Facial affect processing in incarcerated violent males: A systematic review

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Abstract

Previous reviews exploring facial affect processing among forensic samples have focused on the presence of psychopathy and/or have not distinguished on the basis of offense type. In order to develop understandings about etiological processes implicated in different types of antisocial behavior, the principle aim of this review was to systematically explore facial affect processing in incarcerated violent offenders, relative to other non-violent offenders, sexual offenders, and non-offenders. Following a systematic search of electronic databases and subsequent manual search, eight studies were assessed as meeting inclusion criteria, of which seven obtained a quality score deemed acceptable for review. These studies examined recognition accuracy, sensitivity and response bias for seven emotion categories (including neutral) in incarcerated male offenders with a history of violence. Findings supported the presence of generally impaired facial affect processing among violent offenders, including deficits in fear, anger, and disgust. Overall the findings of the review did not support the presence of a hostile attribution bias among violent offenders. The review also highlights differences in sample composition, stimuli, and study designs in emotion recognition research. Recommendations are made for future work on facial affect processing in clinically relevant groups.

1. Introduction

Evidence suggests that there are six basic emotions that are universally recognized across cultures: anger, disgust, fear, happiness, sadness and surprise (Ekman, 1972, 1992a, 1992b, 1993; Ekman & Friesen, 1971; Elfenbein & Ambady, 2002). According to Keltner (2003) emotional facial expressions play a pivotal role in the formation and regulation of relationships; they provide information about the emotions and motives of the sender, they provoke a response in the receiver, and they provide motivation for desired social behavior (Keltner, 2003). It is perhaps not surprising, then, that breakdowns in social and emotional responding occur when individuals are impaired in recognising others' facial displays of emotion (Gillespie, Rotshtein, Satherley, Beech & Mitchell, 2015). Indeed, impairments in decoding socio-emotional information, including facial affect, have been observed in a number of clinical conditions including anxiety disorder (Demenescu, Kortekaas, den Boer & Aleman, 2010; Easter et al., 2005), attention-deficit hyperactivity disorder (Rapport, Friedman, Tzelepis & Van Voorhis, 2002; Singh et al., 1998), autism (Gross, 2004), depression (Demenescu et al., 2010; Surguladze et al., 2004) and schizophrenia (Kohler & Brennan, 2004; Trémeau, 2006).

Socio-cognitive impairments have also been observed in antisocial populations, who exhibit difficulties responding to social rules (Gillespie, Rotshtein, Satherley et al., 2015; Loney, Frick, Clements, Ellis & Kerlin, 2003). Blair (2001) postulated that aggressive behavior in antisocial populations may be related to problems in identifying and responding to social cues, particularly distress cues, such as fear and sadness. In particular, it is believed that accurate decoding of distress cues is required for evoking affective responses in the decoder – such as empathy and remorse – that serve to mitigate the likelihood of aggression against the

sender (Blair, 2001; Marsh & Ambady, 2007; Marsh & Blair, 2008). Indeed, in their meta-analysis exploring facial affect recognition in antisocial populations, Marsh and Blair (2008) found that individuals who show instrumental aggression have specific deficits pertaining to the recognition of fearful, sad, and surprised expressions. Moreover, the impairment in fear recognition was significantly worse than impairments for sad and surprised expressions. However, it is important to note that although impairments in recognizing others fear have been reported in relation to instrumentally aggressive populations, these deficits are not necessarily indicative of deficits in the subjective experience of fear (Hoppenbrouwers, Bulten, & Brazil, 2016).

Antisocial behavior, broadly defined, covers all behaviors that violate social norms and the rights of others (Burt, Mikolajewski, & Larson, 2009; Schönenberg, Mayer, Chistian, Louis, & Jusyte, 2015). It includes aggressive, criminal, and externalising behaviors, and abusive conduct (Marsh & Blair, 2008), and incorporates aggressive and forceful contact with a victim (i.e., violent behavior), as well as behaviors that do not involve such contact. Given the breath of this definition, it is perhaps unsurprising that the concept of antisociality appears to consist of at least two distinct and "only modestly correlated" dimensions: an aggressive subtype and a rule-breaking subtype (Burt, 2009; 2012; Burt & Neiderhiser, 2009; Tackett, Krueger, Sawyer, & Graetz, 2003). It is therefore reasonable to propose that there may be fundamentally different cognitive mechanisms mediating these different subtypes of antisocial behavior (Gillespie, Rotshtein, Satherley et al., 2015). Indeed, the relative influence of different etiological factors differs depending on the subtype of antisocial behavior (Leist & Dadds, 2009), and different etiological factors have been found to be implicated in violent and non-violent behavior. For example, risk factors for violence include the presence of violent attitudes and affective instability, whilst these factors are of lesser importance in

predicting non-violent offences. With this in mind, more recent research has explored facial affect recognition deficits associated with specific types of antisocial behavior. This research has provided insight into whether, and indeed how, patterns of socio-cognitive impairment differ between violent and non-violent delinquency.

A vast amount of this research has utilized prison samples, due to the accessibility of individuals demonstrating violent and non-violent antisocial behavior within incarcerated populations. However, methodological variation makes comparisons across studies difficult. For example, some studies have examined violent offenders relative to non-violent offenders and others relative to non-offenders. For studies that make use of the latter design, it is unclear whether the observed impairments are specific to violent behavior or are associated with rule-breaking behavior more generally. Moreover, there is a lack of consistency in methodological design with regard to the inclusion of sexual offenders, with some studies including sexual offenders in their sample of violent offenders, some studying sexual offenders as a separate sample, and others altogether excluding sexual offenders from the sample. Given that a specific set of risk factors is implicated in sexual offending (such as self-regulation difficulties, sexual preoccupation, and deviant sexual preferences; Hanson & Morton-Bourgon, 2005; Mann, Hanson, & Thornton, 2010), it is reasonable to propose that differences could extend to socio-cognitive factors, and thus the inclusion and exclusion of sexual offenders may make comparisons across studies problematic. Indeed, research comparing samples of sexual offenders to other violent or non-violent offenders has indicated differences in facial affect recognition between these different types of offenders (Gery, Miljkovitch, Berthoz, Soussignan, 2009; Gillespie, Rotshtein, Satherley et al., 2015; Hudson et al., 1993).

1.1. Current review

While previous reviews and meta-analyses have explored deficits in emotion recognition in antisocial populations and in relation to psychopathic tendencies (e.g., Dawel, O'Kearmey, McKone, & Palemo, 2012; Marsh & Blair, 2008; Wilson, Juodis, & Porter, 2011), including samples of offenders, such reviews have not analysed results as a function of offending status and/or have not distinguished on the basis of the type of offence. Collapsing across violent and non-violent offenders precludes learning about differences in etiological processes underlying these subtypes of antisocial behavior. A greater understanding of how patterns of socio-cognitive impairment differ among subtypes of offenders could help to inform the development of intervention modules that are tailored to the specific needs of different types of offender. Indeed, if the behavioral dimensions of rule-breaking and violent behavior cannot be meaningfully distinguished in their interpersonal correlates, then delivering the same intervention protocol to individuals would offer both financial and resource benefits to treatment providers.

The present review attempts to facilitate understanding by assessing the literature on facial affect processing in violent offenders as compared to populations of non-violent offenders and/or non-offenders. The review also explores how the study of sexual offenders has affected study outcomes.

1.2. Existing reviews

A scoping exercise to identify the likely volume of studies to be reviewed and any existing reviews was carried out in July 2015. The search was conducted using the Cochrane Library, EMBASE, MEDLINE, PsycINFO and Web of Knowledge. Over 40 reviews of facial

emotion recognition were identified. The majority of these papers reviewed emotion

recognition in neuropsychiatric conditions ($n = 33$); four papers reviewed abilities in

individuals with cognitive impairment (McCade, Savage & Naismith, 2012; Moore, 2001;

Rojahn, Lederer & Tassé, 1995; Zaja & Rojahn, 2008); two reviewed abilities in Borderline

Personality Disorder (BPD) (Domes, Schulze & Herpertz, 2009; Mitchell, Dickens &

Picchioni, 2014); one reviewed alcoholic patients (Fortunata & de Lima Osório, 2014); and

one reviewed abilities in maltreated children (da Silva Ferreira, Crippa & de Lima Osório,

2014). Of particular relevance to the current review were five papers that reviewed facial

affect processing in antisocial populations, and included samples of offenders. Two of these

reviews, of which one was a meta-analysis, looked at facial affect processing in antisocial and

aggressive populations more generally (Marsh & Blair, 2008; Mellentin, Dervisevic,

Stenager, Pilegaard & Kirk, 2015), while three reviews, of which two were meta-analyses,

looked specifically at psychopathic populations (Brook, Brieman, & Kosson, 2013; Dawel et

al., 2012; Wilson, Juodis, & Porter, 2011).

1.2.1.   Reviews exploring facial affect processing in antisocial populations

The meta-analysis of Marsh and Blair (2008) looked at children and adults with antisocial

traits or behaviors and included participants displaying high levels of violence and/or

aggression, of which an unreported proportion was prisoners. They examined the evidence

that individuals with antisocial behavior showed deficits in recognizing each of the six basic

expressions, whether the impairment is greatest for fear, and whether fear deficits are

attributable to task difficulty. The authors carried out a comprehensive search to identify

relevant studies ($n = 20$). Methods included a search of PsycINFO and PubMed, and a search

of reference lists, citation reports, and unpublished manuscripts. The authors concluded that

antisocial populations exhibited significant deficits in recognising fearful, sad, and surprised expressions, and that deficits in recognising fear were significantly greater than other impairments. Moreover, they found that this impairment was not attributable to task difficulty. It remains to be investigated to what extent their conclusions generalize to populations of violent prisoners specifically, who arguably display more severe aggression and exhibit greater antisocial pathology than those continuing to reside in the community (Pascual-Leone, Bierman, Arnold & Stasiak, 2011). Furthermore, Marsh and Blair (2008) analysed samples of children and adults together. However, recent research suggests that the facial emotion recognition abilities of children differ to those of adults (Leime, Rique Neto, Alves & Torro-Alves, 2013), making it difficult to draw conclusions about the relationship of antisocial behavior with emotion recognition in exclusively adult samples. Additionally, Marsh and Blair's meta-analysis, published in 2008, only included studies up to 2005, and many studies have been carried out in the field since then.

Mellentin et al. (2015) carried out a systematic review of 15 studies to explore whether anger-prone and aggressive individuals show an anger bias when perceiving facial expressions in neuropsychological paradigms. Search strategy included the use of EMBASE, PubMed, PsycINFO, and Web of Science, as well as a search of references. The review included community, forensic and clinical samples of children and adults, and the authors found that anger-prone and aggressive individuals showed a bias towards perceiving anger and hostility in facial expressions.

1.2.2. Reviews exploring facial affect processing in psychopathic populations

The meta-analysis of Wilson et al. (2011) examined the validity of two competing hypotheses that had arisen from models of psychopathy: that recognition deficits are related to amygdala

dysfunction (the integrated emotion systems model) and that deficits are related to the verbal processing demands of the task (the left hemisphere activation model). Twenty two studies exploring the relationship between facial affect recognition and psychopathy were reviewed. The papers were identified through searches of PsycINFO, PubMed, Social Work Abstracts, and ProQuest databases, as well as hare.org/references and Google. The review found a small effect size for the relationship of psychopathy with emotion recognition impairments across all six basic emotions, with the largest correlations observed for fear and sadness (r -.10 and r = .12 respectively). The authors concluded that emotion recognition impairments in psychopathy are dynamic, and are dependent on the verbal processing requirements of the response. While the authors found that the association between psychopathy and recognition deficits was not moderated by offending status (i.e., forensic or community samples), it is not clear whether this would hold when looking at specific subtypes of offenders.

The meta-analysis carried out by Dawel et al. (2012) included 26 studies evaluating the association between psychopathy and emotion recognition across visual and auditory modalities (vocal, facial and postural), in forensic, clinical and community samples. Search strategies included the use of PsycINFO, PubMed and Web of Science, and a hand search of reference lists. The authors found that psychopathy was associated with deficits for positive as well as negative emotions across modalities. Specifically, of the six emotion categories explored, deficits were found for fear, happiness and surprise for facial and vocal expressions, and sadness for facial expressions. Moreover, the authors found that, for children, the deficit for fear was greater than the deficit for other emotions. Although this meta-analysis included participants from forensic settings, results were not analysed as a function of offending status and therefore it does not aid understanding of emotion

recognition deficits among violent offenders, and whether or how the pattern of impairment differs from other types of offender.

Finally, Brook et al. (2013) reviewed research on emotion processing to explore whether psychopathy is associated with generalized emotion recognition deficits or deficits in the recognition of particular emotions. The authors searched PsycINFO and PubMed databases and included 58 studies in the review. Of these, eleven studies examining emotion recognition in psychopathic offenders were reviewed separately and revealed mixed evidence for the specificity of emotion recognition deficits in offenders with psychopathic features. Nonetheless, given that the prevalence of psychopathy in prisoners across England and Wales has been found to be approximately 7% to 8% (Coid et al., 2009), findings from samples of psychopathic offenders cannot be reliably generalized to the vast majority of the prison population, and are therefore of limited utility for informing forensic practice more broadly.

1.3. Aims and objectives of the current review

This review aimed to systematically explore research that has examined facial affect processing in violent offenders. Several questions were investigated in relation to this aim:

1. Is there a consistent pattern of facial affect processing seen in violent offenders relative to non-offending control participants?
2. How do the facial affect processing abilities of violent offenders compare to those of non-violent offenders?
3. Do patterns observed differ depending on the inclusion or exclusion of sexual offenders?

2. Method

2.1. Sampling and search procedure

A scoping search was conducted in order to establish the potential volume of publications relating to this topic. A thorough and systematic search was then carried out in order to identify relevant studies. The following search methods were employed:

1.   Search of electronic databases

A comprehensive search of electronic databases was undertaken in order to identify relevant publications. Four bibliographic databases were used:

- Ovid: PsycINFO (1967 to May Week 1 2016)

- Ovid: EMBASE (1974 to May 6th 2016)

- Ovid: MEDLINE (1946 to April Week 4 2016)

- ISI Web of Science (all years to May Week 1 2016)

The Cochrane Library and Google Scholar (all years on 8th May 2016) were also searched in order to identify existing reviews in the area.

A standardized search strategy was applied to search the databases, although modifications had to be made to meet the specific requirements of each database, which therefore introduces some variation. The search was restricted to English language publications. Book chapters, dissertations, editorials, and comment papers were excluded from the review. Grey literature was not included to ensure that only peer reviewed articles were analysed.

Search terms:

(fac* perception OR fac* expressions OR facial affect recognition OR facial affect decoding OR emotion recognition OR emotion categorisation OR emotion processing OR facial affect processing OR emotional displays OR social cognition OR affective processing)

AND

(violen* OR domestic violence OR intimate partner violence OR violent crime OR perpetrators OR criminals OR prisoner OR offender OR incarcerated)

Keywords and exploded search terms were used in order to increase the likelihood of identifying all of the relevant papers.

2. Reference lists of reviews related to emotion in offenders.

3. Reference lists of papers meeting inclusion criteria and their citation reports.

4. Hand-searching journals. Key journals were identified from the electronic database searches and searched for relevant articles. These included: *Journal of Psychiatric Research*; *International Journal of Law and Psychiatry*; *Journal of Aggressive Behavior*; *European Archives of Psychiatry and Clinical Neuroscience*; *Emotion*.

2.2. Study selection

Titles and abstracts for the identified papers were scanned in order to eliminate obviously irrelevant studies. Following removal of duplicates, the remaining studies were made subject to the inclusion/exclusion criteria detailed below (Table 1). These criteria were informed by the initial scoping exercise.

Table 1. Inclusion/exclusion criteria

	Inclusion	**Exclusion**
Population	Incarcerated violent offenders. Index offence or historical offence. Including intimate partner violence (IPV) and sexual violence. Adult males (aged 18 and over).	Clinical samples of violent offenders (i.e., psychiatric patients). Juvenile/adolescent offenders (under 18 years). Samples of 'antisocial offenders' whereby offence not specified or analysis as a function of nature of offending not carried out. Community samples self-reporting violence/ non-convicted individuals. Females.
Intervention	Facial affect processing task using static displays of any combination of the six basic emotions. Pure emotion or morphed developed using validated and normed stimuli.	Other measures of emotional processing not including facial affect e.g., Stroop tasks. Non-static displays. Studies including context e.g., story or affective stimuli other than face e.g., body posture.
Comparator	Non-violent adult male offenders and/or samples of IPV offenders and/or samples of sexual offenders, and/or non-offending controls.	Studies that do not distinguish between violent and non-violent offenders.

Outcome	Accuracy of facial expression categorisation or sensitivity to discriminating emotional expression. Response bias to ambiguous or neutral expressions. Measured via forced-choice or free-response format. Objective criterion for recognition parameter.	Studies that ask participants to infer anything other than emotion from facial affect slides (e.g., thoughts).
Study type	Quasi-experimental	Other

The primary criterion for inclusion in the review was that the study investigated facial processing (recognition accuracy, sensitivity or response/attribution bias) in violent offenders. To ensure that participants' violence sufficiently deviated from behavior deemed as normal or acceptable, samples of incarcerated offenders were chosen as the population. The violent offence could be current or historical. Comparators could include a separate sample of sexual or IPV offenders (when they were not included in the "violent" group), non-violent offenders (such as theft, substance misuse, fraud), or non-offending controls. Given evidence that difficulties in recognising others' facial expressions of emotion are found in neuropsychiatric conditions such as schizophrenia (e.g., Trémeau, 2006) and anxiety disorder (e.g., Demenescu et al., 2010; Easter et al., 2005), among others, studies were excluded if they specifically examined clinical populations, in order to reduce the chance of spurious relationships. Only studies analysing male samples were included due to evidence of sex differences in facial emotion recognition (Robinson et al., 2012). Furthermore, as research has reported differences in emotion recognition abilities between child, adult, and elderly samples (Leime et al., 2013; Sullivan, Ruffman & Hutton, 2007), only adult (18+) populations were studied in order to ensure maturation of socio-cognitive development.

Only studies examining one or more of the six basic emotions of anger, disgust, fear, happiness, sadness, and surprise were considered for review. These emotions were selected for consistency with previous reviews and due to evidence of their being universally recognized (e.g., Ekman & Friesen, 1971; Elfenbein & Ambady, 2002). This meant that it was not considered necessary to limit investigations to those carried out in Western society. Studies had to include a facial affect categorisation task to be included in the review. The stimuli had to be developed from appropriately normed or validated images so as to provide an objective criterion for judgement. As the review was focused solely on the investigation of facial expression of emotion, studies that presented affective stimuli in addition to facial displays (such as postural or vocal information) were excluded due to their providing accompanying emotional information. Similarly, studies utilising contextual information such as stories or simulated scenarios were excluded. Only static facial stimuli were reviewed (including morphed facial stimuli to allow for a measure of emotion recognition sensitivity and/or attribution bias). Finally, only articles from peer-reviewed journals were included to ensure a minimum threshold for quality, and non-English studies were excluded due to an inability to interpret data.

2.3. Data Extraction

Information was extracted from the studies that satisfied the inclusion criteria using a pro forma to ensure systematic recording and reporting of information. Specifically, information relating to population characteristics, methodology, outcome measures and analyses was extracted and provided sufficient information to inform the quality assessment process. Table 2 highlights key information from each study reviewed.

2.4. Quality assessment

The following steps were taken in order to assess the quality of the studies meeting the inclusion criteria:

1. Threshold criteria

   - Clear description of measures of predictor variables
   - Clear description of outcome measures

Studies that did not meet these two criteria would not have been subsequently subjected to the quality assessment form.

2. Quality assessment forms

A quality assessment form comprising 20 questions relating to methodological quality was used. The form allowed study biases relating to selection/sampling, performance, measurement and analysis to be identified and assessed in a structured way. Each item pertaining to these factors was scored on a three-point Likert-scale. This allowed for an overall quality score to be calculated. When the item was not applicable it was omitted. Likewise, when there was unclear or insufficient information that could not be clarified by authors, the item was omitted.

The scoring system was as follows:

Condition not met (N) = 0

Partially met (P) = 1

Condition fully met (Y) = 2

The overall quality score was calculated by adding all the scores together; yielding a maximum quality score of 40 if no items were omitted. Scores were converted into a

percentage to enable clear comparison of quality between the studies. A minimum threshold of 60% quality was set for the study to be included in the review. This was regarded as a reasonable threshold to ensure that only good quality studies were reviewed, whilst ensuring that a sufficient number of studies were reviewed. An independent rater assessed 50% of the studies in order to ensure that assessment scores were reliable. No difference greater than two points was obtained and, in each case, did not affect whether the study met the threshold for inclusion.

Of the eight studies that met the inclusion criteria, seven were assessed as being of high enough quality to include in the review. One study (Hudson et al., 1993) obtained a quality score of 57% and thus was excluded from the review. The quality of the remaining studies reviewed ranged from 65- 78%. Studies obtaining a score of > 70% were considered to be the methodologically stronger studies in the analysis. Figure 1 depicts the process of the study selection and highlights the number of studies retained and excluded at each stage of the process.
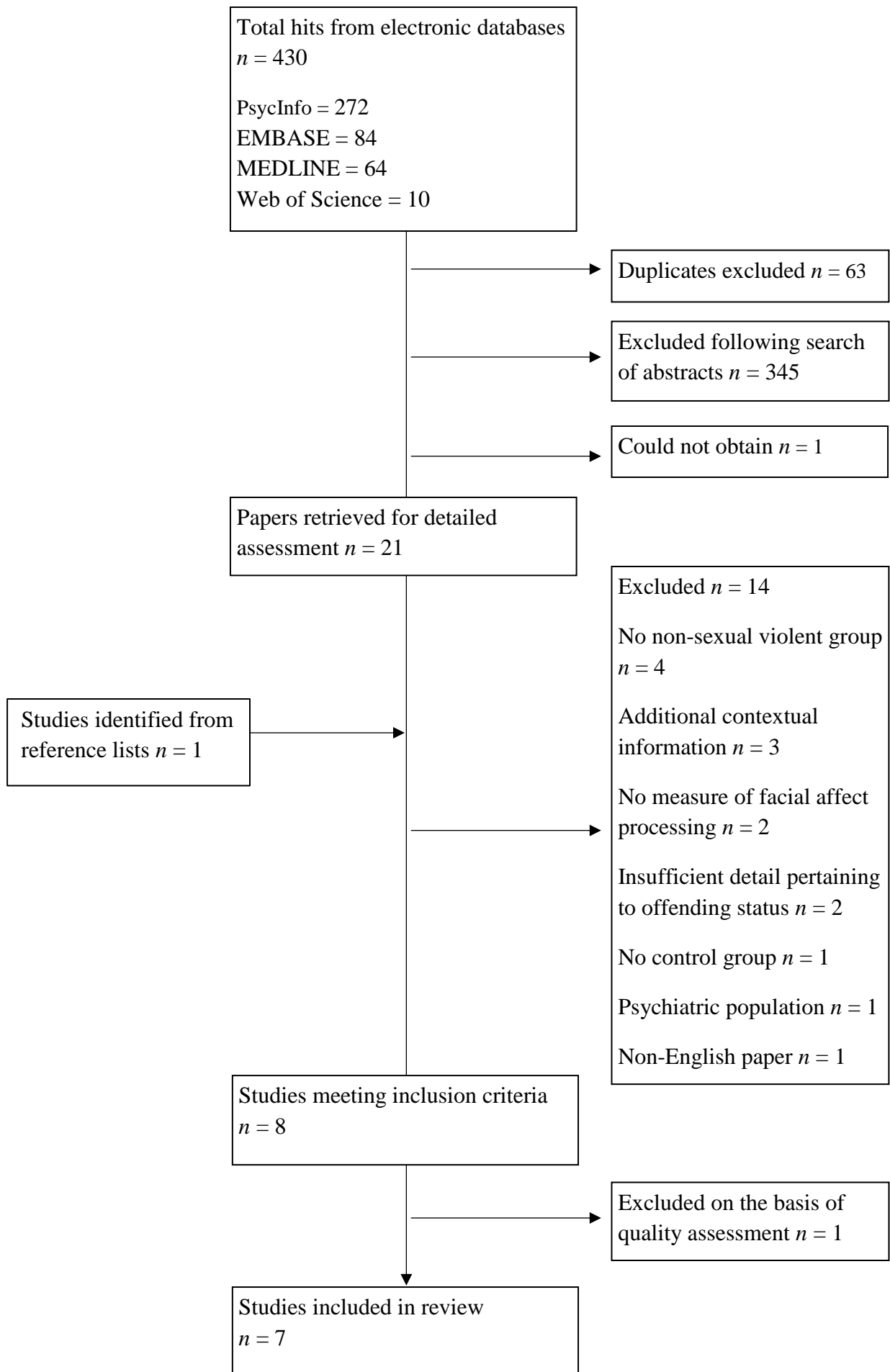
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┌─────────────────────────────────┐
│ Total hits from electronic databases │
│ n = 430                          │
│                                  │
│ PsycInfo = 272                   │
│ EMBASE = 84                      │
│ MEDLINE = 64                     │
│ Web of Science = 10              │
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         ├───▶│ Duplicates excluded n = 63     │
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         │    │ of abstracts n = 345           │
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         ├───▶│ Could not obtain n = 1         │
         │    └──────────────────────────────┘
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┌─────────────────────────────────┐
│ Papers retrieved for detailed   │
│ assessment n = 21               │
└─────────────────────────────────┘
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Total hits from electronic databases
n = 430

PsycInfo = 272
EMBASE = 84
MEDLINE = 64
Web of Science = 10

Duplicates excluded *n* = 63

Excluded following search of abstracts *n* = 345

Could not obtain *n* = 1

Papers retrieved for detailed assessment *n* = 21

Excluded *n* = 14

No non-sexual violent group *n* = 4

Additional contextual information *n* = 3

No measure of facial affect processing *n* = 2

Insufficient detail pertaining to offending status *n* = 2

No control group *n* = 1

Psychiatric population *n* = 1

Non-English paper *n* = 1

Studies identified from reference lists *n* = 1

Studies meeting inclusion criteria *n* = 8

Excluded on the basis of quality assessment *n* = 1

Studies included in review *n* = 7

18

Figure 1. Process of study selection

Table 2. Characteristics of reviewed studies

Study and Quality Score	Participants	Aim(s)	Task Variables and Recognition Parameter(s) Studied	Results
Gillespie, Rotshtein, Satherley, Beech & Mitchell (2015) 65%	Sexual offenders ($n = 13$) and violent non-sex offenders ($n = 16$) recruited from a Therapeutic Community in England UK. Males aged 24-58 years old (mean age of sex offender sample = 50.5, mean age of violent offenders = 37.8). Male non-offending community controls ($n = 19$). Aged 26-67 years old (mean age = 48.2).	To examine emotion recognition accuracy for the six basic emotions among sexual and violent offenders compared with healthy controls.	*Stimuli*: taken from the NimStim Face Stimulus Set (Tottenham et al., 2009). *Gender of models*: five male and five female *Emotions studied*: happy, sad, angry, fear, surprise, disgust, neutral *Intensity of expression*: low intensity (10% expressive, 90% neutral), moderate intensity (55%	*Method of analysis* Sensitivity was calculated as the discriminability index (i.e., the difference between the hit rate and false alarm rate). Response bias was calculated as the criterion (with lower values indicating a more liberal response style). Responses were analysed using a mixed-model ANOVA. Significant interactions were broken down with further ANOVAs. *Sensitivity*

	Matched on: gender $p =$ $p > .20$	To examine the effect of intensity of expression and sex of model on recognition	expressive), and high intensity (90% expressive). *Number of slides*: 180 trials depicting a different stimulus varying in model (10), expression (6) and intensity (3). *Presentation delivery*: randomized *Response format*: face remained on screen until participant chose from seven options (six emotions plus neutral) which emotion was depicted. *Recognition parameters assessed:* sensitivity and response bias	Non-offenders showed greater sensitivity to fearful expressions compared to sexual ($p =$ .007) and violent ($p = .015$) offenders. Non- offenders also showed greater sensitivity to disgust expressions compared to sexual offenders ($p = .009$). The effect of group was non-significant for angry, happy, sad, and surprised expressions (all $p > .20$). There was a significant interaction of group and expression for female faces at a high intensity ($p = .031$). In particular, sexual offenders showed reduced sensitivity to female angry expressions compared to non-offenders ($p =$ .014) and violent offenders ($p = .021$). Non-

				offenders were more sensitive to female expressions of disgust compared with sexual offenders ($p = .005$), and were more sensitive to female expressions of fear compared to both sexual ($p = .029$) and violent ($p = .014$) offenders.
				Response bias
				For moderate intensity male faces, violent offenders showed a more conservative response style for labelling faces as disgust or fear relative to angry, happy or sad (all $p < .01$). For high intensity male faces, violent offenders showed a more conservative response style for fear relative to all other emotions ($p < .01$),

				together with a lower criterion for labelling faces as sad compared to disgust and surprise ($p < .05$).
Hoaken, Allaby & Earle (2007) 70%	20 incarcerated violent* offenders (mean age 34.7) 20 incarcerated non-violent offenders (mean age 32.9) from a medium security institution in Canada. 20 university undergraduates and community controls (mean age 25.2). Matched on: gender	To investigate whether the relationship between executive cognitive functioning and aggression may be due to impairments in the encoding and	*Stimuli*: taken from Ekman's faces of emotional affect (Ekman & Friesen, 1976). *Gender:* not specified *Emotion:* happiness, surprise, sadness, fear, anger, disgust, and neutral *Intensity*: 100% *Number of slides*: 102 *Presentation delivery/response format:* Randomized. Face presented	*Method of analysis* For accuracy, a one-way ANOVA was computed on the number of incorrect responses across all trials. For response bias, a count of the emotions each participant attributed to the neutral face was entered into mixed-model ANOVA to assess for group differences. ANOVAs used for all post-hoc analyses. *Accuracy* The violent group made a greater number of errors than the non-violent or non-offending

*Definition of violent offender based on Harris et al.'s (2002) definition, i.e., any individual who was incarcerated for "any criminal charge for a violent offence against persons- e.g., assault, assault causing bodily harm, wounding, attempted homicide, homicide, kidnapping, forcible confinement, armed robbery and all 'hands-on' sexual offences" (p. 383). Non-violent offenders were those without a history of the above (thus including non-contact sexual offenders)	interpretation levels of social information processing.	for 2000 ms, after which participants had to rate which emotion was depicted from six options (neutral was not an option). *Recognition parameters assessed:* accuracy and response bias	groups ($p <.001$), who did not differ from each other. However, an analysis of errors as a function of emotion was not conducted. *Response bias* The groups differed in how frequently they labelled the face as sadness ($p <.05$) and disgust ($p <.05$). Violent offenders were less likely to interpret a neutral face as "sadness" than were non-offending controls ($p <.05$) and were more likely to interpret it as "disgust" than were non-violent offenders ($p <.05$).

Robinson et al. (2012) 70%	Convicted prisoners in Scotland, recruited as part of an investigation which examined a screening tool for autistic characteristics. 116 prisoners (mean age = 35.6) who either were most likely to have high levels of autistic traits or who evidently did not have high levels, were examined in greater detail. Participants' were categorized taking into consideration previous convictions. Two groups: those who had ever committed violent offences (including sexual offences) and non-violent offences.	To explore whether prisoners show an 'antisocial' pattern of deficits in decoding emotional expressions relative to controls. To examine whether social	*Stimuli:* taken from the Ekman and Friesen stimulus set (1976). *Gender:* not specified but 10 models *Emotions:* happy, sad, anger, fear, surprise and disgust. *Intensity*: 100% *Number of slides*: 60 (one expression per emotion for each model). *Presentation delivery:* randomized. Stimuli shown for five seconds. *Response format:* the names of the six emotions were shown on the screen and participants asked to	*Method of analysis* Mean differences between offender and non-offender groups analysed using *t*-tests. Repeated measures ANOVAs were used to examine recognition accuracy between groups, with the effect of group explored further using one-way ANOVAs. *Accuracy* There was no significant difference in emotion recognition between or within offenders with a violent conviction and offenders without (*p*-value not reported). Prisoners with a sexual index offence were better at recognising sadness (*p* = .046) and

	One participant had dissociative symptoms and one had features suggestive of an organic brain syndrome.\n\nA community control group ($n = 130$, mean age = 37.2).\n\nGroups matched for age, sex and IQ.	cognition is related to markers of antisociality and offence history.	select which best described the expression just shown.\n\n*Recognition parameter assessed:* accuracy	worse at recognising surprise ($p = .006$) in comparison to other prisoners (both violent and non-violent).\n\n*Comparison with non-offending controls*\nPrisoners were significantly less accurate in recognising sadness, anger, fear (all $p < .001$) and disgust ($p < .05$) in comparison with controls.\n\nN.B. Effects held when levels of autistic traits controlled for.
Schönenberg, Christian, Gauber, Mayer,	44 antisocial violent offenders (mean age = 35.32) recruited from a German correctional facility. Excluded offenders charged with intimate partner violence,	To examine facial recognition impairment in antisocial violent	*Stimuli:* digitized colour photographs chosen from the Radboud Faces Database (Langner	*Method of analysis*\nIntensity of emotional expression at time of button press for correct responses analysed using a repeated measures ANCOVA with age

Hautzinger & Jusyte (2014) 75%	sexual assault and drug-related crime (reason not provided). None had a history of schizophrenia or mental retardation. 43 community controls (mean age = 29.34). Matched for education and gender.	offenders with psychopathic personality traits by assessing perceptual sensitivity to emotional expressions.	et al., 2010) based on accuracy of expression. *Gender:* three male models *Emotion:* angry, happy, fearful, sad, surprised, disgusted as well as neutral *Preparation of stimuli:* each emotional expression depicted by every model was morphed with a neutral expression in increments of 2%. This produced 51 intensity levels ranging from 0% (neutral) to 100% (full emotion). *Number of slides:* 72	as covariate. Effect of group followed up using *t*-tests. Repeated-measures ANOVA conducted to examine speed/accuracy trade off using analysis of error rates. *Sensitivity* Violent offenders exhibited significantly impaired recognition of fearful ($p < .01$) and surprised ($p = .01$) expressions relative to non-offending controls, i.e., they required greater emotional intensity to correctly detect the emotional expressions. *Accuracy* There was a significant main effect of emotion only ($p < .001$), with both groups making more

			Delivery: sequence displayed consecutively	errors for fearful, disgusted and surprised expressions.
			Response: participants had to press a button as soon as they were able to identify the emerging expression. The stimulus was then removed and participant had to indicate the emotion that they saw in a multiple choice manner.	
			Recognition parameters assessed: sensitivity and accuracy (the latter to rule out differential speed/accuracy trade-offs)	

Schönenberg & Jusyte (2014) 75%	55 antisocial violent incarcerated offenders, recruited from a German correctional facility (mean age = 33.35). Exclusion criteria were drug-related crime, IPV or sexual assault. All offenders filled the criteria for Antisocial Personality Disorder (ASPD). Four were also diagnosed with major depression and with dysthymia. None had a history of schizophrenia, BPD, or mental retardation. 55 healthy controls (mean age = 30.38) recruited from local vocational schools. Matched for education status and age.	To explore a hostile response bias by assessing response styles to ambiguous facial cues in antisocial violent offenders compared to matched controls.	*Stimuli:* selected from the Radboud Faces Database (Langner et al., 2010). *Gender:* three male models *Emotion:* angry, happy, fearful *Preparation of stimuli*: faces were morphed with each other to create three continuous dimensions (happy-fearful, happy-angry and fearful-angry). Each dimension had five distinct intensity levels containing different amounts of each blended emotion (intensity rations: 90:10, 70:30, 50:50, 30:70, and 10:90).	*Method of analysis* For response bias, a series of 5 (intensity) x 2 (group) x 3 (dimension) repeated measures ANOVAs were conducted. Significant effects on group were followed up with *t*-tests. Independent *t*-tests were computed for intensity ratings for the three dimensions at 50:50 ratio (i.e., most ambiguous expression). *Response bias* A significant effect of intensity emerged for the happy-fearful dimension ($p < .001$), but neither group nor the intensity x group interaction reached significance.

Control participants did not have a history of psychiatric morbidity.		*Number of slides:* 45 *Presentation delivery*: images were repeated four times. Pseudo-randomized across emotions and intensity levels. Presented for 500ms. *Response format:* forced-choice. Open-ended time frame. Participants then rated the intensity level of the emotion identified on a scale ranging from 0 (not at all present) to 10 (full blown emotion). *Recognition parameters assessed:* response bias		For the angry-fearful dimension, violent offenders made significantly more 'angry' responses under conditions of maximal ambiguity (50:50) than did non-offenders ($p < .01$) For the angry- happy dimension, violent offenders responded with 'angry' under conditions of maximal and high ambiguity (50:50 and 30% angry: 70% happy) ($p < .05$). *Perceived intensity ratings* Violent offenders rated the perceived intensity of anger in ambiguous angry-happy and angry-fearful faces significantly higher than non-offenders ($p <. 05$ and $p < .01$, respectively).

				No significant group difference was found for the happy-fearful dimension ($p > .1$).
Schönenberg, Louis, Mayer & Jusyte (2013) 78%	32 prisoners convicted for 'repeated' grievous bodily harm. All met criteria for ASPD. Did not include individuals charged with IPV, sexual offences, or drug-related offences. Exclusion criteria also included offenders with BPD or schizophrenia. 32 controls without a history of offending or psychopathology. Matched on age and education.	To examine identification of threat-related facial expressions in violent offenders with ASPD.	*Stimuli:* digitized colour photographs chosen from the Karolinska Directed Emotional Faces database (Lundqvist, Flykt & Ohman, 1998). *Gender:* two male models. *Emotions:* angry, happy, fearful, neutral *Preparation of stimuli:* morphing procedure used to produce stimuli increasing in intensity by increments of 2%. This produced 51 intensity	*Method of analysis* Intensity of correct detection of emotional expressions at time of button press analysed using a repeated measures ANOVA followed by separately computed *t*-tests to explore significant effects involving group. Additional analysis using error rates were used to examine differential speed/accuracy trade-offs. *Sensitivity* Violent offenders required significantly higher intensity levels to detect angry expressions than did controls ($p = .014$, $n^2 = .10$). There was a

				levels ranging from 0% (neutral) to 100% (full emotion).	trend toward violent offenders requiring higher emotional intensities for identifying fear expressions, although this did not reach statistical significance ($p = .068$).
				Number of slides: Maximum of 2130 (30 sequences of two models depicting three emotions at 51 intensity levels plus five repeated morphs).	Groups did not differ in their sensitivity to happy expressions ($p = .150$).
				Presentation/response format: each image presented for 500 ms, beginning with 0% and progressing successively to 100%. Participants pressed button as soon as they were able to identify the emerging emotion. Sequence then terminated	*Accuracy* Groups did not differ in their recognition accuracy of angry, happy and fearful expressions ($p = .415$).

			and participant required to indicate which emotion they detected (response options provided not specified). *Recognition parameter assessed:* sensitivity and accuracy (the latter to examine differential speed/accuracy trade-offs)	
Seidel, Pfabigan, Keckeis, Wucherer, Jahn, Lamm	30 incarcerated violent offenders (mean age 35.6) and 30 non-offenders (mean age 34.8) matched for age, sex (males), education and intelligence.	To test the three stage model of empathy in violent offenders compared to matched controls	*Stimuli:* colour photographs of Caucasian faces were taken from a standardized stimulus set (Gur et al., 2002). *Gender:* gender-balanced but unknown number of models	*Method of analysis* Accuracy data were analysed using repeated-measures ANOVAs. Significant effects on group were explored using a series of *t*-tests. *Accuracy*

& Derntl (2013) 75%	Most offenders ($n = 22$) had cluster B personality disorders. Some had a history of alcohol ($n = 10$) or drug ($n = 3$) dependence. Their mean PCL-R score was 21.5 (medium to high scorers). The non-offending control group were recruited by advertisements. They had no history of psychiatric illness, neurological illness, or substance abuse in themselves and their first degree relatives.	(i.e., emotion recognition, perspective taking and affective responsiveness).	*Emotions:* happiness, sadness, anger, fear, disgust and neutral. *Intensity:* 100% *Number of slides*: 36 *Presentation/response format:* stimuli were presented for five seconds and remained on screen with six response categories (happiness, sadness, anger, fear, disgust and neutral) until a response was given. *Recognition parameter assessed:* accuracy	There were no significant differences for accuracy when the violent group was divided up into sexually-violent offenders and non-sexually violent offenders ($p > .177$). A significant effect of group was found ($p = .026$) with offenders impaired relative to non-offending controls. A significant emotion by group interaction was found ($p = .049$). Post-hoc tests revealed that controls outperformed offenders for disgust only ($p = .001$). There were no significant differences between groups for all other emotions ($p > .164$).

Note: The samples reported in Schönenberg et al. (2014), Schönenberg and Jusyte (2014), and Schönenberg et al. (2013) did not overlap

3. Results

3.1. Sample characterisation

3.1.1. Operationalizing violence

Violent offenders were operationalized and compared in the following ways across the seven studies reviewed:

1. Violent offenders (including sex offenders) compared to non-violent offenders and non-offenders (Hoaken et al., 2007; Robinson et al., 2012)

2. Violent offenders (including sex offenders) compared to non-offenders (Seidel et al., 2013)

3. Violent offenders (excluding sex offenders) compared to non-offenders (Schönenberg et al., 2013; Schönenberg, Christian et al., 2014; Schönenberg & Jusyte, 2014).

4. Violent offenders compared to sexually-violent offenders and non-offenders (Gillespie, Rotshtein, Satherley et al., 2015).

3.1.2. Defining violent offender

In the majority of studies, offenders were classified into relevant participant groups (i.e., violent or non-violent) on the basis of the nature of their index offence. However, two studies looked at previous convictions in assigning participants to offender groups (Hoaken et al., 2007; Robinson et al., 2012).

Hoaken et al. (2007) categorized participants into groups based on the Harris et al. (2002) definition of a violent offence (see Table 2). Other studies did not specify how violence was defined, although Gillespie, Rotshtein, Satherley et al. (2015) provided examples of some

violent offences included (murder and wounding with intent to do grievous bodily harm) and Schönenberg, Christian et al. (2014) and Schönenberg and Jusyte (2014) specified offences that were excluded (reported below). Finally, Schönenberg et al. (2013) specifically sampled violent offenders who had committed 'repeated' grievous bodily harm.

3.1.3. Control groups and sample characteristics

All seven studies compared violent offenders to a non-offending control group. These were recruited from the community, including undergraduate students (Hoaken et al., 2007). Three studies matched experimental and control groups for age and education level (Schönenberg et al., 2013; Schönenberg, Christian et al., 2014; Schönenberg & Jusyte, 2014), one study matched groups on age and intelligence (Robinson et al., 2012), and another also matched on education (Seidel et al., 2013). Two studies did not match groups on these variables (Gillespie, Rotshtein, Satherley et al., 2015; Hoaken et al., 2007). All studies compared male samples in analyses. Sample sizes of violent offenders ranged from 16 (Gillespie, Rotshtein, Satherley et al., 2015) to 87 (Robinson et al., 2012), with ages of offenders ranging from 18 to 62.

Studies varied in the sampling of psychiatric diagnoses. Schönenberg, Christian et al. (2014) only sampled offenders with 'psychopathic tendencies'. In the violent sample of Schönenberg et al. (2013) and Schönenberg and Jusyte (2014), all participants filled criteria for Antisocial Personality Disorder (ASPD). In the former sample, two men also met the criteria for historical major depressive disorder, while in the latter sample, four men were diagnosed with major depression and two met criteria for dysthymia. None had a history of schizophrenia (Schönenberg et al., 2013; Schönenberg, Christian et al. 2014; Schönenberg & Jusyte, 2014), mental retardation (Schönenberg, Christian et al. 2014; Schönenberg & Jusyte, 2014), or

BPD (Schönenberg et al. 2013; Schönenberg & Jusyte, 2014). In the offender sample of Seidel et al. (2013), 13 participants had a history of alcohol/drug dependence and 22 were diagnosed with Cluster B personality disorders. In addition, the sample scored medium-high on the PCL-R (mean = 21.5). In the offender sample of Robinson et al. (2012), one participant had dissociative symptoms and one had features suggestive of an organic brain syndrome.

In terms of control groups, the samples of Schönenberg et al. (2013) and Schönenberg and Jusyte (2014) had no current or historical psychiatric morbidity, and the sample of Seidel et al. (2013) did not have a history of psychiatric/neurological illness or substance abuse. Neither Gillespie, Rotshtein, Satherley et al.'s (2015) nor Hoaken et al.'s (2007) studies contained information pertaining to psychological disorders in either experimental or control samples.

3.1.4. Exclusion criteria

Three studies excluded from their group of violent offenders individuals charged with domestic violence, sexual assault or drug-related crime (Schönenberg et al., 2013; Schönenberg, Christian et al., 2014; Schönenberg & Jusyte, 2014), as well as individuals with inadequate knowledge of the German language (Schönenberg, Christian et al., 2014; Schönenberg & Jusyte, 2014). Another study excluded prisoners with an IQ less than 70 and/or those scoring above the diagnostic cut off for Autistic Spectrum Disorders (Robinson et al., 2012). Finally, one study excluded those who were denying their offence or appealing their conviction (Hoaken et al., 2007).

3.2. Task characterisation

Two studies (Hoaken et al., 2007; Robinson et al., 2012) used the Pictures of Facial Affect stimulus set (Ekman & Friesen, 1976), two studies (Schönenberg, Christian et al., 2014; Schönenberg & Jusyte, 2014) used stimuli from the Radboud Faces Database (Langner et al., 2010), one study (Schönenberg et al., 2013) selected stimuli from the Karolinska Directed Emotional Faces database (Lundqvist et al., 1998), one study (Gillespie, Rotshtein, Satherley et al., 2015) used stimuli from NimStim Face Stimulus Set (Tottenham et al., 2009), and one study (Seidel et al., 2013) used a stimulus set developed and validated by Gur et al. (2002). Three of these studies used male models only (Schönenberg et al., 2013; Schönenberg, Christian et al., 2014; Schönenberg & Jusyte, 2014) and two did not specify the gender of the models (Hoaken et al., 2007; Robinson et al., 2012).

Two studies investigated the six basic emotions plus a neutral expression (Hoaken et al., 2007; Schönenberg, Christian et al., 2014), two studies investigated the six basic emotions (Gillespie, Rotshtein, Satherley et al., 2015; Robinson et al., 2012), one study investigated five emotions (excluding surprise) plus a neutral expression (Seidel et al., 2013), and two studies investigated anger, happiness and fear (Schönenberg et al., 2013; Schönenberg & Jusyte, 2014).

All stimuli were presented supraliminary. Three studies displayed the stimulus for a limited duration (Hoaken et al., 2007; Robinson et al., 2012; Schönenberg et al., 2013; Schönenberg & Jusyte, 2014). For the remaining studies, the stimulus remained on screen until the participant was either ready to make (Schönenberg, Christian et al., 2014) or made a response (Gillespie, Rotshtein, Satherley et al., 2015; Seidel et al., 2013). Six studies used a forced-choice response format with an open-ended time frame. The response format of Schönenberg et al. (2013) is not clear.

3.3. Outcomes measured

Facial affect processing was measured using three parameters:

1. *Accuracy* - measured by the number of correct responses ("hits") to emotional
   expressions (assessed by Hoaken et al., 2007; Robinson et al., 2012; Seidel et al.,
   2013).

2. *Sensitivity* to emotional expression - including both perceptual sensitivity (assessed by
   using morphing techniques to create emotional expressions of various intensities;
   Schönenberg et al., 2013; Schönenberg, Christian et al., 2014) and discriminability
   index, also known as '*d'* (assessed by Gillespie, Rotshtein, Satherley et al., 2015 as
   the difference between the normalized hit rate and false alarm rate for a given
   expression).

3. *Response bias* - measured by responses made to ambiguous expressions (created
   using morphing techniques; Schönenberg & Jusyte, 2014) or when forced to attribute
   emotion to a neutral expression (Hoaken et al., 2007). Response bias was also
   measured using a measure of criterion to assess the extent to which a conservative or
   liberal response style was adopted when labelling emotional faces (Gillespie,
   Rotshtein, Satherley et al., 2015).

3.4. Outcomes of systematic review

The results of the reviewed studies were examined to identify if there is a consistent pattern
of impairment in facial affect processing associated with violent offending, and whether this
is distinguishable from that of non-violent offenders. The results are reported as a function of
recognition parameter in answering the review questions.

3.4.1. Is there a consistent pattern of facial affect processing seen in violent offenders relative to non-offending control participants?

3.4.1.1. Accuracy

Seidel et al. (2013) found that violent offenders showed deficits in the recognition of disgust expressions only. However, it is noted that this study did not examine recognition for surprise expressions. Robinson et al. (2012) found that violent offenders were significantly less accurate in recognising sadness, anger, fear and disgust in comparison to non-offenders, and Hoaken et al. (2007) found that, overall, violent offenders made significantly more errors than did the non-offenders. However, an analysis of between group differences across the six emotions was not conducted.

3.4.1.2. Sensitivity

Gillespie, Rotshtein, Satherley et al. (2015) found that violent offenders were significantly less sensitive to discriminating fearful expressions compared to non-offenders. Moreover, the violent offenders were significantly less sensitive to female fearful expressions at high intensities compared to non-offenders. Finally, sexually-violent offenders showed significantly reduced sensitivity to disgust expressions, and to female angry and disgust expressions at high intensities, relative to non-offenders (Gillespie, Rotshtein, Satherley et al., 2015).

Using male models only, Schönenberg et al. (2013) found that a sample of non-sexually violent offenders required significantly higher levels of intensity to detect anger in comparison to non-offenders, and there was a trend toward the same for the identification of fear expressions. The two groups did not differ in their sensitivity to happy expressions.

Using a similar sample and procedure but examining sensitivity to six emotion categories, Schönenberg, Christian et al. (2014) found that violent offenders showed significantly impaired sensitivity to fearful and surprised expressions compared to non-offenders.

3.4.1.3. Response bias

Hoaken et al. (2007) found that violent offenders (including sexual offenders) were significantly less likely to interpret a neutral face as sad compared to non-offenders. Schönenberg and Jusyte (2014) found that violent offenders made significantly more 'angry' responses to ambiguous displays containing anger in comparison to controls. Specifically, violent offenders were more likely to interpret anger under conditions of maximal ambiguity (50:50) for an angry-fearful dimension, and under all conditions of ambiguity for an angry-happy dimension (50:50 and 30:70). Furthermore, the violent offenders rated the perceived intensity of anger in these two dimensions significantly greater than did non-offending controls. No significant difference was found between groups for a happy-fearful dimension.

Analyses of the Criterion index, or how conservative participants were in labelling faces as a particular emotion, by Gillespie, Rotshtein, Satherley et al. (2015) showed that, for moderate intensity male faces, violent offenders were more conservative in labelling faces as disgust or fear relative to angry, happy, or sad. For high intensity male faces, violent offenders showed a higher criterion for labelling fear relative to all other emotions, but were more liberal when labelling faces as sad compared with disgust and surprise. The same interaction between emotion, sex and intensity of expression was not observed for either non-offenders or sex offenders.

3.4.2. How do the facial affect processing abilities of violent offenders compare to those of non-violent offenders?

3.4.2.1. Accuracy

Hoaken et al. (2007) found that, overall, violent offenders (inclusive of sex offenders) made significantly more errors than did non-violent offenders. However, the authors did not analyse the number of errors as a function of the expressed emotion. In contrast, Robinson et al. (2012) did not find a significant difference in emotion recognition accuracy between offenders with a violent conviction (including sexual) and those without.

3.4.2.2. Sensitivity

None of the studies reviewed compared sensitivity between violent offenders and non-violent offenders.

3.4.2.3. Response bias

The only study to look at response bias among samples of violent and non-violent offenders found that violent offenders (including sexual offenders) were more likely to interpret a neutral face as disgust relative to non-violent offenders (Hoaken et al., 2007).

3.4.3. Do patterns observed differ depending on the inclusion or exclusion of sexual offenders?

3.4.3.1. Studies that included sex offenders in the violent offender sample

One study found that the violent/sexually-violent group was less accurate at recognising disgust compared to non-offenders (Seidel et al., 2013), while another found deficits in disgust, sadness, anger and fear in violent/sexually-violent offenders compared to non-

offenders (Robinson et al., 2012). Robinson et al. (2012) did not find any differences between the mixed violent offender group and the non-violent offenders. However, a third study found that, overall, the violent/sexually-violent group made a greater number of errors than both a non-violent and a non-offending group, but did not analyse results by emotion (Hoaken et al., 2007). Furthermore, Hoaken et al. (2007) found that the violent/sexually-violent offenders were more likely to interpret a neutral face as 'disgust' relative to non-violent offenders, and were less likely to interpret a neutral face as 'sadness' relative to non-offenders. It is noted that, in this latter study, an individual who had committed a non-contact sexual offence was analysed as a non-violent offender. Thus, the non-violent sample also included non-contact sex offenders.

3.4.3.2. Studies that excluded sex offenders from their sample of violent offenders

Three studies excluded sex offenders from their sample of violent offenders (as well as excluding IPV offenders and offenders with a history of drug-related crime) and examined comparisons with non-offenders. Schönenberg et al. (2013) and Schönenberg, Christian et al. (2014) found that violent offenders were less sensitive to recognising angry (Schönenberg et al., 2013) and fearful and surprised expressions (Schönenberg, Christian et al. 2014), that is, they required greater emotional intensity to correctly detect the expression. Schönenberg and Jusyte (2014) found that the violent offenders made significantly more 'angry' responses to 50:50 angry-fearful faces than did non-offenders. Likewise, the offenders made more angry responses to 30% angry: 70% happy and 50: 50 than did non-offenders. As none of these studies compared violent offenders to a sample of non-violent offenders, it is not clear to what extent the findings are related to antisocial pathology as opposed to violent behavior more specifically.

Overall, both types of sampling method revealed different patterns of facial affect processing in the violent sample relative to non-offending controls. The absence of studies comparing violent non-sex offenders to non-violent offenders means that it is not possible to review whether differences in sampling method affected whether deficits were observed relative to non-violent offenders. Although tentative, there is some indication that deficits in the processing of disgust expressions are only found when the violent sample includes sex offenders.

3.4.3.3. Studies that analysed sex offenders separately

Two studies compared sex offenders to violent non-sex offenders. Gillespie, Rotshtein, Satherley et al. (2015) compared sex offenders to violent non-sex offenders and non-offenders. They found that both groups of offenders were less sensitive to recognising fear compared to non-offenders, and that sex offenders were less sensitive to recognising disgust compared to non-offenders. Gillespie, Rotshtein, Satherley et al. (2015) also found that emotion processing abilities may be dependent on the sex and the intensity of the emotional expression. Specifically, sex offenders and violent offenders were less sensitive to female fearful expressions at high intensities compared to non-offenders. Sex offenders were also less sensitive to high intensity female angry expressions compared to violent offenders and non-offenders, and less sensitive to high intensity female faces depicting disgust relative to non-offenders. For moderate intensity male faces, violent offenders showed a more conservative response style for fear compared with other emotions.

In examining recognition accuracy, Seidel et al. (2013) did not find a difference between sexually-violent offenders and violent non-sex offenders across the five emotions studied (anger, disgust, fear, happiness and sadness).

4.   Discussion

This review set out to explore impairments in facial affect processing among violent offenders, and to examine whether the pattern of performance differs from that of non-violent offenders and non-offenders. We also looked at whether the inclusion or exclusion of sexually-violent offenders affected the pattern of results observed in the violent sample. In total we reviewed seven published articles of facial affect processing in violent offenders. Each of these studies reported some form of recognition impairment among violent offenders relative to non-offenders. While these impairments were limited to negative emotional expressions, the particular emotion/s that impairments were observed for varied between studies. Overall, the studies reviewed varied widely in the combination of comparator and outcome variables used, making it difficult to examine trends across the various studies. Further still, the studies varied in their sampling of psychiatric diagnoses, their matching of groups on demographic variables, and the stimulus set employed. With this in mind, the aggregation of these data provides only a coarse estimate of recognition deficits. Below we recap briefly on the pattern of results observed across these studies.

4.1. Comparisons of violent offenders and non-offenders

When comparing accuracy and sensitivity among violent offenders and non-offenders the evidence suggests that violent offenders were less able to recognize negative emotions relative to non-offenders. Difficulties in emotion recognition were observed across different stimulus sets, duration of stimulus presentation, and response format (that is, including or excluding a neutral option). Furthermore, deficits for accuracy were found in a sample containing medium-high scorers on psychopathy, in which 72% had cluster B personality

disorders (Seidel et al., 2013), as well as in samples where no such pathology was reported (Hoaken et al., 2007; Robinson et al., 2012). The impairments that were most consistently reported were reduced accuracy for disgust (Robinson et al., 2012; Seidel et al., 2013), and reduced sensitivity to fear (Gillespie, Rotshtein, Satherley et al., 2015; Schönenberg et al., 2013; Schönenberg, Christian et al., 2014). The observation of impairments for disgust was noteworthy given research showing specific deficits in disgust recognition in a sample of psychopathic inmates (Kosson, Suchy, Mayer & Libby, 2002).

Although error rates were similar among violent offenders in comparison to non-offending controls in two studies that excluded sex offenders from the violent offender sample (Schönenberg et al., 2013; Schönenberg, Christian et al., 2014), in both of these studies violent offenders required a greater intensity of emotional expression information in order to make accurate judgements. Thus, violent offenders in these two studies demonstrated reduced sensitivity to emotional expressions. Two separate studies of violent non-sex offenders (Gillespie, Rotshtein, Satherley et al., 2015; Schönenberg, Christian et al., 2014) suggested that violent offenders show impaired sensitivity for fearful expressions in particular compared with non-offenders. A similar trend was also reported by Schönenberg et al., (2013). These findings are consistent with the meta-analysis of Marsh and Blair (2008) that found deficits in fear recognition among antisocial populations.

There was contrasting evidence as to whether violent offenders show a hostile attribution bias (Hoaken et al., 2007; Schönenberg & Jusyte, 2014), providing limited support for theories of aggression that cite a tendency to attribute hostile intentions to others (Crick & Dodge, 1996; Dodge, Price, Bachorowski & Newman, 1990; Mellentin et al., 2015). Although there was some evidence that violent offenders are less likely to interpret fear in morphed or ambiguous

facial displays (Gillespie, Rotshtein, Satherley et al., 2015; Schönenberg & Jusyte, 2013), overall the findings raise questions about the consistency with which consistent biases are observed among violent offenders. Future research should focus on the conditions under which these biases may be observed in carefully selected samples that are well characterized in terms of psychopathology.

4.2. Comparisons of offenders with and without a history of violence

Of two studies that compared violent offenders to non-violent offenders (Hoaken et al., 2007; Robinson et al., 2012), one found that, overall, violent offenders generally made more errors (Hoaken et al., 2007). However, differences in sample composition were noted, with Hoaken et al. (2007) including sexually-violent offenders in the violent offender sample. None of the studies reviewed here examined sensitivity between violent and non-violent offenders, while only one study looked at response bias and found that violent offenders were more likely to interpret a neutral face as disgust (Hoaken et al., 2007).

4.3. How does the study of sex offenders affect patterns of performance observed in violent offenders?

Due to considerable variability in comparison groups and outcome measures employed, it is difficult to draw conclusions as to whether the inclusion or exclusion of sex offenders in violent offender samples affects the observed pattern of results. More specific deficits in accuracy for disgust were consistently reported in samples that included sexual offenders (Robinson et al., 2012; Seidel et al., 2013), although reduced sensitivity to fear was consistently reported for violent offender samples that excluded sexual offenders (Gillespie, Rotshtein, Satherley et al., 2015; Schönenberg, Christian et al., 2014).

The most informative studies in answering this question are those that compared sexual offenders and violent non-sex offenders to non-offending controls. Using this design, one study found that sexual offenders showed more pervasive deficits in comparison to violent non-sex offenders (Gillespie, Rotshtein, Satherley et al., 2015). Specifically, both sexually-violent and violent non-sex offenders were less sensitive to fearful expressions compared to non-offenders, whilst sexual offenders also showed reduced sensitivity to disgust relative to non-offenders, and to female anger expressions at high intensities relative to both non-offenders and violent offenders. Overall, the findings of this review suggest that both sexual and violent offenders show impaired facial affect recognition, and that any differences between these groups are likely to be subtle.

4.4. General discussion

At present, a lack of understanding about the mechanisms underpinning emotion recognition impairments in relation to violent and sexually-violent offending precludes understandings about whether, and indeed why, deficits may be associated with particular forms of offending. As suggested by Gillespie, Rotshtein, Satherley et al. (2015), it is possible that differences in social cognition relate to differences in personality characteristics. Indeed, a wide body of literature has demonstrated a link between personality variables and emotion processing; including psychopathic traits (Dawel et al., 2012; Wilson et al., 2011), borderline features (Bland, Williams, Scharer & Manning, 2004; Daros, Zakzanis & Ruocco, 2013; Domes et al., 2009; Dyck et al., 2009; Lynch et al., 2006), depression (Brotman et al., 2004; Demenescu et al., 2010) and anxiety (Buckner, Maner & Schmidt, 2010; Easter et al., 2005). The extent to which these traits are characteristic of different types of offender may help to account for the pattern of emotion recognition impairments observed. For example, sex

offenders with child victims have been found to have high levels of social phobia in comparison to other groups of offenders (McElroy et al., 1999; Raymond, Coleman, Ohlerking, Christenson & Miner, 1999), while high levels of depression and borderline traits have been observed among groups of IPV perpetrators (Holtzworth-Munroe, Meehan, Herron, Rehman, & Stuart 2000; Maiuro, Cahn, Vitaliano, Wagner and Zegree, 1988; Ruiz-Hernández, García-Jiménez, Llor-Esteban & Godoy-Fernández, 2015). Such findings provide a basis upon which to explore how the personality profiles of different types of offenders are related to social-cognitive abilities.

The finding that violent offenders show generally impaired recognition of emotional expressions is consistent with the findings from meta-analyses of emotion recognition impairments in psychopathy (Dawel et al., 2012; Wilson et al., 2011). In their meta-analysis Dawel et al. (2012) concluded that psychopathy-related impairments in emotion recognition were pervasive across different emotions, and also across modalities (e.g., vocal tones). Recent evidence suggests that psychopathic traits are associated with differences in the allocation of attention to emotionally-salient aspects of the face in both developmental (Dadds, El Masry, Wimalaweera & Guastella, 2008) and adult samples of violent offenders (Gillespie, Rotshtein, Beech, & Mitchell, 2017) and non-offenders (Gillespie, Rotshtein, Wells, Beech & Mitchell, 2015). Consistent with this, instructing children with callous-unemotional traits to look at the eye region of facial displays temporarily improves emotion recognition impairments (Dadds et al., 2006).

A better understanding of how attention and emotion interact among offender groups may have implications for improving emotion recognition among violent offenders. A recent study showed that a training approach encouraging juvenile offenders to attend to the salient

features of happy, sad, angry and fear expressions was successful in improving recognition of these particular expressions (Hubble et al., 2015). However, improvements did not generalize to the recognition of disgust, a non-trained emotion. Relative to treatment as usual, juveniles who undertook this training showed a significant reduction in the severity of offending behavior over the following six months (Hubble et al., 2015). Similar results have also been reported following emotion recognition training in a developmental sample referred for emotional/behavioral problems (Dadds et al., 2012). However, it remains unclear how such improvements are attained (Hubble et al., 2015).

4.5. Limitations

Although this review highlights consistent findings of impaired recognition of others emotional expressions among violent offenders, the studies included in the review varied widely in terms of methodology and sample characteristics. In this section we will discuss the importance of these methodological differences, and propose a research agenda for future studies of emotion recognition in forensic and clinical samples.

The first limiting factor in comparing across the studies was variability in the inclusion criteria for the different samples. Several studies included sexual offenders as part of the violent offender sample, others excluded sexual offenders, and one study found evidence for subtle differences when comparing sexual and violent offenders (Gillespie, Rotshtein, Satherley et al., 2015). Sampling differences are emphasized further when considering the inclusion of non-contact sexual offenders. For example, one study included non-contact sexual offenders in a sample of non-violent offenders (Hoaken et al., 2007), while a separate study categorized all sexual offenders, contact and non-contact, as violent (Robinson et al., 2012). Although differences between contact and non-contact sexual offenders have been

identified in the literature (Babchishin, Hanson, & VanZuylen, 2015), the extent to which these groups differ in social-cognitive abilities remains unknown. Indeed, it may be hypothesized that intact affective and social-cognitive abilities (including facial emotion recognition) represents one potential barrier to contact offending among men with a history of online-only offending. Carefully differentiating between these groups may allow for a more nuanced understanding of potential protective factors that exist among men who may be motivated to sexually abuse young people, yet appear able to desist from contact sexual abuse (see the motivation-facilitation model of sexual offending; Seto, 2017).

Understanding differences based on offence type also has implications for assessment and treatment of individuals in the criminal justice system. The allocation of individuals to treatment programs is often based on the index offense, and this allows for the tailoring of treatment modules to the needs of specific types of offender. However, collapsing across sexual and violent offenders clouds any judgments about real differences in social-cognitive and affective abilities between these groups. The logic for allocating offenders with different offense types to specialized treatment programs, for example the old Sex Offender Treatment Program offered by the Prison and Probation Service for England and Wales, is based on the assumption that these groups can be distinguished in terms of *criminogenic* needs, that is, those needs that when treated will be associated with a reduced risk of reoffending (Andrews & Bonta, 2010; Carter & Mann, 2016; Mann, Hanson, & Thornton, 2010). However, if such differences do not exist, at least in some domains, then placing individuals on the same program may have benefits for treatment providers, both in terms of finance and resources. Notably, this approach has been taken in a redesign of treatment programs for high risk and moderate risk offenders in England and Wales, with more specialized modules (e.g., the Healthy Sex Program) offered to those with more specific needs.

Beyond sample composition, some samples were also better characterized than others. For example, not all studies assessed for the presence of clinical or antisocial pathology in the sampling of participants, and some samples included a number of psychological disorders, including personality disorder, depression, and psychopathy. The inconsistent sampling of clinical pathologies renders it difficult to reliably aggregate and explore findings across studies. Moreover, it is difficult to determine to what extent the findings are attributable to psychopathology, violent offending, or both. The failure of some studies to assess for psychopathy (Hoaken et al., 2007 and Robinson et al., 2012) is particularly concerning given that psychopathic traits are associated with impaired facial expression recognition (Blair et al., 2004; Dawel et al., 2012; Dolan & Fullam, 2006; Kosson et al., 2002; Gillespie, Mitchell, Satherley, Beech & Rotshtein, 2015; Montagne et al., 2005).

Previous research has also demonstrated how the nature of the task affects the processing of facial affective information (Smith & Merlusca, 2014), and methodological differences were also noted in terms of the stimuli selected, and the presentation of the stimuli on screen. For example, studies varied in the selection of stimuli across the different emotional expressions (e.g., anger, disgust, fear, happy, sad, surprise), the intensity of the expression, and the sex of the model portraying the expression. These features have been shown to affect the processing of emotional expressions, including accuracy, response times, and eye movements (Guo, 2012; Gillespie et al., 2017; Kret & de Gelder, 2013; Kret, Pichon, Grèzes, & de Gelder, 2011; Schurgin et al., 2014; Wells et al., 2016). Studies also varied in the analysis strategy, and while the majority of studies analysed differences as a function of the emotion expressed, one study reported effects collapsed across the different expressions (Hoaken et al., 2007).

In terms of differences in presentation, Schönenberg, Christian et al. (2014) sequentially presented stimuli of increasing intensity in increments of 2%, rather than presenting individual stimuli in isolation. Although this paradigm allowed for a sophisticated analysis of the effects of intensity, participants may have become more attuned to the emotional stimuli, masking any potential differences in accuracy. Differences in presentation times are also observed, with stimuli presented for five seconds (Robinson et al., 2012), two seconds (Hoaken et al., 2007), or remaining onscreen while a response was made (Gillespie, Rotshtein, Satherley et al., 2015). Previous research has indicated that the duration of stimulus presentation affects emotion recognition, with better accuracy observed at longer presentation times (Fenske et al., 2015; Neath & Itier, 2014). Thus, it is possible that the longer viewing times employed by Robinson et al. (2012) may have diminished any between group differences that would have been observed under more restricted viewing times.

Finally, there was high variability in the number of participants recruited, with small sample sizes a common factor. Although recruitment of forensic samples is often difficult, it is important to recognize that low sample sizes have implications for estimates of effect size, and the chances of observing effects that are real, or not real (Button et al., 2013; Kühberger, Fritz, & Scherndl, 2014). For example, a negative correlation of sample size with effect size has been found in the psychological literature (Kühberger et al., 2014), meaning that even where a true effect is detected, estimates of the magnitude of the effect are likely to be exaggerated in small, underpowered studies (Button et al., 2013). Moreover, a recent article from the Open Science Collaboration (2015) has highlighted problems in the replicability of psychological research, although the conclusions reached have been contested (Gilbert, King, Pettigrew, & Wilson, 2016). Given the low statistical power in the neurosciences literature, recommendations for improving research practices in psychology and the neurosciences have

been put forward by Button et al. (2013). These include: performing a priori power calculations; full disclosure of sample size, data exclusions, manipulations, and measures; preregistration of study protocols and data analysis plans; and making study materials and data openly accessible (Button et al., 2013). Such measures can also help to increase the replicability of research in forensic and clinical psychology, and increase the chances that results detected represent true effects.

The validity of the conclusions drawn from this review is contingent upon a representative sample of all research conducted in this area being examined. The inclusion and exclusion criteria applied means that only a subset of studies investigating emotion recognition in violent offenders was examined. The review did not include participants from psychiatric populations or female samples, which limits the generalizability of the findings beyond men incarcerated for a violent offence. The review specifically explored emotion recognition using static displays of facial affect. Whilst facial expressions convey important information about emotional experience and are central to social communication (Mellentin et al., 2015), facial affect recognition is just one part of social information processing and thus the findings should not be generalized to social-cognitive abilities more generally. Furthermore, despite efforts to identify relevant studies, some may have been missed. Finally, the inclusion of only published studies means that the findings may have been affected by publication bias or a 'file drawer' effect, given that papers reporting positive results are more often published.

5. Conclusion

In conclusion, this review found evidence for generally impaired facial affect processing among violent offenders. Deficits for sensitivity and accuracy were found in comparison to both non-violent offenders and non-offenders and were most reliably reported for disgust and

fear. These deficits cannot be explained by task difficulty since outcomes are reported relative to the performance of controls on each expression. Perhaps surprisingly, there was no consistent evidence that violent offenders show a hostile attribution bias. The review found some evidence based on a limited number of studies that the exclusion of sex offenders from violent samples could affect the pattern of results, although violent samples including and excluding sexual offenders tended to show some pattern of impairment. The review also highlighted that greater consistency between studies is required to allow for more meaningful comparisons. Given that impairments appear to be generalized across emotions, we would recommend that future studies include the six basic emotions, and also examine the effects of intensity and sex given that emotion recognition varies with these parameters. More consistent reporting of psychopathology and offence history would also benefit future comparisons. Finally, many studies included small sample sizes and this is likely to have resulted in inflated effect sizes and reduced power. Based on the finding of generalized impairments in face affect recognition, we would suggest that this may be considered a potential treatment target for violent offenders. However, a greater understanding of the potential mechanisms underlying these impairments is necessary to form an understanding of how these impairments may be modified, and to inform the development of successful training-initiatives (Hubble et al., 2015).

6. Funding

7. References

References marked with an asterisk indicate studies included in the systematic review

Andrews, D. A., & Bonta, J. (2010). *The psychology of criminal conduct* (5th Ed.). New
   Providence, NJ: LexisNexis Group.

Adolphs, R., & Tranel, D. (2004). Impaired judgements of sadness but not happiness
   following bilateral amygdale damage. *Journal of Cognitive Neuroscience, 16*, 453–
   462. doi: 10.1162/089892904322926782

Babchishin, K. M., Hanson, R. K., & VanZuylen, H. (2015). Online child pornography
   offenders are different: A meta-analysis of the characteristics of online and offline
   sex offenders against children. *Archives of Sexual Behavior*, *44*(1), 45-66. doi:
   10.1007/s10508-014-0270

Bishop, S., Dalgleish, T., & Yule, W. (2004). Memory for emotional stories in high and low
   depressed children. *Memory, 12*(2), 214-230. doi:10.1080/09658210244000667

Blair, R. J. R. (2001). Neurocognitive models of aggression, the antisocial personality
   disorders and the psychopath. *Journal of Neurology, Neurosurgery & Psychiatry,
   71*, 727–731. doi:10.1136/jnnp.71.6.727

Blair, R. J. R., Colledge, E., Murray, L., & Mitchell D. G. (2001). A selective impairment in
   the processing of sad and fearful expressions in children with psychopathic
   tendencies. *Journal of Abnormal Child Psychology, 29*(6), 491–498. doi:
   10.1023/A:1012225108281

Blair, R., Mitchell, D., Peschardt, K., Colledge, E., Leonard, R., Shine, J.,… & Perrett, D.
   (2004). Reduced sensitivity to others' fearful expressions in psychopathic

individuals. *Personality and Individual Differences, 37*, 1111–1122.

doi:10.1016/j.paid.2003.10.008

Blair, R. J. R., Morris, J. S., Frith, C. D., Perrett, D. I., & Dolan, R. J. (1999). Dissociable

neural responses to facial expressions of sadness and anger. *Brain*, *122*, 883– 893.

http://dx.doi.org/10.1093/brain/122.5.883

Bland, A. R., Williams, C. A., Scharer, K., & Manning, S. (2004). Emotion processing in

borderline personality disorders. *Issues in Mental Health Nursing, 25,* 655–672.

doi:10.1080/01612840490486692

Brook, M., Brieman, C.L., & Kosson, D. S. (2013). Emotion processing in Psychopathy

Checklist- assessed psychopathy: A review of the literature. *Clinical Psychology*

Review, 33(8), 979-995. doi: 10.1016/j.cpr.2013.07.008

Brotman, M., Rich, B., Schmajuk, M., Reising, M., Monk, C., Dickstein, D… Leibenluft, E.

(2004). Attention bias to threat faces in children with bipolar disorder and comorbid

lifetime anxiety disorders. *Biological Psychiatry*, *61*(6), 819–821.

doi:10.1016/j.biopsych.2006.08.021

Buckner, J. D., Maner, J. K., & Schmidt, N. B. (2010). Difficulty disengaging attention from

social threat in social anxiety. *Cognitive Therapy and Research, 34*, 99- 105.

doi:10.1007/s10608-008-9205

Burt, S. (2009). Are there meaningful etiological differences within antisocial behavior?

Results of a meta-analysis. *Clinical Psychology Review, 29*(2), 163–178.

https://doi.org/10.1016/j.cpr.2008.12.004

Burt, S. (2012). Do etiological influences on aggression overlap with those on rule breaking?

      A meta-analysis. *Psychological Medicine, 42*(1), 1–12.

      https://doi.org/10.1017/S0033291712001894

Burt, S., Mikolajewski, A., & Larson, C. (2009). Do aggression and rule-breaking have

      different interpersonal correlates? A study of antisocial behavior subtypes, negative

      affect, and hostile perceptions of others. *Aggressive Behavior, 35*(6), 453–461. doi:

      10.1002/ab.20324

Burt, S., & Neiderhiser, J. (2009). Aggressive versus nonaggressive antisocial behavior:

      Distinctive etiological moderation by age. *Developmental Psychology, 45*(4), 1164–

      1172. doi: 10.1037/a0016130

Button, K. S., Ioannidis, J. P., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S., &

      Munafò, M. R. (2013). Power failure: why small sample size undermines the

      reliability of neuroscience. *Nature Reviews Neuroscience, 14*(5), 365-376.

      doi:10.1038/nrn3475

Carter, A. J., & Mann, R. E. Organizing Principles for an integrated model of change for the

      treatment of sexual offending. In Beech, A. R., & Ward, T. (Eds.). *The Wiley*

      Blackwell Handbook on assessment, treatment and theories of sexual offending

      (Vol. 1). Chichester: Wiley. doi:10.1002/9781118574003.wattso017

Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009). In bad taste:

      Evidence for the oral origins of moral disgust. *Science, 323*(5918), 1222–1226.

      doi:10.1126/science.1165565

Coid, J., Yang, M., Ullrich, S., Roberts, A., Moran, P., Bebbington, P., ... & Singleton, N. (2009). Psychopathy among prisoners in England and Wales. *International Journal of Law and Psychiatry*, *32*(3), 134-141. doi:10.1016/j.ijlp.2009.02.008

Crick, N. R., & Dodge, K. A. (1996). Social information-processing mechanisms in reactive and proactive aggression. *Child Development*, *67*(3), 993-1002. doi:10.1111/j.1467-8624.1996.tb01778

da Silva Ferreira, G. C., Crippa, J. A., & de Lima Osório, F. (2014). Facial emotion processing and recognition among maltreated children: A systematic literature review. *Frontiers in Psychology*, *5*, 1-10. doi:10.3389/fpsyg.2014.01460

Dadds, M.R., Perry, Y., Hawes, D.J., Merz, S., Riddell, A.C., Haines, D.J., ... & Abeygunawardane, A. I. (2006). Attention to the eyes and fear-recognition deficits in child psychopathy. *British Journal of Psychiatry, 189,* 280–281. doi:10.1192/bjp.bp.105.018150

Dadds, M. R., E,l. Masry, Y., Wimalaweera, S., & Guastella, A. J. (2008). Reduced eye gaze explains "fear blindness" in childhood psychopathic traits. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*, 455- 463. doi:10.1097/CHI.0b013e31816407f1

Daros, A. R., Zakzanis, K. K., & Ruocco, A. C. (2013). Facial emotion recognition in borderline personality disorder. *Psychological Medicine*, *43*(9), 1953-1963. doi:10.1017/S0033291712002607

Dawel, A., O'Kearney, R., McKone, E., & Palermo, R. (2012). Not just fear and sadness:

Meta-analytic evidence of pervasive emotion recognition deficits for facial and vocal expressions in psychopathy. *Neuroscience & Biobehavioral Reviews*, *36*(10), 2288-2304. doi:10.1016/j.neubiorev.2012.08.006

Demenescu, L. R., Kortekaas, R., den Boer, J. A., & Aleman, A. (2010). Impaired attribution of emotion to facial expressions in anxiety and major depression. *PLoS One*, *5*(12), e15058

Dodge, K. A., Laird, R., Lochman, J.E., Zelli, A. (2002). Multidimensional latent-construct analysis of children's social information processing patterns: Correlations with aggressive behavior problems. *Psychological Assessment*, *14,* 60–73. doi:10.1037/1040-3590.14.1.60

Dodge, K. A., Price, J. M., Bachorowski, J. A., & Newman, J. P. (1990). Hostile attributional biases in severely aggressive adolescents. *Journal of Abnormal Psychology, 99,* 385–392. doi:10.1037/0021-843X.99.4.385

Dolan, M., & Fullam, R. (2006). Face affect recognition deficits in personality disordered offenders: Association with psychopathy. *Journal of Psychological Medicine, 36*, 1563–1570. doi:10.1017/S0033291706008634

Domes, G., Schulze, L., Herpertz, S. C. (2009). Emotion recognition in borderline personality disorder: A review of the literature. *Journal of Personality Disorders, 23,* 6–19. doi:10.1521/pedi.2009.23.1.6

Dyck, M., Habel, U., Slodczyk, J., Schlummer, J., Backes, V., Schneider, F., & Reske, M. (2009). Negative bias in fast emotion discrimination in borderline personality

disorder. *Psychological Medicine*, *39*(05), 855-864. doi:
10.1017/S0033291708004273

Easter, J., McClure, E. B., Monk, C. S., Dhanani, M., Hodgdon, H., Leibenluft, E… & Ernst,
M. (2005). Emotion recognition deficits in pediatric anxiety disorders: Implications
for amygdale research. *Journal of Child and Adolescent Psychopharmacology*, *15*,
563–570. doi:10.1089/cap.2005.15.563

Eisenbarth, H., & Alpers, G. W. (2011). Happy mouth and sad eyes: Scanning emotional
facial expressions. *Emotion, 11,* 860–865. doi:10.1037/a0022758

Ekman, P. (1972). Universals and cultural differences in facial expressions of emotion. In: J.
Cole (Ed.), *Nebraska symposium on motivation* (pp. 207–282). Lincoln: University
of Nebraska Press

Ekman, P. (1992a). Facial expressions of emotion: New findings, new questions.
Psychological Science, 3, 34–38. doi:10.1111/j.1467-9280.1992.tb00253

Ekman, P. (1992b). Are there basic emotions? *Psychological Review, 99*, 550–553.
doi:10.1037/0033-295X.99.3.550

Ekman, P. (1993). Facial expression and emotion. *American Psychologist, 48,* 384–392.
doi:10.1037/0003-066X.48.4.384

Ekman, P., & Friesen, W.V. (1971). Constants across cultures in the face and emotion.
Journal of Personality and Social Psychology, *17,* 124–129. doi:10.1037/h0030377

Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect*. San Francisco: University of
California

Elfenbein, H.A., & Ambady, N. (2002). On the universality and cultural specificity of

emotion recognition: A meta-analysis. *Psychological Bulletin, 128,* 203- 235.

doi:10.1037/0033-2909.128.2

Fenske, S., Lis, S., Liebke, L., Niedtfeld, I., Kirsch, P., & Mier, D. (2015). Emotion

recognition in borderline personality disorder: Effects of emotional information on

negative bias. *Borderline Personality Disorder and Emotion Dysregulation*, *2*(1), 1-

12. doi:10.1186/s40479-015-0031

Fortunata, M., & de Lima Osório, F. (2014). Recognition of facial expressions by alcoholic

patients: A systematic literature review. *Neuropsychiatric Disease and Treatment*,

10, 1655-1663. doi:10.2147/NDT.S65376

Gao, X., & Maurer, D. (2009). Influence of intensity on children's sensitivity to happy, sad,

and fearful facial expressions. *Journal of Experimental Child Psychology, 102,* 503–

521. http://dx.doi.org/10.1016/j.jecp .2008.11.002

Gery, I., Miljkovitch, R., Berthoz, S., & Soussignan, R. (2009). Empathy and recognition of

facial expressions of emotion in sex offenders, non-sex offenders and normal

controls. *Psychiatry Research, 165*(3), 252-262. doi:10.1016/j.psychres.2007.11.006

Gilbert, D. T., King, G., Pettigrew, S., & Wilson, T. D. (2016). Comment on "Estimating the

reproducibility of psychological science". *Science, 351*(6277), 1037-1037.

doi:10.1126/science.aad7243

Gillespie, S. M., Mitchell, I. J., Satherley, R. M., Beech, A. R., & Rotshtein, P. (2015). Relations of distinct psychopathic personality traits with anxiety and fear: Findings from offenders and non-offenders. *PloS One*, *10*(11), e0143120

Gillespie, S. M., Rotshtein, P., Beech, A. R., & Mitchell, I. J. (2017). Boldness psychopathic traits predict reduced gaze toward fearful eyes in men with a history of violence. *Biological Psychology, 128*, 29-38. https://doi.org/10.1016/j.biopsycho.2017.07.003

*Gillespie, S. M., Rotshtein, P., Satherley, R. M., Beech, A. R., & Mitchell, I. J. (2015). Emotional expression recognition and attribution bias among sexual and violent offenders: A signal detection analysis. *Frontiers in Psychology, 6*. doi:10.3389/fpsyg.2015.00595

Gillespie, S. M., Rotshtein, P., Wells, L. J., Beech, A. R., & Mitchell, I. J. (2015). Psychopathic traits are associated with reduced attention to the eyes of emotional faces among adult male non-offenders. *Frontiers in Human Neuroscience*, *9*, 1-11. doi: 10.3389/fnhum.2015.00552

Gottman, J. M., & Levenson, R.W. (2002). A two-factor model for predicting when a couple will divorce: Exploratory analyses using 14-year longitudinal data. *Family Process*, *41*(1), 83-96. doi: 10.1111/j.1545-5300.2002.40102000083.x

Gross, T. F. (2004). The perception of our basic emotions in human and non human faces by children with autism and other developmental disabilities. *Journal of Abnormal Child Psychology, 32*, 469–480. doi:10.1023/B:JACP.0000037777.17698.01

Guo, K. (2012). Holistic gaze strategy to categorize facial expression of varying intensities. *PLoS One*, *7*(8), e42585

Gur, R. C., Sara, R., Hagendoorn, M., Marom, O., Hughett, P., Macy, L., … & Gur, R. E. (2002). A method for obtaining 3-dimensional facial expressions and its standardization for use in neurocognitive studies. *Journal of Neuroscience Methods, 115*(2),137–143. doi:10.1016/S0165-0270(02)00006-7

Hanson, R.K., & Morton-Bourgon, K.E. (2005). The characteristics of persistent sexual offenders: A meta-analysis of recidivism studies. *Journal of Consulting and Clinical Psychology*, *73*(6), 1154- 1163. doi:10.1037/0022-006X.73.6.1154

Harris, G.T., Rice, M.E., & Cormier, C.A. (2002). Prospective replication of the Violence Risk Appraisal Guide in predicting violent recidivism among forensic patients. *Law and Human Behavior, 26,* 377–394. doi:10.1023/A:1016347320889

*Hoaken, P.N., Allaby, D.B., & Earle, J. (2007). Executive cognitive functioning and the recognition of facial expressions of emotion in incarcerated violent offenders, non-violent offenders, and controls. *Aggressive Behavior*, *33*(5), 412-421. doi:10.1002/ab.20194

Holtzworth-Munroe, A., Meehan, J. C., Herron, K., Rehman, U., & Stuart, G. L. (2000). Testing the Holtzworth-Munroe and Stuart (1994) batterer typology. *Journal of Consulting and Clinical Psychology*, *68*(6), 1000- 1019. doi:10.1037/0022-006X.68.6.1000

Hoppenbrouwers, S. S., Bulten, B. H., & Brazil, I. A. (2016). Parsing fear: A reassessment of the evidence for fear deficits in psychopathy. *Psychological Bulletin, 142*(6), 573-600. http://dx.doi.org/10.1037/bul0000040

Hubble, K., Bowen, K. L., Moore, S. C., & Van Goozen, S. H. (2015). Improving negative

emotion recognition in young offenders reduces subsequent crime. *PloS One*, *10*(6),

1-13, e0132035

Hudson, S.M., Marshall, W.L., Wales, D., McDonald, E., Bakker, L.W., & McLean, A.

(1993). Emotional recognition skills of sex offenders. *Sexual Abuse: A Journal of

Research and Treatment*, *6*(3), 199-21. doi:10.1177/107906329300 600303

Keltner, D. (2003). Expression and the course of life: Studies of emotion, personality, and

psychopathology form a social-functional perspective. *Annals of the New York

Academy of Sciences, 1000*, 222–243. doi:10.1196/annals.1280.011

Kohler, C. G., & Brennan, A. (2004). Recognition of facial emotions in schizophrenia.

Current Opinion in Psychiatry, 17, 81–86

Kosson, D. S., Suchy, Y., Mayer, A. R., & Libby, J. (2002). Facial affect recognition in

criminal psychopaths. *Emotion, 2*, 398–411. doi:10.1037/1528-3542.2.4.398

Kret, M. E., & de Gelder, B. (2013). When a smile becomes a fist: The perception of facial

and bodily expressions of emotion in violent offenders. *Experimental Brain

Research, 228*, 399–410. doi:10.1007/s00221-013- 3557-6

Kret, M. E., Pichon, S., Grèzes, J., & de Gelder, B. (2011). Men fear other men most: Gender

specific brain activations in perceiving threat from dynamic faces and bodies – an

fMRI study. *Frontiers in Psychology, 2*(3). doi:10.3389/fpsyg.2011. 00003

Kühberger, A., Fritz, A., & Scherndl, T. (2014). Publication bias in psychology: a diagnosis

based on the correlation between effect size and sample size. *PloS One, 9*(9),

e105825

Langner, O., Dotsch, R., Bijlstra, G., Wigboldus, D. H. J., Hawk, S. T., & Van Knippenberg, A. (2010). Presentation and validation of the Radboud Faces Database. *Cognition and Emotion, 24,* 1377–1388. doi:10.1080/02699930903485076

Leime, J. L., Rique Neto, J., Alves, S. M., & Torro-Alves, N. (2013). Recognition of facial expressions in children, young adults and elderly people. *Estudos de Psicologia (Campinas)*, *30*(2), 161-167. doi:10.1590/S0103-166X2013000200002

Leist, T., & Dadds, M.R. (2009). Adolescents' ability to read different emotional faces relates to their history of maltreatment and type of psychopathology. *Clinical Child Psychology and Psychiatry, 14,* 237–250. doi:10.1177/135910450 8100887

Loney, B. R., Frick, P. J., Clements, C. B., Ellis, M. L., & Kerlin, K. (2003). Callous-unemotional traits, impulsivity, and emotional processing in adolescents with antisocial behavior problems. *Journal of Clinical Child and Adolescent Psychology*, *32*(1), 66-80. doi:10.1207/S15374424JCCP3201_07

Luo, Y., Shen, W., Zhang, Y., Feng, T. Y., Huang, H., & Li, H. (2013). Core disgust and moral disgust are related to distinct spatiotemporal patterns of neural processing: An event-related potential study. *Biological psychology*, *94*(2), 242-248. doi:10.1016/j.biopsycho.2013.06.005

Lynch, T. R., Rosenthal, M. Z., Kosson, D. S., Cheavens, J. S., Lejuez, C. W., & Blair, R. J. R. (2006). Heightened sensitivity to facial expressions of emotion in borderline personality disorder. *Emotion, 6*(4)*, 647–655. doi:10.1037/1528-3542.6.4.647

Maiuro, R. D., Cahn, T. S., Vitaliano, P. P., Wagner, B. C., & Zegree, J. B. (1988). Anger,

    hostility, and depression in domestically violent versus generally assaultive men and

    nonviolent control subjects. *Journal of Consulting and Clinical Psychology*, *56*(1),

    17-23. doi:10.1037/0022-006X.56.1.17

Mann, R. E., Hanson, R. K., & Thornton, D. (2010). Assessing risk for sexual recidivism:

    Some proposals on the nature of psychologically meaningful risk factors. *Sexual*

    Abuse: A Journal of Research and Treatment, 22(2), 191-217.

    doi:10.1177/1079063210366039

Marsh, A. A. (2016). Understanding amygdala responsiveness to fearful expressions through

    the lens of psychopathy and altruism. *Journal of Neuroscience Research, 94,* 513-

    525. doi:10.1002/jnr.23668

Marsh, A. A., & Ambady, N. (2007). The influence of the fear facial expression on prosocial

    responding. *Cognition and Emotion, 21,* 225–247. doi:10.1080/02699930600652234

Marsh, A. A., & Blair, R. J. R. (2008). Deficits in facial affect recognition among antisocial

    populations: A meta-analysis. *Neuroscience & Biobehavioral Reviews*, *32*(3), 454-

    465. doi:10.1016/j.neubiorev.2007.08.003

Marsh, A. A., Kozak, M. N., & Ambady, N. (2007). Accurate identification of fear facial

    expressions predicts prosocial behavior. *Emotion, 7*, 239–251. doi:10.1037/1528-

    3542.7.2.239

Marshall, W. L., Hudson, S. M., Jones, R., & Fernandez, Y. M. (1995). Empathy in sex

    offenders. *Clinical Psychology Review, 15,* 99–113. doi:10.1016/0272-

7358(95)00002-7

McCade, D., Savage, G., & Naismith, S. L. (2012). Review of emotion recognition in mild cognitive impairment. *Dementia and Geriatric Cognitive Disorders*, *32*(4), 257-266. doi:10.1159/000335009

McElroy, S. L., Soutullo, C. A., Taylor, P., Nelson, E. B., Beckman, D. A., Brusman, L. A., … & Keck, P. M. (1999). Psychiatric features of 36 men convicted of sexual offenses. *The Journal of Clinical Psychiatry, 60,* 414–420. doi:10.4088/JCP.v60n0613

Mellentin, A. I., Dervisevic, A., Stenager, E., Pilegaard, M., & Kirk, U. (2015). Seeing Enemies? A systematic review of anger bias in the perception of facial expressions among anger-prone and aggressive populations. *Aggression and Violent Behavior*, *25,* 373-383. doi:10.1016/j.avb.2015.09.001

Mitchell, A. E., Dickens, G. L., & Picchioni, M. M. (2014). Facial emotion processing in borderline personality disorder: A systematic review and meta-analysis. *Neuropsychology Review*, *24*(2), 166-184. doi:10.1007/s11065-014-9254-9

Montagne, B., van Honk, J., Kessels, R. P., Frigerio, E., Burt, M., van Zandvoort, M.J., … & de Haan, E. H. (2005). Reduced efficiency in recognising fear in subjects scoring high on psychopathic personality characteristics. *Personality and Individual Differences, 38*, 5–11. doi:10.1016/j.paid.2004.02.008

Moore, B. S. (1990). The origins and development of empathy. *Motivation and Emotion, 14,* 75−80. doi:10.1007/BF00991636

Neath, K., & Itier, R. (2014). Impact of task demands and fixation to features on the time

      course of facial emotion processing. *Journal of Vision*, *14*(10), 1397-1397. doi:

      10.1167/14.10.1397

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science.

      Science, 349(6251), aac4716. doi:10.1126/science.aac4716

Pascual-Leone, A., Bierman, R., Arnold, R., & Stasiak, E. (2011). Emotion-focused therapy

      for incarcerated offenders of intimate partner violence: A 3-year outcome using a

      new whole-sample matching method. *Psychotherapy Research*, *21*(3), 331-347. doi:

      10.1080/10503307.2011.572092

Penton-Voak, I.S., Thomas, J., Gagel, S.H., McMurran, M., McDonald, S., & Munafo, M.R.

      (2013). Increasing recognition of happiness in ambiguous facial expressions reduces

      anger and aggressive behavior. *Psychological Science, 24*, 688–697.

      doi:10.1177/095679761245 9657

Preston, S. D., & de Waal, F. B. M. (2002). Empathy: Its ultimate and proximate bases.

      Behavioral and Brain Sciences, 25, 1–72. doi:10.1017/S0140525X02350015

Rapport, L., Friedman, S., Tzelepis, A., Van Voorhis, A. (2002). Experienced emotion and

      affect recognition in adult attention- deficit hyperactivity disorder. *Neuropsychology*

      16, 102–110. doi:10.1037//0894-4105.16.1.10

Raymond, N. C., Coleman, E., Ohlerking, F., Christenson, G. A., & Miner, M. (1999).

      Psychiatric comorbidity in pedophilic sex offenders. *The American Journal of*

      Psychiatry, 156, 786–788. doi:10.1176/ajp.156.5.786

*Robinson, L., Spencer, M. D., Thomson, L. D., Sprengelmeyer, R., Owens, D. G., Stanfield, A. C., ... & Johnstone, E. C. (2012). Facial emotion recognition in Scottish prisoners. *International Journal of Law and Psychiatry*, *35*(1), 57-61. doi:10.1016/j.ijlp.2011.11.009

Rojahn, J., Lederer, M., & Tassé, M. J. (1995). Facial emotion recognition by persons with mental retardation: A review of the experimental literature. *Research in Developmental Disabilities*, *16*(5), 393-414. doi:10.1016/0891-4222(95)00019-J

Rozin, P., Haidt, J., & McCauley, C. R. (2000). Disgust. In M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (pp. 637–653). New York: Guilford Press

Rozin, P., Haidt, J., & McCauley, C. R. (2008). Disgust: The body and soul emotion in the 21st century. In B. O. Olatunji, & D. McKay (Eds.), *Disgust and its disorders* (pp. 9–29). Washington, DC: American Psychological Association

Ruiz-Hernández, J. A., García-Jiménez, J. J., Llor-Esteban, B., & Godoy-Fernández, C. (2015). Risk factors for intimate partner violence in prison inmates. *The European Journal of Psychology Applied to Legal Context*, *7*(1), 41-49. doi:10.1016/j.ejpal.2014.11.003

*Schönenberg, M., Christian, S., Gaußer, A. K., Mayer, S. V., Hautzinger, M., & Jusyte, A. (2014). Addressing perceptual insensitivity to facial affect in violent offenders: First evidence for the efficacy of a novel implicit training approach. *Psychological Medicine*, *44*(5), 1043-1052. doi:10.1017/S0033291713001517

*Schönenberg, M., & Jusyte, A. (2014). Investigation of the hostile attribution bias toward ambiguous facial cues in antisocial violent offenders. *European Archives of Psychiatry and Clinical Neuroscience*, *264*(1), 61-69. doi:10.1007/s00406-013-0440-1

*Schönenberg, M., Louis, K., Mayer, S., & Jusyte, A. (2013). Impaired identification of threat-related social information in male delinquents with antisocial personality disorder. *Journal of Personality Disorders*, *27*(4), 496-505. doi:10.1521/pedi_2013_27_100

Schönenberg, M., Mayer, S. V., Christian, S., Louis, K., & Jusyte, A. (2015). Facial affect recognition in violent and nonviolent antisocial behavior subtypes. *Journal of Personality Disorders*, *30*(5), 708-719. doi: 10.1521/pedi_2015_29_217

Schurgin, M. W., Nelson, J., Iida, S., Ohira, H., Chiao, J. Y., & Franconeri, S. L. (2014). Eye movements during emotion recognition in faces. *Journal of vision*, *14*(13), 14-14. doi: 10.1167/14.13.14

Schyns, P. G., Petro, L. S., & Smith, M. L. (2007). Dynamics of visual information integration in the brain for categorizing facial expressions. *Current Biology*, *17*(18), 1580-1585. doi:10.1016/j.cub.2007.08.048

Schyns, P. G., Petro, L. S., & Smith, M. L. (2009). Transmission of facial expressions of emotion co-evolved with their efficient decoding in the brain: Behavioral and brain evidence. *PloS One*, *4*(5), e5625. doi:10.1371/journal.pone.0005625

*Seidel, E. M., Pfabigan, D. M., Keckeis, K., Wucherer, A. M., Jahn, T., Lamm, C., &
Derntl, B. (2013). Empathic competencies in violent offenders. *Psychiatry
Research*, *210*(3), 1168-1175. doi:10.1016/j.psychres.2013.08.027

Seto, M. C. (2017). The motivation-facilitation model of sexual offending. *Sexual Abuse*.
doi:1079063217720919.

Singh, S. D., Ellis, C. R., Winton, A. S., Singh, N. N., Leung, J. P., & Oswald, D. P. (1998).
Recognition of facial expressions of emotion by children with attention-deficit
hyperactivity disorder. *Behavior Modification*, *22*(2)*, 128-142.
doi:10.1177/01454455980222002

Smith, M. L., Cottrell, G. W., Gosselin, F., & Schyns, P. G. (2005). Transmitting and
decoding facial expressions. *Psychological Science*, *16*(3), 184-189.
doi:10.1111/j.0956- 7976.2005.00801

Smith, M. L., & Merlusca, C. (2014). How task shapes the use of information during facial
expression categorizations. *Emotion*, *14*(3), 478- 487. doi:10.1037/a0035588

Stevens, D., Charman, T., & Blair, R. J. (2001). Recognition of emotion in facial expressions
and vocal tones in children with psychopathic tendencies. *Journal of Genetic
Psychology, 162*, 201–211. doi:10.1080/00221320109597961

Sullivan, S., Ruffman, T., & Hutton, S.B. (2007). Age differences in emotion recognition
skills and the visual scanning of emotion faces. *The Journals of Gerontology. Series
B, Psychological Sciences and Social Sciences, 62*, 53–60.
doi:10.1093/geronb/62.1.P53

Surguladze, S.A., Young, A.W., Senior, C., Brebion, G., Travis, M., & Phillips, M. (2004). Recognition accuracy and response bias to happy and sad facial expressions in patients with major depression. *Neuropsychology, 18*, 212–218. doi:10.1037/0894-4105.18.2.212

Tackett, J. L., Krueger, R. F., Sawyer, M. G., & Graetz, B. W. (2003). Subfactors of *DSM- IV* conduct disorder: Evidence and connections with syndromes from the Child Behavior Checklist. *Journal of Abnormal Child Psychology, 31*(6), 647–654. doi:0091-0627/03/1200-0647/0

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., … & Nelson, C. (2009). The NimStim set of facial expressions: Judgements from untrained research participants. *Psychiatry Research, 168*, 242–249. doi: 10.1016/j.psychres.2008.05.006

Trémeau, F. (2006). A review of emotion deficits in schizophrenia. *Dialogues in Clinical Neuroscience, 8*, 59–70

Van Rijsbergen, N. J., & Schyns, P. G. (2009). Dynamics of trimming the content of face representations for categorization in the brain. *PLoS Computational Biology*, *5*(11), e1000561. doi:10.1371/journal.pcbi.1000561

Wells, L. J., Gillespie, S. M., & Rotshtein, P. (2016). Identification of emotional facial expressions: effects of expression, intensity, and sex on eye gaze. *PloS one, 11*(12), e0168307

Wilson, K., Juodis, M., & Porter, S. (2011). Fear and loathing in psychopaths: A meta-analytic investigation of the facial affect recognition deficit. *Criminal Justice and Behavior, 38*(7), 659–668. doi:10.1177/0093854811404120

Young, A. W., Rowland, D., Calder, A. J., Etcoff, N. L., Seth, A., & Perrett, D. I. (1997). Facial expression megamix: Tests of dimensional and category accounts of emotion recognition. *Cognition*, *63*(3), 271-313. doi:10.1016/S0010-0277(97)00003-6

Zaja, R. H., & Rojahn, J. (2008). Facial emotion recognition in intellectual disabilities. *Current Opinion in Psychiatry*, *21*(5), 441-444. doi:10.1097/YCO.0b013e328305e5fd