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Attentional bias toward negative and positive pictorial stimuli and its relationship with distorted cognitions, empathy, and moral reasoning among men with intellectual disabilities who have committed crimes

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Abstract

The aims of this study were to examine: (a) whether men with intellectual disabilities who have a history of criminal offending attend to affective pictorial stimuli in a biased manner, and (b) whether there is a relationship between an affective attentional bias and offense-supportive cognitions, empathy, and moral reasoning. Forty-six men with intellectual disabilities who had a documented history of criminal offending, and 51 men who also had intellectual disabilities, but no such history, were recruited and asked to complete a computer-based dot-probe task using affective pictorial stimuli with randomization, along with measures of distorted cognitions, empathy, and moral reasoning. Those with a history of criminal offending endorsed significantly more offense-supportive cognitions, had significantly lower general empathy, and more "mature" moral reasoning, as well as a significant attentional bias toward affective pictorial stimuli. Attentional bias significantly predicted offense-supportive cognitions, and vice versa, having controlled for offense history, and Full-Scale IQ, but this was not the case for empathy or moral reasoning. While the findings require replication, interventions that aim to modify attention bias with this population should be tested.

KEYWORDS

distorted cognitions, empathy, learning disabilities, moral development, neurodevelopmental disorders, offenders

1 | INTRODUCTION

Recently, Garrigan, Adlam, and Langdon (2018) developed a Social Information Procession and Moral Decision Making framework that integrated social information processing and moral development theories in an attempt to help our understanding of behavior exhibited by individuals, inclusive of those experiencing atypical development as a consequence of acquired brain injury, intellectual, or other developmental disability. They reviewed a variety of psychological and social constructs in an attempt to knit together various theories about moral decision-making and behavior, such as working memory (Gibbs, 2013), perspective taking (Baird, 2008; Kohlberg, 1976), attention (Crick & Dodge, 1994), abstract thought and reasoning (Baird, 2008; Piaget, 1932), logical reasoning (Piaget, 1932), schema and scripts (Arsenio & Lemerise, 2004; Hoffman, 2000; Lemerise & Arsenio, 2000), attributions (Gibbs, 2013;

Hoffman, 2000; Lemerise & Arsenio, 2000), affective empathy (Gibbs, 2013; Hoffman, 2000; Kohlberg, 1984), and somatic markers (Baird, 2008; Taber-Thomas & Tranel, 2012).

Garrigan et al. (2018) combined these and other factors together within a six-step framework that has social information processing at its core, but incorporated developmental factors that change over time as a consequence of maturation and developmental experiences, inclusive of socialization and related factors (e.g., socioeconomic status and culture) as well as psychological theories about moral development, social-perspective taking and empathy. The aim of this framework was to attempt to provide an explanation as to how moral decisions are made, while further considering the processes that impact decision-making and develop over time via socialization and maturation. The first step within their framework was labeled the "encoding of cues," which relies upon the allocation of attention and recognition of situational cues, which is affected by the ability to recognize emotions and empathic responsiveness. Attentional ability is considered an important construct related to moral reasoning and development (Gibbs, 2013). Garrigan et al. (2018) hypothesized that shifting attention and related executive functions, as well as attentional bias, will influence what information is encoded within a social situation, thus influencing subsequent affective, cognitive, and behavioral responses within the latter steps within their framework. The remaining steps in the framework are related to those outlined by Crick and Dodge (1994, 1996) and are interpretation of cues, clarification of goals, response access or construction, moral response decision, and behavioral enactment. These latter steps involve processing, which is triggered by the encoding of cues. However, encoding is also impacted by top-down processing as those with a moral developmental delay and/or difficulty with cognitive or affective empathy may encode social information differently. Biased encoding may develop as a consequence of socialization and maturation, inclusive of the maturation of brain regions, which may be different for those who have conditions, which are inherently characterized by atypical development, such as intellectual disabilities (Garrigan et al., 2018).

Attentional bias and its relationship to other psychological constructs and behavior has been investigated within numerous studies, especially with those who have anxiety disorders. Van Bockstaele et al. (2014) reviewed studies examining the role of attentional bias in our understanding of anxiety and fear and concluded that bias is associated with anxiety and fear, and the relationship may be bidirectional. They also noted that changing attentional bias changes fear and anxiety. While the findings have not always been consistent, attentional bias has also been shown to be related to eating disorders (Faunce, 2002), addiction (Field & Cox, 2008), depression (Peckham, McHugh, & Otto, 2010), psychosis (Moritz & Laudan, 2007), and sleep disorders (Harris et al., 2015).

For those with a history of committing crimes, there is evidence that those with antisocial personality disorder have a bias toward violent words (Domes, Mense, Vohs, & Habermeyer, 2013); men and women with either a history of violent or non-violent crimes have an attentional bias toward violent words, with those with the history of violent crime having the most marked bias (Smith & Waterman, 2003), sexual offenders have a bias toward sexual words (Price & Karl Hanson, 2007; Smith & Waterman, 2004), and images (Ciardha & Gormley, 2012); men with a history of perpetrating domestic violence have a bias toward aggressive words (Chan, Raine, & Lee, 2010), and teenage fire-setters have an attentional bias toward fire-related pictures (Gallagher-Duffy, MacKay, Duffy, Sullivan-Thomas, & Peterson-Badali, 2009). Kimonis, Graham, and Cauffman (2018) demonstrated that attention to affective pictures among teenage boys with a history of violent crime was predicted by callous and unemotional or uncaring traits, which was moderated by the severity of aggression, a finding reported in previous studies (Kimonis, Frick, Fazekas, & Loney, 2006; Kimonis, Frick, Munoz, & Aucoin, 2008). Edalati, Walsh, and Kosson (2016) reported that convicted offenders scoring low on a measure of psychopathy had an attentional bias away from affective faces compared to those scoring high, but the difference was not statistically significant; these studies suggest that attention bias may be affected by personality, affect, and other related constructs as outlined by Garrigan et al. (2018).

To further investigate attentional bias among those with a history of criminal offending, and whether such a bias is related to additional psychological constructs, we recruited men with intellectual disabilities who either did or did not have a history of criminal offending. We specifically recruited a sample of men with intellectual disabilities because they are experiencing atypical development and are a markedly vulnerable population. We invited participants to take part in a dot-probe task using affective images to examine attentional bias and to complete questionnaires about empathy, offense-supportive beliefs, and moral reasoning. The aims of this study were twofold: (a) to investigate whether men with intellectual disabilities who have a history of criminal offending attend to affective pictorial stimuli in a biased manner, and (b) whether there is a relationship between an affective attentional bias and offense-supportive cognitions, empathy, and moral reasoning. We specifically hypothesized that (a) men with a history of criminal offenses will attend to affective images more rapidly in comparison to men with no such history, and (b) such attention biases will predict offense-supportive cognitions, empathy, and moral reasoning and vice versa.

2 | METHOD

2.1 | Participants

Forty-six men with intellectual disabilities who had a documented history of criminal offending behavior, and 51 men with intellectual disabilities and no known history of engaging in criminal offending behavior were recruited and invited to take part in this study. Those with a history of criminal offending were recruited from secure inpatient services within eastern England, while those without such a history were recruited from the community. Those with a history of crime were significantly younger, 95% bias-corrected-and-accelerated

TABLE 1 Frequency count of mental and physical health comorbidity among men with intellectual disabilities

Diagnoses	Offending history (n = 46)	No offending history (n = 51)	χ^2	p
Anxiety disorders	11	15	0.29	.59
Depression	9	9	0.09	.77
Autism	9	4	3.01	.08
Attention-deficit-hyperactivity	5	3	0.86	.36
Personality disorders	5*	0	5.98	.01
Schizophrenia	5*	0	5.98	.01
Epilepsy	3	6	0.73	.39
Hypertension	0	5*	4.65	.03
Diabetes	5	3	0.31	.58
Heart problems	3	3	0.02	.87
Asthma	8	4	1.01	.32
Thyroid problems	2	0	1.80	.18
Sensory-related problems	2	3	0.10	.75

*p < .05.

confidence intervals—BC_a CI [−12.98, −2.67], Adj. R^2 = .07, and had a significantly higher Full-Scale IQ, 95% BC_a CI [0.59, 4.40], Adj. R^2 = .05. Data collected about mental and physical health comorbidity are found in Table 1. Those with a history of committing criminal offenses were more likely to have a recorded diagnosis of schizophrenia, $\chi^2(1) = 5.98$, p = .01, or personality disorder $\chi^2(1) = 5.98$, p = .01, while those with no such history were more likely to have difficulties with hypertension,4.65, p = .03.

2.1.1 | Eligibility criteria

Participants were considered eligible to take part in this study if they were (a) a man aged between 18 and 65 years, (b) who had a mild intellectual disability, (c) with the capacity to give or withhold informed consent to take part in this study study, and (d) successfully completed a practice block on the dot-probe task defined as making no more than one error within 10 trials. Participants with a history of offending behaviors were only included if they had a history of committing an indictable offense, rather than a summary offense, or an "either-way" offense (NB: an either-way offense is one which can be heard in either a Magistrate's of Crown Court). This means that the participants included within this study had committed serious offenses that can only be tried by a Crown court within England and Wales. This includes offenses such as those involving violence (e.g., murder, manslaughter, wounding), sexual offenses, burglary, robbery, theft, criminal damage (e.g., arson), drug offenses, and kidnapping, among others. A full breakdown of the most recent indictable offense for the men with intellectual disabilities who had a history of criminal offending is found in Table 2a and was generated through both self-report and checking health records. Participants were excluded if they (a) had a known history of acquired brain injury or a diagnosis of dementia, (b) were a woman, or (c) were unable to speak English. Women were excluded from this study for two reasons: (a) there is some evidence that women and men may score differently on measures of related constructs, such as empathy (Baron-Cohen & Wheelright, 2004); and (b) the population of offenders with intellectual disabilities within secure services in the United Kingdom are predominantly men. The sample of participants in this study have taken part in a previous study (Daniel, Sadek, & Langdon, 2018).

2.2 | Design and procedure

Utilizing a simple between-groups design, participants were initially invited to complete an assessment of their Full-Scale IQ using a two-subtest Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) when no estimate of Full-Scale IQ was available within their records that had been completed within the last 3 years. Where a previous estimate was available, this data was collected. Seventy-three percent of participants completed the WASI. Following this, participants were invited to complete a dot-probe task, following by measures of empathy, distorted cognitions, and moral reasoning that were read aloud. For the measures of empathy and distorted cognitions, which required a forced-choice response, an analogue scale was used to help participants respond.

TABLE 2a The most recent indictable offense for the men with intellectual disabilities who had a known history of engaging in criminal offending behaviors

Offense type	Frequency (%)
Violent offenses	
Manslaughter	1 (2.2)
Murder	2 (4.3)
Attempted murder	1 (2.2)
Wounding or other act endangering life	11 (23.9)
Sexual offenses	
Sexual assault (under 13)	8 (17.4)
Sexual assault (adult)	6 (13.0)
Sexual activity (under 13)	6 (13.0)
Rape	1 (2.2)
Abuse of children through prostitution and pornography	2 (4.3)
Acquisitive offenses	
Burglary	1 (2.2)
Robbery	1 (2.2)
Criminal damage	
Arson	2 (4.3)
Other indictable offense	4 (8.7)

2.2.1 | Measures

Dot-probe task

A dot-probe task using pictorial stimuli was used to examine attentional bias. Following the presentation of a fixation cross on a computer screen, pairs of images were presented followed by the presentation of a dot. Participants were asked to make a timed response by pressing a button to indicate the location of the dot. Pictorial stimuli were chosen for this task as people with intellectual disabilities are likely to have difficulty with reading words. Each single-trial lasted for 11,000 ms and contained (a) a fixation cross presented for 1,000 ms, (b) a fixation cross and two pictures, which were presented directly left and right of the fixation cross for 500 ms, (c) the fixation cross, and a small circle (dot-probe) located either to the left or right of the fixation cross. This remained until a participant made a response, and following this, a new trial started. Pictures were presented side by side to ensure that they were congruent with the orientation of the buttons on the response box.

The main task contained 368 trials (grouped into 8 blocks of 46 trials), and 112 of these trials contained only neutral images (neutral–neutral trial). One hundred and twenty-eight trials were positive affect pictures paired with a neutral image (positive affect–neutral trial), and 128 were negative affect pictures paired with a neutral image (negative affect–neutral trial). Within the trials of positive affect–neutral and negative affect–neutral pairs, there were congruent or incongruent trials; a congruent was one where the affective picture is replaced by the dot-probe, while an incongruent trial was one where the neutral image was replaced by the dot-probe. Neutral–neutral trials are neither congruent nor incongruent.

All participants took part in a short explanation and demonstration of the task with the researcher before taking part in three practice blocks of 10 trials using neutral images that were different from those used within the main task. To progress to the main task, participants had to respond to 9 out of 10 trials correctly in either the first, second, or third practice block. If a participant made two or more errors within a practice block, they completed another practice block. Any participant who did not successfully complete the practice blocks were excluded from the study.

Dot-probe position, position of the affective image, position of the person and object within the picture pair, and congruency of the trial was counterbalanced across the left- and right-side of the computer screen. The order in which trials were presented was randomized.

Stimuli

Twenty-four pictures (eight positive, eight negative, and eight neutral) were chosen from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). The IAPS is a set of over 900 affect-inducing color images that have been standardized for experimental use. Each image has been previously characterized by valence (pleasant to unpleasant) and arousal (calm to excited), as well as control (controlled or uncontrolled; Scherer, Dan, & Flykt, 2006). Positive and negative images were selected for the current study from those which scored within the top or bottom 1.5 points of existing valence ratings, while neutral images were selected from those which scored ±0.35 around the mean valence scale. Positive and negative images were matched on valence and arousal ratings. Dominance ratings were not used in the selection process because of evidence to suggest that they explain a relatively smaller proportion of the variance in the judgments of these stimuli (Coan & Allen, 2007). Considering that some of the participants had a history of sexual offenses, images of children or those of a sexual nature, were excluded. Further, participants had committed offenses against both persons (e.g., wounding) and objects/property (e.g., arson), and therefore images were chosen to ensure that each group (positive, negative, or neutral) of eight pictures contained four pictures of people and four pictures of objects.

Software and hardware

The dot-probe task was programmed using Psychopy v.1.75.01 and presented using PsychoPy v.1.74.00 (Peirce, 2007). The task was presented on Toshiba Satellite Pro C850-1K4 laptop running Microsoft Windows 7 Enterprise Operating System with an Intel Core i3-3120M processor, 2.5 GHz, and 4 GB RAM. The laptop had a 15-inch screen, 1,266 × 768 resolution, 60-Hz refresh rate, and set at maximum brightness. A DirectIN High Speed Button-Box v2012 manufactured by Empirisoft was used to record participant responses and connected to the laptop via a USB port. The box has nine buttons in landscape orientation, and the first and last keys within the row of nine buttons were used by respondents as they are physically separate from the middle buttons. Each key was labeled with a black or white arrow pointing to the left or right, corresponding to the left- or right-side of the computer screen.

2.2.2 | Offense-supportive cognitions

Distorted cognitions, or offense supported cognitions, were measured using the How I Think Questionnaire (HIT; Barriga & Gibbs, 1996; Barriga, Gibbs, Potter, & Liau, 2001) which was adapted for use with adults with intellectual disabilities by Daniel et al. (2018) where it was read to participants. A thorough description of the adaptations can be found elsewhere, where the authors also reported that this measure has excellent internal consistency and good test–retest reliability (Daniel et al., 2018).

2.2.3 | Empathy

The Empathy Quotient (Baron-Cohen & Wheelright, 2004) is a self-report measure of global empathy comprising items that attempt to assess cognitive and affective empathy, as well as social skills. Higher scores indicate greater empathy. The measure has previously been used with men who have intellectual disabilities where the questionnaire was read to participants and discriminates between those with and without a history of criminal offending (Daniel et al., 2018;

Hockley & Langdon, 2015; Langdon & Hockley, 2012). In one study, the internal consistency was reported as $\alpha = .70$ (Daniel et al., 2018).

2.2.4 | Moral reasoning

The Sociomoral Reflection Measure-Short Form (Gibbs, Basinger, & Fuller, 1992) was used to measure moral reasoning. This is a production instrument which has been used with men and women with intellectual disabilities, where it was read to participants, including those with a history of criminal offending (Langdon, Murphy, Clare, & Palmer, 2010; Langdon, Murphy, Clare, Steverson, & Palmer, 2011; McDermott & Langdon, 2016) and it has been shown to possess substantial internal consistent and good test–retest reliability (Langdon, Murphy, et al., 2010). The measure is comprised of 11 questions pertaining to 7 constructs including Contract, Truth, Affiliation, Life, Law, and Legal Justice.

The instrument was administered as a semistructured interview. Higher scores are associated with a more "mature" moral developmental stage. Total scores correspond to the following developmental stages as follows: (a) Stage 1: 100–125, (b) Transition Stage 1(2): 126–149, (c) Transition Stage 2(1): 150–174, (d) Stage 2: 175–225, (e) Transition Stage 2(3): 226–249, (f) Transition Stage 3(2): 250–274, (g) Stage 3: 275–327, (h) Transition Stage 3(4): 326–349, (i) Transition Stage 4(3): 350–374, and (j) Stage 4: 375–400. Stages 1 and 2 are considered "immature" and Stage 1 is associated with decision-making based upon unilateral authority, rules, and avoidance of punishment, while Stage 2 is associated with decision-making that has arisen from social interaction, but is based upon instrumental exchanges (e.g., "if you scratch my back then I'll scratch yours"). Stages 3 and 4 are considered "mature" stages and are increasingly associated with further decentration within decision-making, where constructs such as empathy, care, good conduct, rights, values, character, and society feature within decision-making. Verbatim answers on the Sociomoral Reflection Measure-Short Form were scored, and a second-rater scored 25% of the completed questionnaires; the inter-rater reliability was $r_i = .96$.

2.3 | Data preparation and analysis

Data generated using the dot-probe task were inspected and incorrect responses were removed along with reaction time data that were more than two standard deviations above each participant's mean (i.e., outliers). Considering the number of practice trials needed by participants to meet the criterion necessary to complete the dot-probe task, 2.9% of those with an offense history needed two practice trials, while the remaining required only one trial. For those without a history of offending behavior, 15.6% required two practice trials, while the remaining required one trial. The reaction time data generated during the dot-probe task were used to calculate an attention bias score for positive and negative images, as well as overall. This was done by calculating the mean reaction time for congruent trials (where the dot replaces the affective image), and incongruent trials (where the dot replaces the neutral image) for both positive and negative images. To calculate a bias score, the mean reaction time to congruent trials was subjected from incongruent trials for positive images and then negative images. The sum of mean reaction times to both positive and negative congruent images was subtracted from the sum of mean reaction times to both positive and negative congruent images to calculate a total bias score. A negative score was indicative of a bias away from affective images, while a positive score was indicative of a bias toward affective images.

In terms of statistical analysis, initially, hierarchical linear regression was used to compare those with and without an offending history. Excluding the group comparisons for Full-Scale IQ and age, Full-Scale IQ was entered on the first block to control for general intellectual functioning, and other variables were entered on further blocks, again to control for them, while the variable of interest was always entered on the final block. Bootstrapping with 5,000 samples with replacement was used, and 95% BC_a CIs were calculated; differences were considered statistically significant if the confidence interval did not include zero.

3 | RESULTS

Controlling for Full-Scale IQ, initial comparisons between those with and without a history of criminal offending indicated that those with an offense history endorsed significantly more distorted cognitions, or offense-supportive beliefs, 95% BC_a CI [0.02, 0.39], Adj. $R^2 = .02$, and had significantly lower empathy scores, 95% BC_a CI [−7.73, −0.92], Adj. $R^2 = .08$ (Table 2b). Those with an offense history also had significantly more "mature" moral reasoning, 95% BC_a CI [21.07, 48.65], Adj. $R^2 = .30$, than those without such a history (Table 2b). Those with an offense history scored at Transition Stage 2(3), while those without this history scored at the earlier developmental Stage 2. Both these stages are associated with decision-making based upon instrumental gain (i.e., you help others because they help you). Considering the constructs assessed by the Sociomoral Reflection Measure-Short Form, those with an offense history scored significantly higher on Contract, Truth, Affiliation, Life, Law, and Legal Justice, but not Property, 95% BC_a CI [−1.97, 62.58], Adj. $R^2 = .10$ (Table 2b). Notably, those without an offense history scored at the earlier Transition Stage 2(1) on Law, where decision-making is more likely to be characterized by appealing to unilateral authority, rules, or avoidance of punishment, while those with such a history scored at Transition Stage 2(3), where decision-making is more likely to be based upon instrumental gain.

Turning to consider attentional bias, those with an offense history had a significant bias toward negative images, 95% BC_a CI [0.02, 0.14], Adj. $R^2 = .05$, compared to those with no offending history. Men with an offense history had a significantly smaller attention bias away from positive images than men without this history, 95% BC_a CI [0.002, 0.09], Adj. $R^2 = .02$. When responses to both negative and positive images were combined, men with intellectual disabilities who

TABLE 2b Descriptive data

	Offending history (n = 46)		No offending history (n = 51)						
Measure	*M*	*SD*	*M*	*SD*	*B*	*SE B*	*β*	*t*	95% BC_a CI
Age	33.49	12.67	41.16	13.74	−7.67	2.71	−.28	−2.83	−12.98, −2.67*
Full-Scale IQ	66.20	4.67	60.70	5.13	2.50	1.00	.24	2.50	0.59, 4.40*
Sociomoral Reflection Measure-Short Form									
Contract	242.02	40.68	218.33	36.78	23.76	8.20	.30	2.90	7.94, 40.72*
Truth	243.11	63.60	204.00	60.47	32.41	12.90	.25	2.15	7.55, 58.46*
Affiliation	255.76	56.66	225.00	61.24	29.80	12.53	.25	2.38	4.78, 56.44*
Life	260.33	47.31	218.50	49.18	35.60	9.88	.34	3.60	15.77, 55.44*
Property	215.56	72.94	177.55	75.04	29.04	15.45	.19	1.88	−1.97, 62.58
Law	233.33	89.82	160.20	72.87	62.32	16.89	.35	3.69	27.85, 97.73*
Legal justice	253.26	85.25	179.35	81.36	69.35	17.78	.38	3.90	32.83, 105.71*
Total score	245.17	34.74	205.54	33.81	34.76	6.96	.44	5.00	21.07, 48.65*
How I Think Questionnaire									
Covert	1.96	0.55	1.80	0.46	0.18	0.11	.15	1.47	−0.04, 0.35
Overt	2.07	5.4	1.83	0.50	0.25	0.11	.24	2.33	0.05, 0.45*
Total	2.01	0.52	1.81	0.44	0.20	0.10	.21	1.99	0.02, 0.39*
Empathy Quotient	31.63	8.13	36.65	9.60	−4.29	1.86	−.233	−2.31	−7.73, −0.92*

Note: Group comparisons using data from the Sociomoral Reflection Measure-Short Form, How I Think Questionnaire, and the Empathy Quotient were made controlling for Full-Scale IQ.
Abbreviations: 95% BC_a CI, 95% bias-corrected-and-accelerated confidence intervals; SD, standard deviation; SE, standard error.
*$p < .05$.

had a history of criminal offending had a significant bias toward affective images, 95% BC_a CI [0.02, 0.11], Adj. $R^2 = .05$, compared to men without such a history (Figure 1).

Controlling for Full-Scale IQ and offense history revealed that distorted cognitions significantly predicted attentional bias in men with intellectual disabilities, 95% BC_a CI [0.001, 0.09], Adj. $R^2 = .07$, while offense history remained a significant predictor, 95% BC_a CI [0.01, 0.10], Adj. $R^2 = .07$. Neither empathy, 95% BC_a CI [−0.002, 0.004], Adj. $R^2 = .04$, nor moral reasoning, 95% BC_a CI [−0.001, 0.001], Adj. $R^2 = .04$, significantly predicted attention bias, and again, offense history remained a significant predictor in both regression models (Table 3). Considering whether attentional bias is a significant predictor of distorted cognitions, again while controlling for Full-Scale IQ and offense history, revealed that distorted cognitions predicted attentional bias, having controlled for both Full-Scale IQ and offense history, 95% BC_a CI [0.03, 1.84], Adj. $R^2 = .03$. However, attentional bias did not significantly predict empathy, 95% BC_a CI [−15.60, 19.15], Adj. $R^2 = .09$, or moral reasoning, 95% BC_a CI [−78.38, 74.99], Adj. $R^2 = .31$ (Table 4).

4 | DISCUSSION

The findings from this study indicated that men with intellectual disabilities who have a history of committing crimes have an attentional bias toward negative affective stimuli, while those without this history had an attention bias away from negative affective stimuli. Considering positive images, those with an offense history had a significantly smaller bias away from positive images than those without this history. Combining bias scores to positive and negative images revealed that those with an offense history had a bias toward affective images. These findings are similar to that reported by others using samples of offenders who do not have intellectual disabilities (Chan et al., 2010; Ciardha & Gormley, 2012; Domes et al., 2013; Gallagher-Duffy et al., 2009; Smith & Waterman, 2003, 2004). In addition, and as reported by others, men with intellectual disabilities and a history of offending endorsed more distorted cognitions (Daniel et al., 2018; Langdon & Talbot, 2006; Langdon, Murphy, et al., 2011; Lindsay & Michie, 2004; Lindsay et al., 2006), and reported less general empathy (Hockley & Langdon, 2015; Langdon &

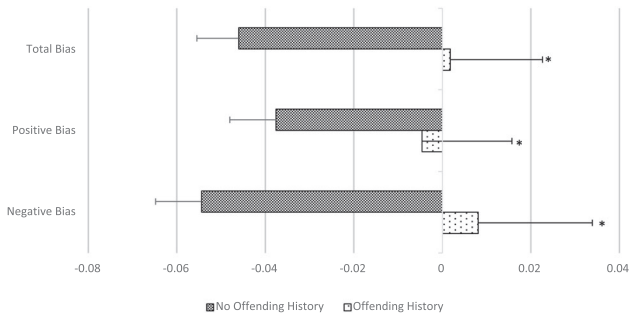

FIGURE 1 Attention bias toward positive and negative pictures for those with and without an offense history

TABLE 3 Distorted cognitions, empathy, and moral reasoning were entered into separate hierarchical regression models to determine whether each predicted attentional bias having controlled for Full-Scale IQ and whether participants did or did not have an offending history

	Attentional bias				
Predictor variable	***B***	***SE B***	***β***	***t***	**95% BC_a CI**
Block 1					
Constant	0.09	0.15		0.58	−0.20, 0.40
Full-Scale IQ	−0.002	0.002	−.080	−0.73	−0.01, 0.003
Block 2					
Constant	1.75	0.15		1.17	−0.11, 0.50
Full-Scale IQ	−0.004	0.002	−.66	−1.486	−0.01, 0.001
Group	0.06	0.02	.271	2.434	0.02, 0.11*
Block 3					
Constant	0.11	0.15		0.70	−0.16, 0.41
Full-Scale IQ	−0.004	0.002	−.172	−1.56	−0.01, 0.001
Group	0.05	0.02	.244	2.19	0.01, 0.10*
Distorted cognitions	0.04	0.02	.181	1.70	0.001, 0.09*
	$F(3, 85) = 3.18$, $p = .03$; Adj. $R^2 = .07$				
Block 3—empathy					
Constant	0.14	0.17		0.83	−0.11, 0.42
Full-Scale IQ	−0.003	0.002	−.157	−1.40	−0.01, 0.001
Group	0.06	0.03	.061	2.48	0.01, 0.12*
Empathy	0.001	0.001	.061	0.55	−0.002, 0.004
	$F(3, 85) = 2.25$, $p = .09$; Adj. $R^2 = .04$				
Block 3—moral reasoning					
Constant	0.18	0.15		1.18	−0.11, 0.52
Full-Scale IQ	−0.003	0.003	−.156	−1.31	−0.01, 0.001
Group	0.06	0.03	.284	2.29	0.02, 0.12*
Moral reasoning	<1	0.00	−.031	−0.240	−0.001, 0.001
	$F(3, 85) = 2.16$, $p = .10$; Adj. $R^2 = .04$				

Abbreviations: 95% BC_a CI, 95% bias-corrected-and-accelerated confidence intervals; SE, standard error.
*$p < .05$.

TABLE 4 Distorted cognitions, empathy, or moral reasoning was predicted using attentional bias having controlled for other variables, including Full-Scale IQ and group within hierarchical regression

Predictor variable	***B***	***SE B***	***β***	***t***	**95% BC_a CI**
Distorted cognitions					
Block 1					
Constant	1.44	0.66		2.19	0.11, 2.72*
Full-Scale IQ	0.01	0.011	.08	0.75	−0.01, 0.03
Block 2					
Constant	1.65	0.67		2.46	0.29, 2.97*
Full-Scale IQ	0.003	0.01	.03	0.30	−0.02, 0.03
Group	0.015	0.11	.15	1.33	−0.07, 0.36
Block 3					
Constant	1.501	0.67		2.25	0.14, 2.85*
Full-Scale IQ	0.001	0.01	.07	0.57	−0.02, 0.03
Group	0.10	0.11	.10	0.86	−0.11, 0.30
Attentional bias	0.83	0.49	.19	1.70	0.03, 1.84*
	$F(3, 85) = 1.76$, $p = .16$; Adj. $R^2 = .03$				
Empathy					
Block 1					
Constant	58.88	12.50		4.71	34.18, 88.26*
Full-Scale IQ	−0.40	0.21	−.21	−1.99	−0.83, −0.03
Block 2					
Constant	53.22	12.71		4.19	28.00, 82.06*
Full-Scale IQ	−0.28	0.21	−.15	−1.33	−0.71, 0.01
Group	−3.80	2.07	−.20	−1.84	−7.80, 0.14
Block 3					
Constant	52.32	12.87		7.07	27.31, 80.18*
Full-Scale IQ	−0.26	−0.004	−.22	−1.22	−0.72, 0.16
Group	−4.10	2.15	−.22	1.91	−8.10, −0.16*
Attentional bias	5.12	9.38	.06	0.55	−15.60, 19.15
	$F(3, 85) = 2.56$, $p = .06$; Adj. $R^2 = .09$				
Moral reasoning					
Block 1					
Constant	7.81	49.40		0.16	−71.77, 89.61
Full-Scale IQ	3.54	0.80	.44	4.45	2.28, 4.76*
Block 2					
Constant	55.82	46.39		1.20	−25.41, 150.85
Full-Scale IQ	2.51	0.77	.31	3.28	1.09, 3.73*
Group	32.22	7.56	.40	4.26	17.22, 48.11*
Block 3					
Constant	57.25	47.04		1.22	−25.59, 152.96]
Full-Scale IQ	2.48	0.78	.31	3.18	1.02, 3.77*
Group	32.71	7.87	.41	4.16	16.70, 49.45*
Attentional bias	−8.18	34.29	−.02	−0.24	−78.38, 74.99
	$F(3, 85) = 13.86$, $p < .000$; Adj. $R^2 = .31$				

Abbreviations: 95% BC_a CI, 95% bias-corrected-and-accelerated confidence intervals; SE, standard error.
*$p < .05$.

Hockley, 2012); however, not all previous studies have reported that men with intellectual disabilities who have a history of committing crimes score lower on measures of empathy (Beail & Proctor, 2004; Langdon, Murphy, et al., 2011; Proctor & Beail, 2007; Ralfs & Beail, 2012) than men without such a history, which is likely related to measurement and sampling.

Further, men with intellectual disabilities who had a history of committing crimes had more "mature" moral reasoning than those without such a history. This finding has been reported in other studies (Langdon, Murphy, et al., 2011; McDermott & Langdon, 2016), and the literature in this area has been previously reviewed (Langdon, Clare, & Murphy, 2010), but the finding is inconsistent with

meta-analytic work showing an inverse relationship between moral development and criminal offending (Van Vugt et al., 2011), where increasingly "mature" moral reasoning is associated with less criminal behavior. This is likely to be associated with the lack of individuals within these studies who present with moral reasoning characterized by the earliest developmental stages, which can be seen within some adults with intellectual disabilities. Wilson and Herrnstein (1985) hypothesized that the relationship between crime and intelligence is curvilinear, and within the current study, while those with a history of committing crimes had more "mature" moral reasoning than those without, both groups had a moral developmental stage that has been associated with criminal offending behavior in samples of adolescents (Blasi, 1983; Gregg, Gibbs, & Basinger, 1994; Nelson, Smith, & Dodd, 1990). Langdon, Clare, and Murphy (2011) previously hypothesized that the relationship between moral development and illegal behavior is curvilinear and this relationship is actually moderated by general intellectual functioning, with those evidencing the highest and lowest moral development stages being the least likely to engage in illegal behavior, while they will also have higher and lower levels of general intellectual functioning. Examining the moral developmental stage of participants across the constructs assessed by the Sociomoral Reflection Measure-Short Form, for those with no history of criminal offending, moral reasoning about the Law was more "immature" and associated with reasoning likely to characterize an earlier stage, and based upon adherence to rules and avoidance of punishment, while this group also had a significantly lower Full-Scale IQ; this may partially explain why these participants did not have a history of criminal offending. This finding has been previously reported (Langdon, Murphy, et al., 2011; McDermott & Langdon, 2016), and Langdon, Clare, et al. (2011) discussed this further where they argued that many people with intellectual disabilities may be at lower risk of committing criminal offenses because they present with "immature" moral reasoning. Further evidence of a curvilinear relationship between crime and intelligence was reported by Mears and Cochran (2013) using a large sample from the National Longitudinal Survey of Youth, and they supposed that moral development may be related to intelligence and further explain this curvilinear relationship.

Both offense history and distorted cognitions predicted attentional bias while offense history was controlled within our regression model. However, neither empathy nor moral reasoning predicted attentional bias while controlling for offense history. Further, attentional bias predicted distorted cognitions, having controlled for offense history, while this was not the case for empathy or moral reasoning. These results are partially consistent with the framework proposed by Garrigan et al. (2018). First, those with a history of engaging in criminal offending behavior had an attentional bias toward affective images when both positive and negative images were combined, increased distorted cognitions, lower empathy and different moral reasoning than those without this history indicating the information processing and moral decision-making of those with an offense history is different than those without such a history. Second, attentional bias was related to distorted cognitions, and distorted cognitions were related to attentional bias, but some of the variance in attentional bias scores remained explained by offense history after distorted cognitions were entered into the regression model. Within the Social Information Processing Moral Decision Making framework (Garrigan et al., 2018), attributions and beliefs within Step 2: the interpretation of cues, are thought to be affected by encoding within Step 1, and vice versa, and our findings appear consistent with this hypothesized relationship.

Third, Garrigan et al. (2018) suggested the encoding of cues within Step 1 of the framework is hypothesized to be affected by empathic responsiveness, but we did not find a relationship between the measure of empathy used and attentional bias, or vice versa, controlling for offense history. A possible reason for this is that the empathy quotient is a measure of cognitive and affective empathy, and associated social skills (Lawrence, Shaw, Baron-Cohen, & David, 2004), but it may not index empathy responsiveness appropriately as other laboratory-based methods where affect is aroused (Robinson, Roberts, Strayer, & Koopman, 2007). As such, the measure of empathy used may be more distally related to the information processing that occurred during the dot-probe task. Fourth, moral judgments within Step 2 are expected to influence encoding within Step 1, and again, vice versa. However, within the current study moral reasoning did not predict attention bias, nor did attention bias predict moral reasoning after controlling for offense history. As a measure of moral reasoning was used to allow participants to be characterized into stages, rather than make moral judgments about the images they were viewing, a relationship may not have been found. As such, the measure of moral reasoning may also index reasoning that is more distal to attentional bias, while distorted cognitions, are more proximal.

There are some strengths and weaknesses associated with the current study. A convenience sample of participants was used within the study, but men with an offense history had a documented history of serious offending that necessitated detention within hospital, indicating that they had substantial conduct-related problems, which is a strength. We did make use of robust eligibility criteria, and as is the case with the dot-probe task, the order of presentation of pairs of images was randomized. Also, the use of pictures, rather than words, has clear advantages for people with intellectual disabilities who are likely to have difficulties with reading rapidly.

Unfortunately, as this is a sample that is difficult to recruit into research studies, our sample size was too small to allow for more complex analysis. As such, our findings are merely correlational, which is a substantial weakness. Further, it may be the case that difficulties with empathy, distorted cognitions, and moral reasoning may vary with offense type and level of intellectual disability. For example, sexual offenders with intellectual disabilities may have more difficulties with empathy in some contexts, but not other contexts (Hockley & Langdon, 2015; Langdon & Hockley, 2012). While there is some evidence that affective empathy may relate to violent crime in teenagers (Jolliffe & Farrington, 2007), there is further evidence that cognitive empathy is more likely related to offending than affective empathy (van Langen, Wissink, van Vugt, Van

der Stouwe, & Stams, 2014). Jolliffe and Farrington (2004) demonstrated that differences in empathy between offenders and non-offenders could be accounted for by intelligence and socioeconomic status. Within this study, we made use of a mixed sample of offenders, which varied according to offense type (e.g., violent offenders and sexual offenders), which may have had an impact upon our findings, and all had intellectual disabilities with likely atypical development within the affective domain.

Finally, considering the finding that men with intellectual disabilities who have a history of criminal offending behavior have an attentional bias that is different from those without such a history, the question as to whether procedures to modify such a bias would help address forensic risk needs to be addressed. While there is evidence that attention bias modification training is associated with a small effect size for symptoms of anxiety (Mogoase, David, & Koster, 2014), such procedures may offer an opportunity for engaging people with intellectual disabilities within psychological therapies who may not be able to take part in traditional talking-based psychological interventions to target criminogenic risk

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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