Lilienfeld, 2015). This in turn may aid the development of treatment and prevention programs. As argued by Dargis et al. (2017), treatment efforts emphasizing a balance of attention between primary and peripheral information may prove especially effective for reducing maladaptive behavior in psychopathic individuals. Their result illustrated that priming relevant information may help psychopathic individuals to overcome information processing deficits. Similarly, Baskin-Sommers, Curtin, and Newman (2015) demonstrated that cognitive remediation training for psychopathic individuals’ peripheral information deficit, results in improvement on trained and non-trained tasks. Over the past two decades, at least two prominent theories concerning the aetiology of psychopathy dominated the field, namely the low-fear hypothesis (LFH) and the response modulation hypothesis (RMH).

Lykken’s LFH emphasizes the absence of fear as the main developmental precursor of psychopathy (Lykken, 1957). He used measures that are known to be strongly related to fearfulness and anxiety, including a fear-conditioning paradigm and found that psychopathic individuals scored lower than normal controls, indicating less fear (Patrick, 2005). Lykken’s findings have been replicated several times using a variety of paradigms (Birbaumer et al., 2005; Epstein, Poythress, & Brandon, 2006). Patrick, Bradley, and Lang (1993) used the fear-potentiated startle reflex as an outcome measure, which is normally enhanced during a fear-state

(Patrick et al., 1993; Lang, Bradley, & Cuthbert, 1990). Their findings indicated an abnormality in the processing of emotional stimuli by psychopathic individuals. Specifically, psychopathic individuals did not demonstrate a larger fear-potentiated startle reflex when confronted with aversive stimuli compared to pleasant stimuli. Deficits in an increased fear-potentiated startle reflex to aversive stimuli compared to pleasant stimuli were primarily associated with PCL-R Factor 1. A meta-analysis (Hoppenbrouwer, Bulten, & Brazil, 2016) provided evidence for a fear deficit in psychopathic individuals, when fearlessness was defined as an abnormality in the system that should detect and respond to threat (e.g. the fear-potentiated startle reflex), rather than the conscious experience of fear.

Newman and Brinkley (1997) provided many points of criticism arguing against Lykken's LFH. According to them, psychopathic individuals' poor passive avoidance learning does not depend on fear-eliciting stimuli, since also studies using monetary reward and monetary punishment paradigms (that are not necessarily fear-eliciting) found poorer passive avoidance learning in psychopathic individuals compared to non-psychopathic individuals (Newman & Kosson, 1986; Newman, Patterson, Howland, & Nichols, 1990). Moreover, when using a punishment-only task or a reward and punishment task that required participants to attend to both the reward and punishment contingencies from the outset (Newman & Kosson, 1986; Newman et al., 1990), psychopathic individuals' passive avoidance learning did not significantly differ from controls. This indicates that psychopathic individuals' fear deficits may be situation specific rather than pan-situational (as would be predicted by the LFH). Psychopathic individuals seem to not exhibit general fear deficits but rather fear deficits seem to be present under certain conditions (e.g. contradicting reward-punishment contingencies not attended from the outset). Finally, the peripheral presentation of motivational neutral stimuli during a picture-word task produced less interference in high psychopathic individuals compared to low psychopathic individuals (Newman, Schmitt, & Voss, 1997). This again illustrates that psychopathic individuals' cognitive processing deficits may not be specific to fear-eliciting stimuli (as predicted by the LFH) and extend to peripherally presented neutral cues.

By integrating these shortcomings of the LFH, an alternative hypothesis, referred to as the response modulation hypothesis (RMH), developed (Patterson & Newman, 1993). In its most recent incarnations this hypothesis proposes that psychopathic individuals exhibit difficulties in adjusting their behavior in the presence of a dominant response set (Smith & Lilienfeld, 2015).

In other words, psychopathic individuals have less ability compared to normal controls to integrate peripheral information while implementing goal-directed behavior (Smith & Lilienfeld, 2015).

Empirical evidence for the response modulation hypothesis comes from a variety of paradigms. The attention interference paradigms (e.g. Stroop tasks, picture-word task, picture-word Stroop task, flanker-type task; Newman et al., 1997; Vitale, Brinkley, Hiatt, & Newman, 2007; Zeier, Maxwell, & Newman, 2009) demonstrated less interference of peripheral information on the performance of high psychopathic individuals in a primary task compared to controls (Newman et al., 1997; Vitale et al., 2007; Zeier et al., 2009; Hiatt, Schmitt, & Newman, 2004). However, when psychopathic individuals' focus of attention was manipulated such that there was no prepotent focus of attention or when peripheral information was spatially coincident (Hiatt et al., 2004) they displayed as much interference as controls. Additionally, psychopathic individuals' deficits in using peripheral information seem to be specific to incongruent stimuli (outside of attentional focus), since psychopathic individuals were found to demonstrate a normal or stronger facilitation effect of peripherally presented stimuli congruent with attentional focus (Hiatt et al., 2004; Dargis, Mattern, & Newman, 2017).

Moreover, evidence for the response modulation hypothesis has been found in the very paradigms that provided the strongest evidence for a fear deficit. Indeed, psychopathic individuals' deficits in the fear-potentiated startle reflex may be due to response modulation deficits, namely psychopathic individuals may lack the ability to allocate attention to fear-eliciting stimuli presented peripherally (e.g. auditory startle probes) to the primary task (e.g. picture viewing; Patrick et al., 1993; Lang et al., 1990). Experimental results of the fear-potentiated startle reflex attention manipulation paradigm indicated that psychopathic individuals' diminished reactivity to threat-eliciting stimuli reflect idiosyncrasies in attention that limit their processing of peripheral information (Newman et al., 2010). In other words, psychopathic individuals display a normal fear-potentiated startle reflex when their attention is directed to threat-eliciting stimuli but display a significant deficit in the fear-potentiated startle reflex when their attention is directed elsewhere. A recent meta-analysis found some support for the RMH, revealing a small to medium relationship between psychopathy and response modulation deficits (Smith & Lilienfeld, 2015), but findings also indicated great variability of the response modulation effect size across psychopathy measures, experimental paradigms,

samples examined, and dependent measures used. The authors are critical about the generalizability of the results, because some of the original RMH findings of Newman and his colleagues have not been replicated by other researches. Additionally, Lilienfeld, Smith and Watts (2016) argue that Newman and Baskin-Sommers selectively report findings that support the RMH and ignore contradicting findings.

In the current study, a Lexical Decision Task (LDT) will be used to contrast the potential role of fear deficits (LFH) with the role of attention deficits to peripheral information (RMH) in psychopathic individuals. In an LDT (Williamson, Harpur, & Hare, 1991; Lorenz & Newman, 2002) participants are instructed to decide as quickly as possible whether a stimulus (string of letters) presented is an existing word or not (see Figure 1-3). Non-psychopathic individuals generally experience emotion facilitation, which means that their decision whether a string of letters is a word, or a non-word is facilitated (faster response) when confronted with an emotional word (Williamson, Harpur, & Hare, 1991; Lorenz & Newman, 2002). Previous work with the LDT found that psychopathic individuals' do not experience normal emotion facilitation (Williamson et al., 1991; Lorenz & Newman, 2002; Reidy, Zeichner, Hunnicutt-Ferguson, & Lilienfeld, 2008; Vitale, Kosson, Resch, & Newman, 2018). According to the LFH, these findings are due to a general fear deficit, whereas according to the RMH, these findings can be explained by denoting the affective connotation of a word as peripheral to the dominant response set (making a lexical decision). The LFH predicts a lack of emotion facilitation in psychopathic individuals, irrespective of the attention focus. The RMH predicts that such deficit is only present when threat is outside of the focus of attention, and that psychopathic individuals should display normal emotion facilitation during an LDT when directly attending emotional stimuli. Additionally, it is expected that across all participants emotion facilitation will be decreased when attention is directed away from emotional stimuli (Everaert, Spruyt, Rossi, Pourtois, & De Houwer, 2013).

To the best of our knowledge these hypotheses have not been tested so far with the LDT. This study aims to fill this gap by manipulating attention focus in an LDT. Participants will be presented with 3 different versions/conditions of the LDT (see figure 1-3). They will be instructed to either focus on threatening words (by counting them), focus on non-threatening words (counting) or no attention instructions will be provided. This will allow us to contrast the LFH and RMH and examine the emotion-attention interaction in psychopathic individuals. Based

on the LFH, psychopathic individuals are expected to display emotion facilitation deficits across all conditions. Based on the RMH, psychopathic individuals are expected to overcome their emotion facilitation deficits when attention is focused on emotional stimuli (threatening words). In other words, highly psychopathic individuals' lexical decision for threatening words should be slower (less emotion facilitation) during the control condition and alternative focus condition but normalize during the threat focus condition.

Methods

The data for this project has been partially used in the context of a previous study (Verschuere & 't Hout, 2016). All participants provided written informed consent using a consent form approved by the local ethical committee. This study used a cross-sectional design. The independent variables are psychopathy, attentional focus instructions during the LDT and threat level of the words within the LDT, as specified below. Psychopathy is approached dimensionally, since psychopathy is not a taxon, but rather a dimensional construct (Edens, Marcus, Lilienfeld & Poythress, 2006; Murrie, Marcus, Douglas, Lee, Salekin, & Vincent, 2007; Guay, Ruscio, Knight, & Hare, 2007). Psychopathy was assessed using the Youth Psychopathic Traits Inventory (YPI), as specified below. The dependent variable is the reaction time of a participant in an LDT, as specified below.

Participants

Power analysis ($f = .40$, $\alpha = 0.05$, $\beta = 0.8$) with the program G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that a sample size of 25 would be desirable to conduct the planned repeated measures ANOVA. Power analysis ($f = 0.38$, $\alpha = 0.05$, $\beta = 0.8$) with the program G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that a sample size of 70 would be desirable to conduct the planned analysis of covariance. The sample consisted of 62 violent offenders that were recruited in three Dutch forensic institutions. Exclusion criteria for participants were a diagnosis of schizophrenia, acute psychotic symptoms, bipolar disorder, insufficient Dutch language ability and an IQ below 80. After exclusion the sample consisted of 47 male offenders (M age = 43.28, $SD = 11.42$; M psychopathy score = 85.94, $SD = 19.68$; M IQ = 99.57, $SD = 10.78$). For 10 participants the IQ score was not available. Participants received financial compensation.

Materials

Youth Psychopathic Traits Inventory (YPI; Authorized Dutch translation: Das & De Ruiter, 2003). The YPI was conducted in digital format with the software INQUISIT to assess psychopathy. The YPI is a 50-item self-report scale originally designed to measure traits of psychopathy in youth, but items are not unique to youth (see examples below) and the YPI has also been successfully used with older participants (Uzieblo, Verschuere, Van den Bussche, & Crombez, 2010). The YPI uses a 4-point Likert-type response scale ranging from 1 (does not apply at all) to 4 (applies very well). The 50 items load on 10 subscales with the Dishonest Charm, Grandiosity, Lying, and Manipulation tapping into the factor Grandiose-Manipulative (20 items; e.g., "I have the ability to con people by using my charm and smile"), the Callousness, Unemotionality, and Remorselessness tapping into the factor Callous-Unemotional (15 items; e.g., "I think that crying is a sign of weakness, even if no one sees you"), and the Impulsiveness, Thrill seeking, and Irresponsibility tapping into the factor Impulsive-Irresponsible traits (15 items; e.g., "I consider myself as a pretty impulsive person"). High scores on the YPI subscales indicate stronger psychopathic traits. Uzieblo et al. (2010) found acceptable Cronbach's alphas in a Dutch adult sample for each of the three dimensions and for the YPI total score: Grandiose-Manipulative: .91, Callous-Unemotional: .79 and Impulsive-Irresponsible: .83, and the YPI full-scale: .91.

Lexical Decision Task (LDT). The LDT in this study was presented in a digital format with the PRESENTATION software (version 20.0). Participants were instructed to decide as quickly as possible whether a stimulus (string of letters) presented was an existing word ("rabbit") or not ("raibbt"). Participants were instructed to respond by pressing either the letter "A" or the letter "L" on the computer keyboard. Assignment of words versus non-words to the responding letters on the keyboard was counterbalanced between participants. Before every stimulus, a fixation cross was centrally located on the computer screen for 500 milliseconds. Next, a stimulus appeared for 1000 milliseconds (or until a response was given) at the location where the fixation cross had been before. If participants response was too slow, they were given digital feedback ("Too slow"). The inter-stimulus interval varied between 500 milliseconds to 1250 milliseconds. The stimulus presented belonged to one of 3 categories, namely threatening words, non-threatening words, and non-words. The non-words are a pronounceable version of randomly

allocated letters of the threatening and non-threatening words used in this study. A maximum of two stimuli from the same category can be presented in a row.

The LDT consisted of two practice sets (9 non-threatening words and 9 non-threatening non-words) and six test sets (total of 360 stimuli). At the end of each set a short break took place of which participants could set the duration. None of the stimuli used in the practice sets were presented in the test sets. During the first practice set participants were asked to judge whether a presented stimulus was a word or a non-word. In the second practice set, participants were additionally asked to count the words presented. The six test sets were presented in a random order. There were three conditions each containing two test sets.

In the two test sets of the **alternative focus condition** participants were instructed to count the non-words (see Figure 1). In the two test sets of the **threat focus condition**, participants were instructed to count the threatening words (see Figure 2). After all sets that required counting non-words or threatening words, participants were required to type in their counting result after terminating that set. During the two tests sets of the **control condition**, no counting

instructions were given (see Figure 3). The overall instruction to judge whether a stimulus was a word, or a non-word remained constant across all sets and conditions. By adding the counting instructions to the LDT, attention of the participants was manipulated (Gawronski, Cunningham, LeBel, & Deutsch, 2010; Olson & Fazio, 2003). The random order of the six test sets underlay two restrictions, namely that two sets of the same condition could not be presented after each other and that the last set (set number six) could not be a set of the control condition. The latter restriction was inserted so that a manipulation check could follow the sixth set. Participants were first required to type in how many threatening or non-words (depending on the set they would get as a sixth set) they had counted. Next, in a second question they were unexpectedly asked how many threatening or non-words there were (the opposite of what they were asked before). Additionally, to prevent participants from guessing the correct count, the two sets of one condition contained a different number of stimuli (61 and 59).

After the last test set participants were asked to rate the threat level of all existing words. This part of the study did not have a time limit. Participants were instructed to rate the threat level of the existing words on a 5-point Likert scale (1 = not threatening; 2 = a bit threatening; 3 = somewhat threatening; 4 = threatening; 5 = very threatening).

Procedure

Recruitment was done by institutional therapists, flyers and personally approaching patients of the forensic institution. During recruitment, an information letter that contained the topic, goal, procedure, conditions of participation, and information about the confidentiality of participants' data was handed to potential participants. After recruitment participants were given written informed consent and asked for a written permission to access their file information for the IQ and PCL-R scores. Another appointment was made, during which participants completed the YPI and the LDT tasks in a session of about 1.5 hours that also included the Experience in Close Relationships (Conradi, Boertien, Cavus, & Verschuere, 2016), the modified Sheffield lie test (Verschuere & 't Hout, 2016), and another attention test. The latter three will not form a part of this study. Apart from the participant, only the test assistant was present in the room.

Hypotheses and analyses

Primary analyses will be conducted using psychopathy total scores.

Manipulation check

The manipulation check consisted of an unexpectedly asked question after the sixth set that was always either the threat focus condition or alternative focus condition. Participants were asked how many threatening or non-words they had seen during this set (the opposite of what they were asked as test question in the sixth set). If the attention manipulation was implemented successfully participants are expected to deviate significantly less from the true value on the test question compared to the manipulation check question. To test this hypothesis, a standardized deviation from the perfect count was calculated. The given count for each participant was divided by the true count to obtain a proportion score. Next, a value of one was subtracted from this proportion score to acquire the deviation from zero, where zero indicated a perfect count. Suppose a participant finished with a threat focus block. The participant expects and receives the question how many threatening words there were in the block. If the block contained 16 threatening words and the participants response was 12. The proportion score of that participant was $12/16$ or 0.75 , whereas a proportion score of 1 ($16/16$) would indicate a perfect response. To make interpretation easier we subtracted 1 from the proportion score of a participant ($0.75-1$). The absolute value of this result (0.25) was the final deviation score used in the analysis. This deviation score indicated the deviation from the true count, where a value of zero indicated no deviation. The manipulation check, however would thereafter unexpectedly additionally ask about the number of non-words in the block. If the block contained 30 non-words and the participant responded 14, the proportion score was calculated to be $14/30$ or 0.47 . The deviation score would then be the absolute value of $0.47-1$ or 0.53 . The participants response deviated less from the true count on the expected question compared to the manipulation check question. Separate paired samples t-test were conducted in JASP (JASP Team, 2017, Version 0.8.4) for participants that received either one of the conditions as a sixth set.

Word appraisal

Neutral words were expected to be rated less threatening than threatening words. Based on previous studies (Williamson et al., 1991; Lorenz & Newman, 2002), word appraisal was expected to be comparable for individuals high versus low on psychopathy measures (emotion paradox: while they process emotions differently, psychopathic individuals *report* to feel the same). These hypotheses were tested with a repeated measures analyses of variance (ANCOVA) with SPSS (IBM SPSS Statistics for Windows, Version 24.0) with word appraisal as the

dependent variable, word category (threatening vs non-threatening words) as the independent variables and psychopathy (continuous variable) as the covariate. Psychopathy effects, word effects and an interaction effect of psychopathy and word were examined in the customized model. Only the word effect was expected to be significant, namely that neutral words are rated lower (less threatening) than threatening words.

Emotion facilitation

For each participant, the mean reaction time for threatening and non-threatening words per condition was calculated. Emotion facilitation was tested by conducting repeated measures 2 x 3 analyses of covariance (ANCOVA) in SPSS with reaction time as the dependent variable, word category (threatening vs non-threatening words) and condition (threat focus versus alternative focus versus control) as the independent variables (within-subject) and psychopathy (continuous) as covariate (between-subject). Effects of word category, condition, psychopathy and all interaction effects were examined in the customized model.

Earlier findings indicated that non-psychopathic individuals generally experience emotion facilitation (faster RT when confronted with emotional words compared to neutral words) and psychopathic individuals were found to not experience this effect (Williamson, Harpur, & Hare, 1991; Lorenz & Newman, 2002; Reidy, Zeichner, Hunnicutt-Ferguson, & Lilienfeld, 2008). Therefore, it was expected that the emotional facilitation (faster RTs for threatening than for neutral words) would be reduced for high psychopathic individuals as compared to low psychopathic individuals. Thus, an interaction effect of word category with psychopathy was expected.

The LFH predicts an invariant fear deficit irrespective of attentional focus, which would be apparent from an interaction effect of word category with psychopathy across all conditions (no interaction with condition). The RMH predicts that psychopathic individuals process threat information less efficiently than non-psychopathic individuals only when not focused on the threatening stimuli, this would be apparent from the 3-way interaction Word category x Condition x Psychopathy effect. Specifically, the RMH expects this interaction effect to show reduced emotional facilitation in the control and attention focus but not the threat focus condition (Baskin-Sommers et al., 2011, Newman et al., 2010, Larson et al., 2013, Smith & Lilienfeld, 2015).

Supplemental analyses

Low fear and response modulation deficits were often found to be primarily related to low-anxious psychopathic individuals (Lykken, 1957; Patrick, 2005; Newman et al., 1997; Vitale, Brinkley, Hiatt, & Newman, 2007; Zeier, Maxwell, & Newman, 2009), and/or to the affective-interpersonal dimension of psychopathy (Frick, & White, 2008). All primary analyses were repeated with the YPI-CU scores as an independent variable. The hypotheses remained the same.

Results

Exclusion criteria

Participants with error rates above 50% (given binary response options, 50% reflects above chance performance) were excluded. Based on that criterium, eleven participants (range of proportion wrong: .75 - .89) were excluded. An additional exclusion criterium was the proportion misses on the LDT (missed stimuli/ total stimuli). Participants that missed more than half of the presented stimuli were excluded. None of the participants fulfilled this criterium.

Descriptive

The final sample consisted of 36 violent male offenders (M age = 42.33, SD = 10.75; M YPI total score = 87.08, SD = 20.36; M IQ = 99.26, SD = 11.41). On average they spent 8.6 (SD = 6.9) years in the forensic institution and were on average 22.07 (SD = 7.65) years old when they first offended. Most participants were single (N = 30), some had a relationship (N = 2), and one participant was married. Thirty-two participants were Dutch and the remaining 4 participants were Surinamese, Moroccan and British-Hungarian. Most participants had either graduated from primary school plus a maximum of two years follow-up education (N = 14) or had graduated from a school below the Dutch MAVO-level (e.g. LTS, LEAO, LHNO) (N = 13). One participant finished primary school only, five graduated from a school on MAVO-level and three participants graduated from any school above the Dutch HAVO-level. The proportion of incorrect answers (incorrect answers / total stimuli) on the LDT ranged from .01 to .32 and the proportion missed stimuli (missed/ total stimuli) ranged from .01 to .10. For 8 participants the total IQ score was not available and for 3 participants no information about the civil status first offending behavior was given.

Manipulation check

For the analyses of the manipulation check, two outliers that deviated more than three standard deviations from the mean were excluded. Normality assumptions were violated for the paired samples t-test of the alternative focus condition. Bootstrap for the paired sample t-test of the alternative focus condition was conducted. Results are presented for the threat focus condition and alternative focus condition respectively. In line with our expectations, on average, participants deviated less from the true count on the test question (threat focus condition: $M = 0.22$, $SE = 0.05$; alternative focus condition: $M = 0.14$, $SE = 0.05$), than on the manipulation check question (threat focus condition: $M = 0.37$, $SE = 0.05$; alternative focus condition: $M = 0.55$, $SE = 0.05$) (see Figure 4). This difference, -0.15 , BCa 95% CI $[-\infty, -0.27]$; -0.41 , BCa $[-\infty, -0.65]$, was significant $t(14) = -2.99$, $p = .005$; $t(18) = -5.01$, $p < .001$, and represented large effect sizes, $d = -0.77$; $d = -1.15$. These results indicate that participants did follow the instructions and paid attention to the instructed category (i.e., threat versus non-words).

Figure 4. Mean deviation of the given response from the true count on the test question (expected) compared to the manipulation check question (unexpected). Threat focus condition as sixth set (left), alternative focus condition as sixth set (right).

Word appraisal

Prior to the analyses one outlier that deviated more than three standard deviations from the mean rating was excluded. Data on the word rating of seven participants was not available.

Consequently, twenty-eight participants were included in the analyses. Psychopathy total scores were entered as a centered variable. The results of the repeated measures ANCOVA show that word appraisal was significantly affected by the word category, $F(1, 26) = 126.58$, $p < .001$, $\text{partial } \eta^2 = .83$. Planned contrasts confirmed that threat words ($M = 3.33$, $SE = 0.02$) were

appraised as being more threatening than neutral words ($M = 1.07$, $SE = 0.21$), this difference - 2.26, BCa 95% CI [- 2.68, - 1.85]; was significant $t(26) = - 10.97$, $p < .001$, and represented a large effect size, $d = -2.07$ (see Figure 5). As expected, the effect of psychopathy $F(1, 26) = 1.94$, $p = .175$ $partial\ n^2 = .07$, and the interaction of psychopathy and word category was not significant, $F(1, 26) = 2.16$, $p = .153$ $partial\ n^2 = .08$, confirming that psychopathy does not affect word appraisal.

Figure 5. Mean rating of the neutral words compared to the threatening words (left). Median split psychopathy low versus high (right) only for visualizing of effects. All statistical analyses were conducted with continuous scores.

Emotion facilitation

Prior to the analyses, one outlier that deviated more than three standard deviations from the mean rating was excluded. The assumption of sphericity was violated for the Condition x Word Category interaction. Therefore, results of the Greenhouse-Geisser sphericity correction will be reported for this interaction. The results show that the reaction time on the LDT was significantly affected by condition, $F(2, 32) = 6.5$, $p = .003$, $partial\ n^2 = .16$. Planned contrasts revealed that the reaction time in the threat focus condition ($M = 612.39$, $SE = 8.58$) was significantly higher (slower) than in the control condition ($M = 586.68$, $SE = 8.51$), $t(32) = - 3.97$, $p < .001$, $d = - 0.67$, but did not significantly differ from the alternative focus condition ($M = 601.32$, $SE = 6.59$), $t(32) = 1.68$, $p = .293$, $d = 0.28$, nor did the RT in the alternative focus condition significantly differ from the RT in the control condition, $t(32) = -2.33$, $p = .069$, $d = -0.39$. There was no effect of YPI Total, $F(1, 33) = 0.22$, $p = .641$, $partial\ n^2 = .01$. The interaction of Condition x YPI Total was not significant, $F(2, 32) = 0.24$, $p = .786$, $partial\ n^2 = .01$, nor was

there an effect of word category, $F(1, 33) = 0.002$, $p = .962$, $partial\ n^2 = .000$. The interaction of Word Category x YPI Total was not significant, $F(1, 33) = 0.07$, $p = .788$, $partial\ n^2 = .002$, contradicting a general emotion facilitation deficit across all conditions as would be expected from the LFH. There was no interaction effect of Condition x Word Category, $F(2, 32) = 0.28$, $p = .711$, $partial\ n^2 = .009$ and the from the RMH expected three-way interaction was not significant $F(2, 32) = 0.26$, $p = .774$, $partial\ n^2 = .01$.

Figure 6. Median split psychopathy low versus psychopathy high. Control condition (top left), threat focus condition (top right), alternative focus condition (bottom left).

Supplemental analyses

The analysis for word appraisal and emotion facilitation was repeated with the affective-interpersonal dimension (YPI Callous-Unemotional factor) instead of the total YPI score. The results of the repeated measures ANCOVA show that word appraisal was significantly affected by the word category, $F(1, 26) = 140.19$, $p < .001$, $partial\ n^2 = .84$. Planned contrasts confirmed that threat words ($M = 3.33$, $SE = 0.19$) were appraised as being more threatening than neutral words ($M = 1.07$, $SE = 0.02$), this difference -2.26 , BCa 95% CI $[-2.66, -1.86]$; was significant $t(26) = -10.97$, $p < .001$, and represented a large effect size, $d = -2.07$. In contradiction to our

hypotheses, the effect of psychopathy $F(1, 26) = 5.04, p = .034, \text{partial } n^2 = .162$, and the interaction of psychopathy and word category was significant, $F(1, 26) = 4.57, p = .042, \text{partial } n^2 = .150$.

Figure 7. Mean rating of the neutral words compared to the threatening words with separate lines for participants low versus high on callous-unemotional traits (median split).

For the analysis of emotion facilitation (repeated measures ANCOVA) the assumption of sphericity was violated for the Condition x Word Category interaction. Therefore, results of the Greenhouse-Geisser sphericity correction will be reported for this interaction. The results show that the reaction time on the LDT was significantly affected by condition, $F(2, 32) = 6.5, p = .003, \text{partial } n^2 = .16$. Planned contrasts revealed that the reaction time in the threat focus condition ($M = 612.39, SE = 8.58$) was significantly higher (slower) than in the control condition ($M = 586.68, SE = 8.51$), $t(32) = -3.97, p < .001, d = -0.67$, but did not significantly differ from the alternative focus condition ($M = 601.32, SE = 6.59$), $t(32) = 1.68, p = .293, d = 0.28$, nor did the RT in the alternative focus condition significantly differ from the RT in the control condition, $t(32) = -2.33, p = .069, d = -0.39$. There was no effect of YPI CU, $F(1, 33) = 0.32, p = .578, \text{partial } n^2 = .009$. The interaction of Condition x YPI CU was not significant, $F(2, 32) = 0.51, p = .606, \text{partial } n^2 = .02$. There was no effect of word category, $F(1, 33) = 0.00, p = .989, \text{partial } n^2 = .000$. The interaction of Word Category x YPI CU was not significant, $F(2, 33) = 0.12, p = .735, \text{partial } n^2 = .004$, which stands in contradiction to the LFH that expects a general fear deficit (no emotion facilitation for threat words) across all conditions for individuals with high scores on psychopathic measures. There was no interaction effect of Condition x Word Category, $F(2, 32) = 0.33, p = .683, \text{partial } n^2 = .01$. In contradiction to the predictions made based on the

RMH, the expected (RMH) three-way interaction was not significant $F(2, 32) = 2.14, p = .126$, $\text{partial } n^2 = .06$.

Figure 8. Median split psychopathy low versus psychopathy high. Control condition (top left), threat focus condition (top right), alternative focus condition (bottom left).

Exploratory analyses

Based on recently published results (Vitale et al., 2018) we conducted two additional exploratory regression analyses, one for neutral word trials and one for threatening word trials. Accuracy for words on the LDT was the predicted variable, YPI-total scores, RT and their interaction were the predictor variables. Based on Vitale et al.'s (2018) results, we expected the interaction of RT and YPI-total scores to be significant for threatening word trials, but not for neutral word trials, indicating a speed-accuracy trade-off among psychopathic individuals on threatening word trials. We did not find the expected RT x YPI-total interaction effect for threatening word trials. No other effects were found to be significant.

Discussion

The key goal of this study was to contrast the potential role of fear deficits (LFH) with the role of attention deficits to peripheral information (RMH) in psychopathic individuals using a Lexical Decision Task that contained threatening words, non-threatening words and non-words. Prior research indicated that non-psychopathic individuals generally experience emotion facilitation, which means that their response whether a string of letters is a word, or a non-word is facilitated when confronted with an emotional word, whereas psychopathic individuals were found not to experience normal emotion facilitation (Williamson, Harpur, & Hare, 1991; Lorenz & Newman, 2002, Reidy et al., 2008). This indicates a potential role of fear deficits in psychopathic individuals. By focusing attention on the threatening words in one condition (within-subject design) we contrasted the potential role of fear deficits (LFH) with the role of attention deficits (RMH). The findings did not support these hypotheses. We did not find a general emotion facilitation deficit across any condition, as would be apparent from an interaction effect of Word Category x Psychopathy. We did not find psychopathic individuals' emotion facilitation to depend on their attentional focus, as would be apparent from a three-way interaction effect of Word Category x Psychopathy x Condition.

Firstly, a possible explanation that we did not find the expected emotion facilitation deficits of psychopathic individuals that were found in prior studies (Williamson, Harpur, & Hare, 1991; Lorenz & Newman, 2002, Reidy et al., 2008) might be that we did not obtain enough power for our repeated measures 2 x 3 (Word Category x Condition) analyses of covariance (ANCOVA). Power analyses with the program G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that a sample size of 70 would have been desirable to conduct the planned analysis of covariance for emotion facilitation. After exclusion of outliers, participants with a high error rate on the LDT and exclusion based on the pre-determined exclusion criteria, the sample consisted of 35 male offenders. The observed power for the effect of condition was as desired above .8, the observed power for all other effects of the repeated measures 2 x 3 analyses of covariance (ANCOVA) for emotion facilitation ranged from .05 to .09, which is interpreted as very low.

Secondly, a plausible explanation might be that the hypotheses (LFH and RMH), that we based our expectation on (emotion facilitation deficits in psychopathic individuals), are not robust and only partially correct. Several findings point to situation specific fear deficits in psychopathic individuals contradicting pan-situational fear deficits as would be predicted by the

LFH (Newman & Kosson, 1986; Newman et al., 1990). The meta-analysis by Smith and Lilienfeld (2015) only found a small to medium relationship between psychopathy and response modulation deficits with great variability of effect sizes across psychopathic measures, experimental paradigms, and dependent measures used. They also found a potential publication bias. Moreover, Lilienfeld, Smith and Watts (2016) argued that advocates of the RMH selectively report data in favor of their hypotheses and that there is an overreliance on the use of a positive test strategy, the latter holds for the RMH and the LFH. To counteract the influence of human bias during the last decade the use of platforms such as the Open Science Framework became increasingly popular. Using these platforms, researchers are encouraged to preregister their project so that the full research process can be evaluated, critiqued and reused by the scientific community. None of the studies that have investigated the hypotheses (RMH and LFH) used such an approach. Taken together this calls the robustness and validity of the hypotheses into question.

Thirdly, a clarification that we failed to find the expected emotion facilitation deficits in psychopathic individuals might be that we used the YPI as a psychopathic measure. In Smith and Lilienfeld's (2015) meta-analysis only one finding using the YPI as psychopathic measure was included compared to 86 findings with the PCL or a variant as psychopathic measure. In fact, the correlation between the YPI and the RMH was found to be not significant (Smith and Lilienfeld, 2015).

Fourthly, a reason might be that the emotion facilitation deficits of psychopathic individuals is moderated by other variables that we did not include in our analysis. For example, working memory capacity has been found to interact with psychopathy (e.g. WM was related to the ability to maintain attention focus; Baskin-Sommers et al., 2011) and/or right-handed responses were found to have an influence on psychopathic individuals' performance deficits in a lexical-decision task (e.g. performance deficits on an LDT were found to be specific to conditions involving right-handed responses; Lorenz & Newman, 2002). However, Smith and Lilienfeld's meta-analysis found a significant positive correlation between psychopathy and response modulation deficits when the LDT was used as experimental paradigm (based on five findings).

Moreover, a plausible explanation might be that participants did not follow the instructions and did not pay attention to the instructed condition (threat-focus versus alternative-

focus). However, analysis of the manipulation check revealed that instructions were followed. Additionally, threatening words may not have been perceived as threatening. However, compared to non-threatening words, threatening words were rated as more threatening. There was, as expected no effect of psychopathy (Williamson et al., 1991; Lorenz & Newman, 2002), except the supplemental analysis with the affective-interpersonal dimension (YPI Callous-Unemotional factor) instead of the total YPI score. Using the affective-interpersonal dimension, individuals high on psychopathic measures were found to rate threatening words as less threatening compared to individuals low on psychopathic measures (see *Figure 7*). A related explanation that we did not find the expected emotion facilitation deficits in psychopathic individuals could be that low fear and response modulation deficits in psychopathic individuals are primarily related to low-anxious psychopathic individuals and to the affective-interpersonal dimension of psychopathy, as has been often claimed by prior research (Lykken, 1957; Patrick, 2005; Newman et al., 1997; Vitale et al., 2007; Zeier et al., 2009; Frick, & White, 2008). However, findings of our supplemental analysis including this dimension of psychopathy instead of total scores did not support the hypotheses either.

A major limitation of our study was the lack of power, which is related to a relatively small sample size. Secondly, we made use of the YPI only. Including the PCL-R in addition would have been more in line with prior research, since the PCL-R was the most frequently used measure in studies investigating the RMH (Smith & Lilienfeld, 2015) and would have added an additional valid and reliable measure of psychopathic traits (Hildebrand, de Ruiter, de Vogel, & Wolf, 2002). Another limitation of our study is that the potential role of working memory and handedness of the response was not included in our analyses. Moreover, we relied on a single experimental paradigm (LDT) to contrast the LFH with the RMH, whereas there is a broad spectrum of commonly used paradigms to test the LFH and the RMH. Making use of several experimental paradigms could shed more light on the robustness of these hypotheses.

In conclusion, our study did not find support for the LFH or the RMH. However, these results should be interpreted with caution, since our observed power was very low. Future research should make use of a bigger sample size, make additional use of the most frequently used psychopathic measure (PCL-R), include several experimental paradigms and make use of a preregistration protocol to provide transparency into the research process. Additionally, the potential influence of working memory should be assessed. Finally, future research should

counter-balance the handedness of the responses to investigate a potential influence of handedness of the response on the performance deficits of psychopathic individuals.

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