Examining the influence of psychopathy, hostility biases, and automatic processing on criminal offenders' Theory of Mind

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ABSTRACT

Theory of Mind (ToM) is a social perceptual skill that refers to the ability to take someone else's perspective and infer what others think. The current study examined the effect of potential hostility biases, as well as controlled (slow) versus automatic (fast) processing on ToM performance in psychopathy. ToM abilities (as assessed with the Reading the Mind in the Eyes Test; RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), was compared between 39 PCL-R diagnosed psychopathic offenders, 37 non-psychopathic offenders, and 26 nonoffender controls. Contrary to our hypothesis, psychopathic individuals presented with intact overall RMET performance when restrictions were imposed on how long task stimuli could be processed. In addition, psychopaths did not over-ascribe hostility to task stimuli (i.e., lack of hostility bias). However, there was a significant three-way interaction between hostility, processing speed, and psychopathy: when there was no time limit on stimulus presentation, psychopathic offenders made fewer errors in identifying more hostile eye stimuli compared to nonoffender controls, who seemed to be less accurate in detecting hostility. Psychopaths' more realistic appraisal of others' malevolent mental states is discussed in the light of theories that stress its potential adaptive function.

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1. Introduction

Psychopathy is a developmental disorder that is characterized by high levels of antisocial behavior, as well as emotional impairments such as callousness and a lack of moral emotions like remorse (Cleckley, 1941; Hare, 2003). The disorder is typically assessed using Hare's Psychopathy Checklist Revised (PCL-R; Hare, 2003). Research has shown this extensively validated instrument to be comprised of two factors (Harpur, Hakstian, & Hare, 1988): Factor 1 describes affective and interpersonal items (e.g., shallow affect, conning/manipulative behavior), whereas Factor 2 reflects impulsive and antisocial lifestyle traits (e.g., parasitic lifestyle, irresponsibility).[1] A very prominent deficit in psychopathic individuals is their lack of empathy (Cleckley, 1941; Hare,

2003), a moral emotion that is believed to inhibit antisocial behavior and promote pro-social behavior (Hoffman, 2000). Empathy is usually defined as the capacity to understand and to some extent share the feelings of another person. A distinction is made between at least two forms of empathy, i.e., cognitive and emotional empathy (Feshbach, 1975). Cognitive empathy refers to the ability to take someone else's perspective, and is closely related, or even synonymous to Theory of Mind (ToM). ToM has been described as the capacity to attribute mental states (e.g., intentions, beliefs, and desires) to others (Premack & Woodruff, 1978). In contrast, emotional empathy equals the ability to be responsive to and share in the emotional state of another person (Blair, 2005).

Research has shown psychopathic individuals to present with notable emotional empathic deficiencies, like a reduced physiological responsiveness to others' distress (Blair, Jones, Clark, & Smith, 1997). Results of studies on cognitive empathy and psychopathy have been a lot more equivocal. For many years, it has been assumed that adult psychopathy is not associated with ToM deficiencies. A study supporting this supposition was conducted by Blair et al. (1996), who did not find performance differences between psychopathic and nonpsychopathic offenders on Happé's advanced test of ToM (Happé, 1994), a test that requires subjects to infer story characters' thoughts, feelings, and intentions. Subsequently, Richell et al. (2003) could also not find deficits in

[1] Subsequent studies indicate the PCL-R to be described by three factors (Cooke & Michie, 2001), or by a two-factor/four-facet model, in which Factors 1 and 2 have both been divided into two facets, resulting into four components representing 1) interpersonal, 2) affective, 3) lifestyle, and 4) antisocial traits (Bolt, Hare, Vitale, & Newman, 2004). In the present study, however, we decided to adopt a two-factor model as this has been the most widely validated so far.

psychopathic offenders' ToM using the Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), in which subjects are instructed to identify mental states from photographs of the eye region only.

Although seemingly supportive of intact ToM in psychopathy, the results of the studies described above have to be interpreted in the light of some limitations. First, sample sizes in the aforementioned studies were relatively small. Second, no previous ToM research has considered the potential influence of automatic versus controlled processing. Taking this distinction into account could be important as information is thought to be processed via two interacting, yet separable neural routes: an affective, subcortical pathway (depending on limbic structures like the amygdala) that provides a 'quick and dirty' impression; and a slower, cortical route, which is thought to be responsible for deliberate, cognitive processing, providing a more fine-grained, complex interpretation of information (Adolphs, 2002; Johnson, 2005). Imaging research on the RMET suggests that amygdala activation mediates performance on this task in healthy individuals (Baron-Cohen et al., 1999). In addition, patients with acquired bilateral amygdala damage have been found to show impairments on the RMET (Stone, Baron-Cohen, Calder, Keane, & Young, 2003). As psychopathy is associated with amygdala dysfunction, yet does not seem to influence RMET performance, it has been suggested that psychopathic people might compensate for their amygdala dysfunction by using cortical brain regions in the identification of mental states (Richell et al., 2003). Possibly, previous studies could not reveal any psychopathy-specific deficits in ToM as subjects could look at task stimuli for as long as they wanted, enabling them to rely on such compensatory cognitive strategies.

Another factor that has been overlooked in previous research is the potential influence of offenders' cognitive processing style on ToM performance. Anger and violent behavior are common characteristics in forensic samples, and individuals high on these traits show difficulty ignoring hostile stimuli (Cohen, Eckhardt, & Schagat, 1998; Smith & Waterman, 2004). Moreover, both aggression and psychopathy have been found to relate to the presence of hostile attributional biases, i.e., the more elevated these traits are in individuals, the more hostile intent is perceived from others in ambiguous situations (Dodge, 1980; Vitale, Newman, Serin, & Bolt, 2005). Possibly, preferential attending to hostile stimuli and the incorrect attribution of malevolent intentions to others, could interfere with correctly inferring others' mental states in psychopathy.

The current study aimed to build on previous research on ToM by administering the RMET to a group of offenders (varying in their degree of psychopathy) and a group of non-offender subjects. We took a number of precautions in order to overcome the aforementioned limitations. First, we took the possibility into consideration that psychopathic people only present with ToM deficits under conditions where stimuli have to be processed fast. In order to examine this prediction, we presented half of the RMET stimuli rapidly, whereas subjects could look at the other half of the task stimuli without any time restrictions. We expected psychopathic individuals to show impairments on the RMET in comparison with nonoffenders, yet only when stimuli were presented quickly (Hypothesis 1). Second, we investigated whether offenders' ToM performance might be distorted by a cognitive 'hostility bias.' In order to test this hypothesis, we changed a number of incorrect answering options in the RMET, making sure that the alternatives subjects could choose from varied in their degree of hostility. We predicted offenders' performance on the RMET to be distorted by a bias towards more hostile answering options, reflected by a tendency to choose for more hostile answering alternatives when making mistakes (Hypothesis 2). As psychopathy has been found to positively relate to the perception of hostility (Vitale et al., 2005), we predicted this effect to be strongest in the psychopathic offender group, as compared with the nonoffenders.

2. Method

2.1. Participants

We recruited 85 male criminal offenders with Cluster B personality disorders (PDs) from six forensic psychiatric centers and a prison. Thirty-six of these participants were participating in a randomized clinical trial (RCT) on the effectiveness of Schema Therapy versus Treatment as Usual in forensic patients with Cluster B PDs (Bernstein et al., 2012). The inclusion and exclusion criteria for this RCT aimed to select a group of patients whose personality pathology was the primary focus of treatment. The inclusion criteria were (a) the presence of a DSM-IV Antisocial, Narcissistic, Borderline, or Paranoid PD, or a PD not otherwise specified with at least five cluster B PD traits; and (b) a good understanding of the Dutch language. Exclusion criteria were (a) the presence of current psychotic symptoms, (b) schizophrenia or bipolar disorder, (c) current drug or alcohol dependence (but not abuse), (d) low intelligence (i.e., IQ < 80), (e) serious neurological impairment, (f) an autistic spectrum disorder, and (g) fixated pedophilia. In order to create in this respect a homogeneous sample, the subjects who did not participate in the RCT ($n = 49$) were recruited using the same inclusion and exclusion criteria as described above.

In the entire offender group, there was no RMET data available on the first nine subjects due to a programming error, resulting in a sample of 76 forensic subjects. The forensic sample was divided into a psychopathic and a non-psychopathic group using the European PCL-R cut-off of 25 (Cooke & Michie, 1999; this cut-off also happened to be the median PCL-R score in the current sample). Twenty-six healthy male controls were additionally recruited from the general population. An inclusion criterion for this group was a) good understanding of the Dutch language. Exclusion criteria were a) the presence of any axis I disorder; b) the presence of threshold minus two criteria for any DSM-IV PD; c) the presence of a PD diagnosis Not Otherwise Specified (i.e., fulfillment of five or more criteria of different PD diagnoses), d) low intelligence (i.e., IQ < 80), (e) serious neurological impairment, (f) an autistic spectrum disorder, and (g) a level of self reported psychopathy higher than one SD above the general population mean.

Table 1 shows an overview of participant characteristics. All of the control subjects had Dutch nationality. In the forensic sample, ten different nationalities were represented, with the most prevalent being

Table 1
Sample characteristics ($N = 102$).

	Psychopathic offenders ($n = 39$)		Nonpsychopathic offenders ($n = 37$)		Nonoffenders ($n = 26$)	
	M (SD)	Range	M (SD)	Range	M (SD)	Range
Age (years)	38.6 (9.7)	23–65	39.3 (10.2)	24–64	35.6 (13.5)	18–57
IQ	95.1 (11.6)	80–120	96.6 (11.1)	80–121	101.2 (12.5)	80–128
PCL-R total	29.7 (3.1)	25.0–36.8	18.5 (3.9)	11.0–24.0	–	–
PCL-R F1	12.2 (2.8)	6.0–16.0	8.5 (3.1)	3.0–16.0	–	–
PCL-R F2	13.9 (2.5)	7.2–18.0	7.6 (3.6)	1.0–14.0	–	–
% correct RMET short	58.5 (13.3)	27.8–83.3	61.4 (12.6)	38.9–88.9	61.3 (10.2)	38.9–77.8
% correct RMET long	65.7 (13.0)	38.9–88.9	64.1 (12.5)	38.9–94.4	66.9 (14.6)	22.2–94.4

Note. PCL-R = Psychopathy Checklist-Revised; F1 = Factor 1; F2 = Factor 2; % correct RMET = percentage of correctly identified trials on the Reading the Mind in the Eyes Test.

Dutch (74.7%), Moroccan (7.2%), and Surinamese (8.4%). Types of crime that were committed in the forensic group included homicide offenses (27.7%), assault (20.5%), property crime with (10.8%) and without (1.2%) violence, pedophilic (10.8%) and nonpedophilic (19.3%) sexual offenses, arson (6.0%), and drug offenses (3.6%). The mean time that forensic subjects had been institutionalized since their last offense was 6.7 years (SD = 4.2, range = 1–20). PD diagnoses in the forensic group included antisocial (82.9%), borderline (32.9%), narcissistic (31.6%), paranoid (10.5%), and avoidant PD (1.3%). (There were no subjects with a histrionic PD.) The study was approved by the standing ethical committee of the Faculty of Psychology and Neuroscience of Maastricht University. All participants provided written informed consent.

2.2. Measures

2.2.1. Screening measures

2.2.1.1. SIDP-IV. In the forensic participant group, PDs were assessed using the Structured Interview for DSM-IV Personality Disorders (SIDP-IV; Pfohl, Blum, & Zimmerman, 1995). SIDP-IV scores were derived from participants' file records when these had already been scored by diagnostic staff thoroughly trained in assessing the SIDP-IV ($n = 52$). Eighteen of these interviews (from different clinics) were recorded and independently scored by a second rater, yielding intra class correlation coefficients (ICCs, single measures) for item scores of the PDs of interest ranging between .52 and .93, with a mean of .71. Scores were averaged when interviews had been rated twice. When SIDP-IV results were not available ($n = 33$), the interview was administered by the first author (L. N.). Following extensive training, L. N. independently scored five SIDP-IV interviews that had also been scored by a rater that conducted several of the other SIDP-IV interviews in the study. For this double scoring, single rater ICCs for the PDs of interest ranged from .75 to .96, with a mean of .84.

2.2.1.2. SCID-I and II. The nonforensic control group was screened for axis I and II psychopathology using the Structured Clinical Interview for DSM-IV Axis I disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 1997) and the SCID for Axis II Personality Disorders (SCID-II; First, Spitzer, Gibbon, Williams, & Benjamin, 1994). SCID screenings were conducted by either the first author (L. N.) or a graduate student. Prior to the actual screening, both interviewers independently rated five audiotaped SCID-I and II interviews of PD patients who participated in a different study. The number of axis I diagnoses that was present in these patients was insufficient to determine Kappas. However, both raters agreed on the presence of 24 axis I disorders over these five patients, whereas disagreement existed on the presence of only two diagnoses, suggesting a high level of consistency between raters. ICCs (single rater) for the dimensional scores of all PDs obtained with the SCID-II ranged from .79 to .99, with an average of .88.

2.2.1.3. AQ. When there was reason to suspect the presence of an autism spectrum disorder, the Autism-Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) was administered. Subjects scoring 32 or higher on the self-report questionnaire were excluded from the study (based on Baron-Cohen, Wheelwright, Skinner, et al., 2001). Offenders were not approached for this study when an autism spectrum disorder had been diagnosed by an institution's staff, for which various, often times more extensive methods were used, e.g., patient interviewing complemented with collateral and observational information.

2.2.1.4. LSRP. The level of psychopathic traits in the nonforensic participants was determined using the Levenson Self-Report Psychopathy Scale (LSRP; Levenson, Kiehl, & Fitzpatrick, 1995). In the current study, control subjects were excluded when their score exceeded a cut-off of 58, which is approximately one SD above the mean LSRP total score found in males in the general population (e.g., Uzieblo, Verschuere, van den Bussche, & Crombez, 2010).

2.2.2. Main predictor and outcome variables

2.2.2.1. PCL-R. In order to assess psychopathy in the offenders, the PCL-R (Hare, 2003) was used, an instrument based on a semi-structured interview and a review of subjects' institutional and judicial file information. PCL-R scores were obtained from clinical files when these had already been scored by the diagnostic staff in a clinic ($n = 73$; all of these staff members had been extensively trained during a three day PCL-R assessment course). Sixteen of these interviews (selected from different clinics) were rated by two independent raters, resulting in single rater ICCs for PCL-R total, Factor 1, and Factor 2 scores of .76, .74, and .74, respectively. When recent PCL-R scoring was not available (which was the case for 11 subjects), the first author (L. N.) scored the PCL-R, also based on an interview and an extensive file search. Regular meetings were held with the third author (D. P. B.) to ensure adherence to the diagnostic criteria. Standardized Cronbach's alpha for PCL-R total, Factor 1, and Factor 2 scores in the entire forensic sample was .79, .82, and .82, respectively.

2.2.2.2. RMET. In order to assess ToM, we used the Reading the Mind in the Eyes Task (RMET; Baron-Cohen, Wheelwright, Hill, et al., 2001). In this test, subjects are presented with a series of 36 different pictures showing the eye region of faces only, and are asked which out of four words (one correct answer, three foils) best represents what the person in the picture is feeling or thinking. (For information on the construction and psychometric properties of this test we refer to Baron-Cohen, Wheelwright, Hill, et al., 2001). In the current study, the task was presented on a computer screen, and subjects were required to make a forced-choice using a button-box with a button representing each answering option. As mentioned before, we altered the RMET in two ways. First, we presented the first half of the eyes stimuli (trials 1–18) only shortly,[2] i.e., a trial consisted out of the consecutive presentation of a fixation cross (1000 ms), the picture stimulus (1000 ms), and the answering options. The second half of the stimuli (trials 19–36) was presented for an unlimited amount of time (as in the original test), i.e., a fixation cross would appear (1000 ms) after which the eye stimulus was displayed in combination with the four answering options, for an unlimited time. For all trials (both short and long), subjects could look at the answering options as long as they wanted. Both halves of the test were preceded by two practice trials, for which eye pictures were used that were not part of the actual RMET stimulus set.

Second, we attempted to create more variation in the level of hostility in the RMET answering options by adding some hostile answering options (e.g., 'aggressive,' "attacking") and by replacing some foils with other original RMET answering options. In this way, 23 of the 108 foils were changed, creating a wide range of hostility in the answering options throughout the test. In order to determine how hostile words were, 33 students of Maastricht University rated the level of hostility for each RMET answering option (and the additional foils) on 80 mm visual analog scales, ranging from 0 (*not hostile at all*) to 10 (*very hostile*). This procedure enabled us to calculate an average level of hostility that raters assigned to each answering option (i.e., the answering option's 'hostility score'; HS). Both the order in which trials were presented as well as the order of the four answering options for each trial was randomized. The task always began with the short stimulus presentation.

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[2] Based on earlier research (e.g., Liddell, Williams, Rathjen, Shevrin, & Gordon, 2004), the short stimulus-presentation for the RMET was initially set at 400 ms. However, pilot research with two (nonpsychopathic) offenders and two employees of Maastricht University (all not participating in the actual study) was conducted, in which the four participants claimed that the presentation was too fast to properly evaluate the stimuli. In order to prevent floor effects on the RMET, we tried out various presentation times with the pilot subjects. The eventual interval was set at 1000 ms, which was still experienced as a very fast presentation time by the four pilot participants.

Participants were instructed to do the task as fast and correct as possible.

In order to ensure construct validity of our modified version of the RMET, we looked at its association with another test of ToM, i.e., Happé's advanced test of ToM, which requires the inference of story characters' mental states (Happé, 1994). In the current sample, performance on Happé's test and RMET total scores were significantly correlated ($r = .36$, $p < .001$, $n = 102$). Correlations between Happé's test and performance for the short and long stimulus duration of the RMET were $r = .32$ ($p < .001$) and $r = .28$ ($p < .001$), respectively. These correlations are similar in magnitude as to those found in previous studies reporting the association between the RMET and story tasks assessing ToM (e.g., Ferguson & Austin, 2010).

2.2.3. Potential covariates

As executive functioning has consistently been found to be associated with performance on ToM tests (e.g., Ahmed & Stephen Miller, 2011), we took several measures into account that assess related, yet distinct domains of executive functioning: Full scale IQs were obtained from recent Wechsler Adult Intelligence Scale-III (WAIS-III; Wechsler, 1997) assessments that had been conducted at the forensic sites. When these were not available, subjects were administered a shortened version of the WAIS-III, in which IQ was based on the subtests Block Design and Vocabulary (Jeyakumar, Warriner, Raval, & Ahmad, 2004). The WAIS-III Picture Arrangement subtest was used as a measure of social logical reasoning. In order to assess subjects' working memory capacity a computerized version of the self-ordered pointing task (SOPT; Petrides & Milner, 1982) was administered. In this task, subjects are presented with pictures that are spatially arranged on a computer screen in a 3×4 matrix. The arrangement of stimulus items is varied from trial to trial. On each trial, participants are required to point to a picture which they have not pointed to on a previous trial. The number of correct responses was summed over two repetitions of the task. A last executive function that was taken into account was impulsivity, examined using a 'stop' test, designed following the methodology described in Rubia, Smith, and Taylor (2007). This computerized task assessed the capacity to inhibit an ongoing response.

Other potential covariates in the current study included age, state and trait anxiety, as assessed with the State–Trait Anxiety Inventory (STAI; Spielberger, 1983), and several variables that characterize the pictures in the RMET. The latter included the gender of the person in the picture, thickness of the eyebrows, color of the eyebrows (light vs. dark), visibility of the eyelashes, perspective from which the picture was taken (en face vs. en profile), visibility of the pupil, gaze direction of the eyes, diameter of the iris, the ratio between height and width of the eyes, the amount of visible sclera surface of the eyes, and the estimated age of the person in the picture (averaged ICC over two independent raters = .92).

2.3. Procedure

Control subjects were recruited using flyers and newspaper advertisements. The SCID interviews and the LSRP were administered over the phone. Eligible candidates were invited to Maastricht University, where they completed the rest of the assessment measures described above. Potential forensic participants were identified using patients' file information and with the help of therapists who were informed about the in- and exclusion criteria. Volunteers were first assessed with the PCL-R, the SIDP-IV, and the WAIS-III (if necessary), after which the other measures above were administered. At each site, testing was performed in a quiet, designated testing room. Both control and forensic subjects also completed a variety of other tests measuring different emotional capacities, which are and will be described elsewhere (e.g., Nentjes, Meijer, Bernstein, Arntz, & Medendorp, 2013). All measures were presented in counterbalanced order across participants. Subjects were reimbursed with 25 euro for their participation.

2.4. Data preparation and analysis

All analyses were conducted using IBM SPSS Statistics 19.0. We used multilevel logistic regression to model the effects of various predictors on the binary outcome correct vs. incorrect response on each RMET trial, thereby taking into account the hierarchical data structure, with trials nested within persons, as well as taking into account within subject covariates such as trial number (Hox, 2010). The random model part consisted of a random intercept to capture residual between-subject outcome variation, plus Autoregresssive Moving Average error (ARMA 1,1) for the within-subject residual variation. ARMA 1,1 was chosen as this is the most general structure for the within-subject variation that can be combined with a random intercept and that is still parsimonious in the presence of a large number of repeated measures per person. Fixed effects (predictors) in this model were the RMET trials' relative hostility score (HS^{rel})[3], stimulus duration (short vs. long), and group (nonoffenders, nonpsychopathic, and psychopathic offenders). Group was coded using linear and quadratic contrasts, respectively coded as −1 (nonoffenders), 0 (nonpsychopathic offenders), 1 (psychopathic offenders), and −1 (nonoffenders), 2 (nonpsychopathic offenders), and −1 (psychopathic offenders), in order to check deviation from linearity. All two- and three-way interactions between these three predictors (HS^{rel}, stimulus duration, and group) were entered into the model. In accordance with Hypothesis 1, we expected a significant effect of the interaction term 'group × stimulus duration,' carried by worse performance of the psychopathic group compared with the nonoffenders for the short stimulus duration. Regarding Hypothesis 2, we expected an interaction of group with HS^{rel}, in the sense that the psychopathic offenders were expected to make more mistakes for trials characterized by a low HS^{rel} (implying the presence of relatively hostile foils), in combination with psychopathic offenders choosing more hostile foils than nonoffenders when making mistakes (see below).

Psychopathy is considered to be a multidimensional construct, consisting of at least two factors that are differentially related to external constructs (e.g., Verona, Patrick, & Joiner, 2001). Therefore, the analyses described above were repeated defining the two offender groups according to the median splits of PCL-R Factors 1 and 2, in order to investigate whether potential effects would be specific for one of the PCL-R factors. We decided to use this categorical approach, rather than investigating the fixed effects of the dimensional Factor 1 and 2 scores, as to enable inclusion of the nonoffender group in these analyses (on whom no PCL-R data could be obtained due to a lack of criminal background).

Next to the predictors described above, a number of between-subject covariates were taken into account in the analyses. We decided to include the main effects of age and IQ into all analyses, as these variables have been found to be robust predictors of performance on ToM tasks (including the RMET; e.g., Ahmed & Stephen Miller, 2011). Next to that, we investigated the potential influence of working memory capacity, impulsivity, state and trait anxiety, and a number of within-subject covariates, including the RMET picture characteristics described above, trial number (recoded into numbers 1–18 for the first half of the trials [short stimulus durations] and 1–18 for the last half [long stimulus durations]), and the interaction 'trial number × stimulus duration.'

Prior to the regression analyses we undertook a number of steps. First, inspection of the data revealed no multivariate outliers on the quantitative covariates and PCL-R-scores, using a criterion of $p < .001$ for Mahalanobis distance (Tabachnick & Fidell, 2007). When individual scores on continuous variables deviated more than 3 SD from the sample mean, they were replaced by a value representing the mean

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[3] A relative hostility score (HS^{rel}) was computed for each trial, using the following formula: *'HS of the correct answering option'* — *'highest HS of the three foils.'* The HS^{rel} ranged from −64.0 to 57.0 ($M = 18.7$, $SD = 30.9$). So the more hostile the eyes in a trial are (relative to the most hostile foil in the trial) the higher the HS^{rel}.

plus or minus 3 SD (changing 3.8% and 1.8% of the scores on impulsivity and working memory capacity, respectively). Second, collinearity diagnostics were inspected for all between and within-subject factors. In order to prevent potential collinearity that could arise from the inclusion of interaction terms in the regression model, all predictor variables were centered around the sample mean (which also facilitates the interpretation of the intercept; categorical predictors were coded -0.5 and 0.5).

3. Results

3.1. Performance on the RMET by stimulus duration, hostility, and total psychopathy level

The fixed part of the regression analysis was modeled in a number of steps. First, all main effects (group contrast, stimulus duration, HS^{rel}), as well as the two- and three-way interactions of group, HS^{rel}, and stimulus duration (short vs. long) were entered into the model, along with the main effects of age and IQ. Subsequently, clearly non-significant ($p > .10$) terms involving group (quadratic) were deleted, first deleting the three-way interaction, then the two-way interactions and finally the main effect, resulting in the model displayed in Table 2.

The other between and within-subject factors described above (e.g., impulsivity and trial number) were then entered into the model as fixed effects, in order to investigate whether this would change the effects reported in Table 2. Due to computational restrictions, subsets of a maximum of three covariates could be added to the model at one time. Besides age and IQ, no other between-subject variables significantly contributed to the model (at $p < .05$). Predictive within-subject covariates were the estimated age of the person in the picture, color of the eyebrows (light vs. dark), the ratio between height and width of the eyes, the amount of visible sclera surface of the eyes, and the gender of the person in the picture. The deletion of age and IQ, or addition of within-subject covariates to the model did not appreciably change either the direction of the regression coefficients or their associated significance levels as described in Table 2. The three-way interaction 'group (linear) × HS^{rel} × stimulus duration' was further examined by plotting the interaction between HS^{rel} and group per level of stimulus duration (see Fig. 1). Furthermore, repeating the regression analyses three times, leaving out one group (i.e., either nonoffenders, nonpsychopathic offenders, or psychopathic offenders) per analysis, revealed the three-way interaction effect to be significant only when contrasting the nonoffender controls with the psychopathic offenders ($p = .034$), but not when comparing nonoffenders vs. nonpsychopathic offenders ($p = .206$) or nonpsychopathic offenders vs. psychopathic offenders

($p = .349$). Further inspecting the effect of group (linear), HS^{rel}, and the interaction between both variables per stimulus duration (controlling for the main effects of IQ and age), showed the interaction 'HS^{rel} × group group (linear)' to be significant for the long duration ($p = .031$), but not for the short duration ($p = .475$). Within the short duration, the main effect was significant for HS^{rel} ($p < .001$), but not for group (linear) ($p = .727$), after deleting the interaction 'HS^{rel} × group (linear).'

Last, pairwise group contrasts for the upper quartile of HS^{rel}, for the long stimulus duration, were significant for the psychopathic offenders vs. nonoffenders pair ($B = 0.735$, $p = .009$), but not for the nonpsychopathic offenders vs. nonoffenders pair ($B = 0.378$, $p = .161$), or the psychopathic vs. nonpsychopathic offenders pair ($B = 0.376$, $p = .108$). None of the three pairwise contrasts were significant for the lower quartile of HS^{rel} for the long stimulus duration (all p's < .137). In summary, these analyses show that higher HS^{rel} was associated with worse RMET performance in all three participant groups when stimuli were presented briefly. For the long stimulus duration, however, an increasing HS^{rel} was associated with better performance in the psychopathic offender group and with worse performance in the nonoffender group, such that the group difference was significant and in favor of the psychopathic offender group at the highest HS^{rel} level, and non-significant and in favor of the nonoffender group at the lowest HS^{rel}. The performance of the nonpsychopathic offenders was in between the other two groups at each level of HS^{rel}.

3.2. Performance on the RMET by stimulus duration, hostility, and psychopathy factors

In order to investigate whether the three-way interaction between group (linear), HS^{rel}, and stimulus duration was PCL-R factor-specific, we repeated the regression analysis described above twice, once per factor, by dividing the offenders into two groups on the median of the factor concerned (for Factor 1: 10.5, for Factor 2: 12.0). For the first analysis, all the main effects of group (nonoffenders, offenders low on Factor 1, offenders high on Factor 1), HS^{rel}, and stimulus duration, as well as all the two- and three-way interactions between group (Factor 1), HS^{rel}, and stimulus duration were entered into the model, along with the main effects of IQ and age, showing the three-way interaction 'group (Factor 1) × HS^{rel} × stimulus duration' to be significant ($B = 0.006$, $p = .023$). Repeating this analysis using the Factor 2 grouping variable (nonoffenders, offenders low on Factor 2, offenders high on Factor 2), revealed a borderline significant three-way interaction 'group (Factor 2) × HS^{rel} × stimulus duration' ($B = 0.005$, $p = .064$). Covariates that significantly contributed to these models (including either group [Factor 1] or group [Factor 2]) were the same as for the regression analysis in Table 2 where grouping was based on the total PCL-R score; addition of the within-subject covariates, or deletion of the main effects of age and IQ, again did not substantially change direction or significance of the regression coefficients. The three-way interaction 'group (linear; based on total PCL-R scores) × HS^{rel} × stimulus duration' was thus carried by both factors. When plotting the three-way interactions for Factors 1 and 2, respectively, very similar patterns were obtained as that observed in Fig. 1.

3.3. Predicting chosen hostility within incorrect answers on the RMET

As psychopathy interacted with HS^{rel}, at least for the long stimulus duration, we subsequently investigated whether psychopathy was related to choosing more hostile answering alternatives when making mistakes (Hypothesis 2). This analysis was therefore limited to the incorrect responses. A linear mixed model was specified with the same random model part as in the logistic mixed models (i.e., random intercept plus ARMA 1,1) and as fixed effects group (nonoffenders, nonpsychopathic, and psychopathic offenders; using the same linear and quadratic contrasts as before), stimulus duration (short vs. long), and the interaction between these two predictors. The dependent

Table 2
Multilevel logistic regression analysis of predictors (with group based on total PCL-R score) of correctly responding to trials in the reading the mind in the Eyes Test.

Parameter	Estimate (B)	SE	Sign.
Intercept	0.164	0.375	.662
Group (linear)	0.009	0.056	.874
HS^{rel}	-0.005	0.001	<.001
Stimulus duration	0.208	0.071	.004
Group (linear) × HS^{rel}	0.001	0.001	.300
Group (linear) × Stimulus duration	0.049	0.090	.587
HS^{rel} × Stimulus duration	0.008	0.002	<.001
Group (linear) × HS^{rel} × Stimulus duration	0.006	0.003	.035
IQ	0.010	0.004	.010
Age	-0.015	0.004	<.001

Note. Stimulus duration was coded as -0.5 (short) vs. 0.5 (long); Group (linear) was coded as -1 (nonoffenders), 0 (nonpsychopathic offenders), and 1 (psychopathic offenders). Random intercept (between-subject) variance = 0.059 (SE = 0.029); Residual (within-subject) variance = 0.991 (SE = 0.024); Autocorrelation was ignorably small (first lag = 0.012, *SE* = 0.016).
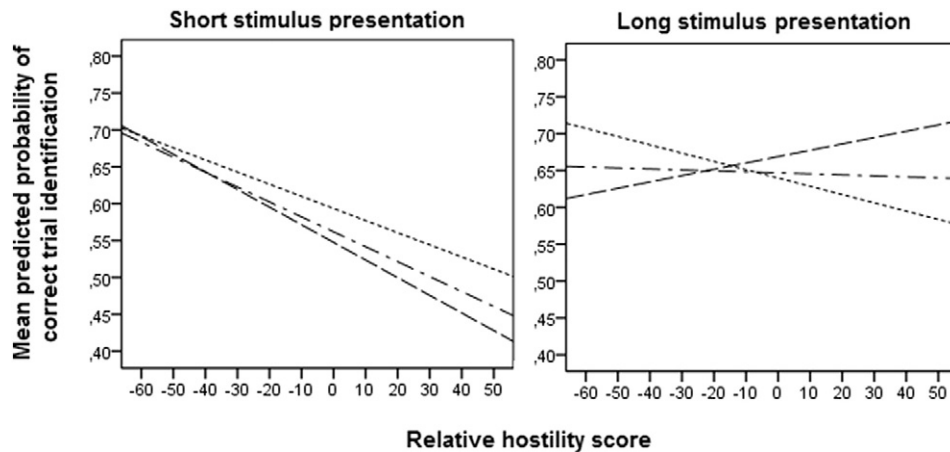
Fig. 1. Associations between trials' relative hostility scores (HS^{rel}) and probability of correct identification, split up by stimulus duration, as a function of group: nonoffenders (- - - - - -); nonpsychopathic offenders (- – - –); and psychopathic offenders (– – –) (corrected for age and IQ).

variable was the relative hostility score of the chosen incorrect option relative to the other incorrect answering options in that trial (HS^{chosen}; which was computed using the formula *'HS of the chosen option'* — *'highest HS of the other two foils'*). To solve nonconvergence, the within-subjects random part was reduced from ARMA 1,1 to uncorrelated residuals. Analyses showed no significant relation between the outcome HS^{chosen} and the predictors ($p > .10$ for the interaction or for the main effects after taking out the interaction). Repeating this analysis using grouping based on Factor 1 showed no effects either, and the same holds for grouping based on Factor 2. These results suggest that, given an incorrect answer, psychopathy was not related to choosing a more hostile answering option.

4. Discussion

The current study administered the RMET to a group of offenders with PDs, as well as a group of nonoffenders, expecting psychopathy to be associated with ToM deficits under certain conditions, such as fast stimulus presentation and the presence of hostile response alternatives. However, contrary to our expectations, psychopathic offenders' ToM did not break down under such conditions, providing support for the robustness of psychopathic individuals presenting with intact ToM. This finding could help explain why psychopaths – even though they lack emotional empathy for their victims (e.g., Blair et al., 1997; Hare, 2003) – are very well able to manipulate others, a capacity that requires knowledge about what another person feels or thinks.

4.1. Psychopathy and ToM capacities under time restrictions

Our first hypothesis was that psychopathy is related to impairments in ToM, yet only when limited time is available to process task stimuli, presuming this short duration to hinder compensation for deficiencies in early stages of information processing. As expected, psychopathy was not related to worse RMET performance when the stimulus duration was long. This finding is in line with previous studies showing (psychopathic) offenders to be unimpaired in the inference of complex mental states from pictures of eyes when no time restrictions are imposed (Dolan & Fullam, 2004; Richell et al., 2003). Contrary to our expectations though, we did not find psychopaths to make more mistakes than nonoffenders when stimuli were presented only briefly either. It is unlikely that this result was due to floor effects, as there was a substantial degree of variation in correctly identified RMET stimuli across participants. However, the absence of group differences might be explained by other artifacts in our experimental set-up, such as the possibility that our stimulus duration was too long in order to tap into early stages of information processing (Luo et al., 2010). Alternatively,

psychopaths might have kept the image of the eyes in visual short-term memory, still enabling the engagement in slower, cognitive strategies for identifying mental states. This potential artifact in our design might have been circumvented had we limited the time that participants could take to respond, or if we had used a visual mask presented after the stimuli to wash out iconic visual memory.

Although not supportive of our initial hypothesis, we do not feel that the current study disconfirms the possibility that psychopathic individuals relied on cortical neural circuitry during the RMET to compensate for limbic dysfunctions. In fact, such a compensatory explanation is supported by a recent study by Dadds et al. (2009) which showed boys high in psychopathic traits to display marked emotional empathy dysfunction across different age groups. Reduced cognitive empathy, on the other hand, was related to these traits in younger boys only, whereas the adolescent boys high in psychopathic characteristics seemed to have 'caught up' with their peers over time in understanding others' emotions.

Therefore, instead of dismissing the possibility that psychopaths process mental states in a different manner, a more compelling explanation could be that their processing style is not slower. Experimental research shows that mental skills that initially require slow and controlled processing can become more automatic over time after repeated practice, a shift that is reflected in a more accurate, effortless, and fast performance (e.g., Jansma, Ramsey, Slagter, & Kahn, 2001). Likewise, the social perceptual skills of psychopathic individuals might have become automatized through extensive practice in social situations, enabling them to make judgments about others' mental states just as fast and accurate as nonpsychopaths. This conjecture would explain why the current, as well as previous studies, fail to find psychopathy-related deficits in the attribution of mental states, even under high task demands.

4.2. Psychopathy and the influence of hostility on Theory of Mind

A second hypothesis we investigated was that offenders' ToM capacities would be distorted by a cognitive bias towards hostility. Although we found that at long stimulus durations, psychopathic offenders were significantly better than nonoffenders at recognizing hostile eyes, our findings were not clearly supportive of such a cognitive bias: the offenders (both nonpsychopathic and psychopathic) did not make significantly more mistakes than nonoffenders when the relative hostility of eyes was low (so in the presence of relatively hostile foils). For the short stimulus duration, hostility did not appear to influence response correctness differently per group at all, as no group by hostility interaction was found for stimuli with a short duration. Relatedly, offenders' incorrect answers on both long and short trials were not characterized by relatively higher levels of hostility compared with nonoffenders. These

findings seem to be inconsistent with previous research showing aggression and psychopathy to be related to a more hostile interpretation of others' intentions in ambiguous social situations (Dodge, 1980; Vitale et al., 2005). This discrepancy could be explained by the fact that we used a paradigm that was not analogous to those adopted in previous studies and in which stimuli were not necessarily ambiguous, i.e., there was only one right answer for each trial. Indeed, aggression does not seem to relate to the inference of more hostile intent when social situations are unambiguous (Dodge, 1980).

Though not supportive of our initial hypotheses, the current study revealed another interesting finding. When stimuli were presented briefly, all participant groups showed more difficulty in identifying the mental states of relatively hostile eyes as compared with non-hostile eyes. With a longer stimulus duration, this effect became smaller for the nonoffenders, disappeared for the nonpsychopathic offenders, and even reversed for the psychopathic offenders. As a result, psychopathic offenders were better in correctly attributing mental states when the hostility of eyes was high, compared to the nonoffender controls, with nonpsychopathic offenders falling in between both groups. Analyses focusing on the antisocial behavior component (Factor 2) and interpersonal, affective traits of psychopathy (Factor 1), showed this effect to be carried by both factors. Thus, psychopathy did not seem to be related to an over-attribution of malevolence, but rather to an increased sensitivity to actual hostile mental states. These findings are in line with recent research by Wilkowski and Robinson (2012), showing aggressive individuals to be more accurate in detecting subtle cues of facial anger than nonaggressive participants, an effect that could not be explained by a general bias towards perceiving more anger in faces.

Psychopaths' potential realistic appreciation of others' malevolence might be explained in the light of research showing information is generally processed more readily when its content is congruent with one's own personality traits or current mood (Rusting, 1998). Depressed individuals, for example, make more negative, yet accurate inferences of the world in comparison to nondepressed people, a phenomenon referred to as 'depressive realism' (Moore & Fresco, 2012). In contrast, a positive mood, as well as more general personality traits like agreeableness, are related to a 'positivity bias,' meaning that reality is interpreted in an overly optimistic manner (for a review, see Rusting, 1998). This latter phenomenon is compatible with nonoffenders' decreased tendency to infer hostility to eyes when it was actually there. Assuming that emotion and personality can also guide perception in offenders, it is not surprising that psychopathy was related to an increased sensitivity to hostile intent, as this disorder is associated with the propensity to experience hostility and anger (Hicks & Patrick, 2006). In the current study, psychopathy thus seemed to be related to a processing style characterized by what one might refer to as 'antagonistic realism.'

A more general explanation for psychopaths' potential 'antagonistic realism' and nonoffenders' 'positivity bias' in reading others' hostile intentions comes from a developmental perspective. Psychopathic offenders' increased ability to read hostile mental states could be the result of repeated exposure to hostile environments, in which detection of others' bad intentions actually serves an adaptive purpose, i.e., signaling realistic threats. This supposition is supported by the fact that adult psychopathy is associated with childhood abuse (Lang, Klinteberg, & Alm, 2002). Furthermore, the conjecture that growing up in abusive environments fosters the ability to read hostility in others' eyes is consistent with a robust line of research showing that people get more successful at processing stimuli to which they have been exposed repeatedly (e.g., Ghuman, Bar, Dobbins, & Schnyer, 2008), and get more skillful in complex cognitive operations after practice (Jansma et al., 2001; see Pollak (2008) and Wilkowski and Robinson (2012) for similar interpretations relating to anger detection in aggressive individuals). In contrast, nonoffenders' underdetection of hostility could have originated from interacting with a mostly nonhostile environment, in which a relatively high threshold for hostile cues provides a behavioral advantage in, for example, maintaining social relationships.

A last finding that deserves further discussion is that psychopathy was only related to a more accurate inference of hostility when presentation time was unlimited. Potentially, the briefly presented eyes lacked personal relevance to the psychopathic participants, whereas the prolonged presentation of stimuli was experienced as though the eyes were staring at them. Being stared at could be particularly evoking for psychopathic people as it might signal provocation. Therefore, the prolonged presentation could have led psychopathic participants to engage in a more focused, elaborate processing of the possible intention depicted by the eyes, a process that has been referred to as 'provocation-focused rumination,' which has found to amplify the accessibility of aggressive thoughts (Pedersen et al., 2011). This interpretation is congruous with a study by Wilkowski, Robinson, and Meier (2006) showing low agreeableness to be related to difficulties in disengaging attention from antisocial stimuli.

5. Conclusion, limitations and future directions

The current study aimed to investigate whether psychopathy is related to ToM deficiencies under certain conditions, by comparing (non)psychopathic offenders to nonoffender controls. Contrary to our expectations, results revealed psychopaths' ToM to be intact, even under very stringent conditions (i.e., brief stimulus presentation) or in the presence of hostile answering alternatives, lending further support for intact ToM in psychopathic individuals. An unexpected intriguing finding was that during the long RMET stimulus presentation, psychopathic offenders' performance was positively influenced by the level of hostility in eyes in comparison to nonoffender controls, who seemed to be less accurate in detecting hostility. This finding requires replication though, especially since it is based on a three-way interaction, and constitutes an interesting avenue for future research.

These current results should be interpreted in the light of some limitations. First, when using a more stringent cut-off (i.e., a PCL-R score of ≥30), our sample included only 19 psychopathic offenders. However, we believe that the inclusion of nonoffender controls, as well as nonpsychopathic offenders made our sample broadly representative. Second, our experimental set-up might not have been appropriate to test whether psychopaths' ToM relies on compensatory cognitive strategies associated with a slower processing speed. Research investigating the social perceptual skills of psychopathic people using neuroimaging techniques might provide more definitive answers to this question. A last drawback of most past research on ToM and psychopathology, including the current study, is that it has disregarded the possibility that individuals' ToM could mainly be distorted in more personally relevant situations, such as when making inferences about what other people think and feel about one personally.

If research replicates the finding that psychopathy is related to more accurate hostility detection (rather than a general bias to see hostile intent), the current findings could also have some clinical implications. Instead of regarding antisocial offenders' hostile thoughts as errors in thinking, clinicians might want to focus on the fact that this accurate appraisal of hostility no longer serves an adaptive purpose, and might hinder the attainment of prosocial goals, such as building meaningful relationships with others.

References

Adolphs, R. (2002). Neural systems for recognizing emotion. *Current Opinion in Neurobiology, 12*, 169–177. http://dx.doi.org/10.1016/S0959-4388(02)00301-X.

Ahmed, F.S., & Stephen Miller, L. (2011). Executive function mechanisms of theory of mind. *Journal of Autism and Developmental Disorders, 41*, 667–678. http://dx.doi.org/10.1007/s10803-010-1087-7.

Baron-Cohen, S., Ring, H.A., Wheelwright, S., Bullmore, E.T., Brammer, M.J., Simmons, A., et al. (1999). Social intelligence in the normal and autistic brain: An fMRI study. *The European Journal of Neuroscience, 11*, 1891–1898. http://dx.doi.org/10.1046/j.1460-9568.1999.00621.x.

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The "reading the mind in the eyes" test revised version: A study with normal adults, and adults with

Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry*, 42, 241–251. http://dx.doi.org/10.1111/1469-7610.00715.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders*, 31, 5–17. http://dx.doi.org/10.1023/A:1005653411471.

Bernstein, D.P., Nijman, H., Karos, K., Keulen-de Vos, M., de Vogel, V., & Lucker, T. (2012). Schema Therapy for forensic patients with personality disorders: Design and preliminary findings of a multicenter randomized clinical trial in the Netherlands. *International Journal of Forensic Mental Health*, 11, 312–324. http://dx.doi.org/10.1080/14999013.2012.746757.

Blair, R.J.R. (2005). Responding to the emotions of others: Dissociating forms of empathy through the study of typical and psychiatric populations. *Consciousness and Cognition*, 14, 698–718. http://dx.doi.org/10.1016/j.concog.2005.06.004.

Blair, R.J., Jones, L., Clark, F., & Smith, M. (1997). The psychopathic individual: A lack of responsiveness to distress cues? *Psychophysiology*, 34, 192–198. http://dx.doi.org/10.1111/j.1469-8986.1997.tb02131.x.

Blair, R.J.R., Sellers, C., Strickland, I., Clark, F., Williams, A.O., Smith, M., et al. (1996). Theory of mind in the psychopath. *Journal of Forensic Psychiatry*, 7, 741–752. http://dx.doi.org/10.1080/09585189608409914.

Bolt, D.M., Hare, R.D., Vitale, J.E., & Newman, J.P. (2004). A multigroup item response theory analysis of the Psychopathy Checklist-Revised. *Psychological Assessment*, 16, 155–168. http://dx.doi.org/10.1037/1040-3590.16.2.155.

Cleckley, H.M. (1941). *The mask of sanity*. St Louis, MO: Mosby.

Cohen, D.J., Eckhardt, C.I., & Schagat, K.D. (1998). Attention allocation and habituation to anger-related stimuli during a visual search task. *Aggressive Behavior*, 24, 399–409. http://dx.doi.org/10.1002/(SICI)1098-2337(1998).

Cooke, D.J., & Michie, C. (1999). Psychopathy across cultures: North America and Scotland compared. *Journal of Abnormal Psychology*, 108, 58–68. http://dx.doi.org/10.1037/0021-843X.108.1.58.

Cooke, D.J., & Michie, C. (2001). Refining the construct of psychopathy: Towards a hierarchical model. *Psychological Assessment*, 13, 171–188. http://dx.doi.org/10.1037/1040-3590.13.2.171.

Dadds, M.R., Hawes, D.J., Frost, A.D., Vassallo, S., Bunn, P., Hunter, K., et al. (2009). Learning to 'talk the talk': The relationship of psychopathic traits to deficits in empathy across childhood. *Journal of Child Psychology and Psychiatry*, 50, 599–606. http://dx.doi.org/10.1111/j.1469-7610.2008.02058.x.

Dodge, K.A. (1980). Social cognition and children's aggressive behavior. *Child Development*, 51, 162–170. http://dx.doi.org/10.2307/1129603.

Dolan, M., & Fullam, R. (2004). Theory of mind and mentalizing ability in antisocial personality disorders with and without psychopathy. *Psychological Medicine*, 34, 1093–1102. http://dx.doi.org/10.1017/S0033291704002028.

Ferguson, F.J., & Austin, E.J. (2010). Associations of trait and ability emotional intelligence with performance on Theory of Mind tasks in an adult sample. *Personality and Individual differences*, 49, 414–418. http://dx.doi.org/10.1016/j.paid.2010.04.009.

Feshbach, N.D. (1975). Empathy in children: Some theoretical and empirical considerations. *Counseling Psychologist*, 5, 25–30. http://dx.doi.org/10.1177/001100007500500207.

First, M.B., Spitzer, R.L., Gibbon, M., & Williams, J.B. (1997). *Structured clinical interview for DSM-IV axis I disorders (SCID-I)*. New York, NY: New York State Psychiatric Institute.

First, M.B., Spitzer, R.L., Gibbon, M., Williams, J.B., & Benjamin, L. (1994). *Structured clinical interview for DSM-IV axis II personality disorders (SCID-II)*. New York, NY: New York State Psychiatric Institute.

Ghuman, S., Bar, M., Dobbins, I.G., & Schnyer, D.M. (2008). The effects of priming on frontal–temporal communication. *Proceedings of the National Academy of Science*, 105, 8405–8409. http://dx.doi.org/10.1073/pnas.0710674105.

Happé, F.G.E. (1994). An advanced test of theory of mind: Understanding of story characters' thoughts and feelings by able autistic, mentally handicapped, and normal children and adults. *Journal of Autism and Developmental Disorders*, 24, 129–154. http://dx.doi.org/10.1007/BF02172093.

Hare, R.D. (2003). *Manual for the Revised Psychopathy Checklist-Revised* (2nd ed.). Toronto, ON: Multi-Health Systems.

Harpur, T.J., Hakstian, A.R., & Hare, R.D. (1988). Factor structure of the Psychopathy Checklist. *Journal of Consulting and Clinical Psychology*, 56, 741–747. http://dx.doi.org/10.1037/0022-006X.56.5.741.

Hicks, B.M., & Patrick, C.J. (2006). Psychopathy and negative emotionality: Analyses of suppressor effects reveal distinct relations with emotional distress, fearfulness, and anger-hostility. *Journal of Abnormal Psychology*, 115, 276–287. http://dx.doi.org/10.1037/0021-843X.115.2.276.

Hoffman, M.L. (2000). *Empathy and moral development: Implications for caring and justice*. New York, NY: Cambridge University Press.

Hox, J.J. (2010). *Multilevel analysis: Techniques and applications* (2nd ed.). New York, NY: Routlegde.

Jansma, J.M., Ramsey, N.F., Slagter, H.A., & Kahn, R.S. (2001). Functional anatomical correlates of controlled and automatic processing. *Journal of Cognitive Neuroscience*, 13, 730–743. http://dx.doi.org/10.1162/08989290152541403.

Jeyakumar, S.L.E., Warriner, E.M., Raval, V.V., & Ahmad, S.A. (2004). Balancing the need for reliability and time efficiency: Short forms of the Wechsler Adult Intelligence Scale-

III. *Educational and Psychological Measurement*, 64, 71–87. http://dx.doi.org/10.1177/0013164403258407.

Johnson, M.H. (2005). Subcortical face processing. *Nature Reviews Neuroscience*, 6, 766–774. http://dx.doi.org/10.1038/nrn1766.

Lang, S., Klinteberg, B., & Alm, P.O. (2002). Adult psychopathy and violent behavior in males with early neglect and abuse. *Acta Psychiatrica Scandinavica. Supplementum*, 412, 93–100. http://dx.doi.org/10.1034/j.1600-0447.106.s412.20.x.

Levenson, M.R., Kiehl, K.A., & Fitzpatrick, C.M. (1995). Assessing psychopathic attributes in a non-institutionalized population. *Journal of Personality and Social Psychology*, 68, 151–158. http://dx.doi.org/10.1037/0022-3514.68.1.151.

Liddell, B.J., Williams, L.M., Rathjen, J., Shevrin, H., & Gordon, E. (2004). A temporal dissociation of subliminal vs. supraliminal fear perception: An event-related potential study. *Journal of Cognitive Neuroscience*, 16, 479–486. http://dx.doi.org/10.1162/089892904322926809.

Luo, Q., Holroyd, T., Majestic, C., Cheng, X., Schechter, J., & Blair, R.J. (2010). Emotional automaticity is a matter of timing. *The Journal of Neuroscience*, 30, 5825–5829. http://dx.doi.org/10.1523/JNEUROSCI.BC-5668-09.2010.

Moore, M.T., & Fresco, D.M. (2012). Depressive realism: A meta-analytic review. *Clinical Psychology Review*, 32, 496–509. http://dx.doi.org/10.1016/j.cpr.2012.05.004.

Nentjes, L., Meijer, E.H., Bernstein, D.P., Arntz, A., & Medendorp, W.N. (2013). Brief communication: Investigating the relationship between psychopathy and interoceptive awareness. *Journal of Personality Disorders*, 27, 617–624. http://dx.doi.org/10.1521/pedi_2013_27_105.

Pedersen, W.C., Denson, T.F., Goss, R.J., Vasquez, E.A., Kelly, N.J., & Miller, N. (2011). The impact of rumination on aggressive thoughts, feelings, arousal, and behaviour. *British Journal of Social Psychology*, 50, 281–301. http://dx.doi.org/10.1348/014466610X515696.

Petrides, M., & Milner, B. (1982). Deficits on subject-ordered tasks after frontal- and temporal-lobe lesions in man. *Neuropsychologia*, 20, 249–262. http://dx.doi.org/10.1016/0028-3932(82)90100-2.

Pfohl, B., Blum, N., & Zimmerman, M. (1995). *Structured interview for DSM-IV personality: SIDP-IV*. Iowa City, IA: University of Iowa College of Medicine.

Pollak, S.D. (2008). Mechanisms linking early experience and the emergence of emotions: Illustrations from the study of maltreated children. *Current Directions in Psychological Science*, 17, 370–375. http://dx.doi.org/10.1111/j.1467-8721.2008.00608.x.

Premack, D., & Woodruff, G. (1978). Chimpanzee problem-solving: A test for comprehension. *Science*, 202, 532–535. http://dx.doi.org/10.1126/science.705342.

Richell, R.A., Mitchell, D.G., Newman, C., Leonard, A., Baron-Cohen, S., & Blair, R.J. (2003). Theory of mind and psychopathy: Can psychopathic individuals read the 'language of the eyes'? *Neuropsychologia*, 41, 523–526. http://dx.doi.org/10.1016/S0028-3932(02)00175-6.

Rubia, K., Smith, A., & Taylor, E. (2007). Performance of children with attention deficit hyperactivity disorder (ADHD) on a test battery for impulsiveness. *Child Neuropsychology*, 13, 276–304. http://dx.doi.org/10.1080/09297040600770761.

Rusting, C.L. (1998). Personality, mood and cognitive processing of emotional information: Three conceptual frameworks. *Psychological Bulletin*, 124, 165–196. http://dx.doi.org/10.1037/0033-2909.124.2.165.

Smith, P., & Waterman, M. (2004). Role of experience in processing bias for aggressive words in forensic and non-forensic populations. *Aggressive Behavior*, 30, 105–122. http://dx.doi.org/10.1002/ab.20001.

Spielberger, C.D. (1983). *Manual for the State-Trait Inventory STAI (Form Y)*. Palo Alto, CA: Mind Garden.

Stone, V.E., Baron-Cohen, S., Calder, A., Keane, J., & Young, A. (2003). Acquired theory of mind impairments in individuals with bilateral amygdala lesions. *Neuropsychologia*, 41, 209–220. http://dx.doi.org/10.1016/S0028-3932(02)00151-3.

Tabachnick, B.G., & Fidell, L.S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Pearson.

Uzieblo, K., Verschuere, B., van den Bussche, E., & Crombez, G. (2010). The validity of the Psychopathic Personality Inventory-Revised in a community sample. *Assessment*, 17, 334–346. http://dx.doi.org/10.1177/1073191109356544.

Verona, E., Patrick, C.J., & Joiner, T.E. (2001). Psychopathy, antisocial personality disorder, and suicide risk. *Journal of Abnormal Psychology*, 110, 462–470. http://dx.doi.org/10.1037/0021-843X.110.3.462.

Vitale, J.E., Newman, J.P., Serin, R.C., & Bolt, D.M. (2005). Hostile attributions in incarcerated adult male offenders: An exploration of diverse pathways. *Aggressive Behavior*, 31, 99–115. http://dx.doi.org/10.1002/ab.20050.

Wechsler, D. (1997). *WAIS-III administration and scoring manual*. San Antonio, TX: The Psychological Corporation.

Wilkowski, B.M., & Robinson, M.D. (2012). When aggressive individuals see the world more accurately: The case of perceptual sensitivity to subtle facial expressions of anger. *Personality and Social Psychology Bulletin*, 38, 540–543. http://dx.doi.org/10.1177/0146167211430233.

Wilkowski, B.M., Robinson, M.D., & Meier, B.P. (2006). Agreeableness and the prolonged spatial processing of antisocial and prosocial information. *Journal of Research in Personality*, 40, 1152–1168. http://dx.doi.org/10.1016/j.jrp.2005.12.004.