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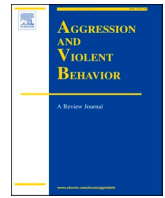
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Facial emotion recognition in sexual offenders

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ABSTRACT

Sexual offending represents a significant societal burden and a critical public health concern due to its devastating impact on victims. Extensive research on the etiology and maintenance of sexual offending has led to the development of several hypotheses. Among these, a compelling hypothesis suggests that a putative deficit in emotional recognition skills may underlie the genesis of aggressive behavior, including acts of sexual assault against both adults and children. However, previous studies have reported heterogeneity in emotion recognition skills across different subtypes of offending behavior.

The aim of this systematic review was to determine whether adult sexual offenders (ASO), pedophile diagnosed offenders (PED), and pedophile non-diagnosed offenders (N-PED) share a common deficit in facial emotion recognition.

A systematic literature search was conducted using the PRISMA guidelines. A total of 13 studies were included that met the following inclusion criteria: inclusion of sex offenders and a control group, and original measurement of facial emotion recognition using a validated face battery.

The results indicate a reduced ability to recognize facial emotions in ASO offenders. However, no differences emerged between PED and N-PED offenders and controls. Moreover, this review highlights the difficulties of homogenizing and implementing a systematic assessment of the sex offender population. Factors such as psychiatric/personality disorders, medications and victim characteristics have been particularly understudied in relation to offender etiology and their potential influence on emotional processing. We have therefore formulated basic recommendations for systematizing sexual offender screening in future studies investigating emotional processing in forensic populations.

1. Introduction

Research with sex offenders has highlighted the strong relationship between cognitive processes associated with social cognition and their role in the etiology and maintenance of sexual offending. Social cognition in humans refers to various cognitive processes, such as empathy or emotion recognition, that enable individuals to understand the beliefs and intentions of others to benefit from being part of a social group (Frith, 2008). Recognizing emotional facial expressions is one of the most important ways to accurately adapt behavior and communicate, as it provides information about other people's emotions and intentions (Connolly et al., 2020). Indeed, difficulties in processing emotional faces have been described as a core feature of social cognition deficits observed in many disorders, including psychopathy (Dawel et al., 2012)

or borderline personality disorder (Domes et al., 2009; Fenske et al., 2015). The key role of deficient social cognition has also been reported in delinquent behavior (Walters, 2022) and violent offenders (Chapman et al., 2018). The link between social cognition and delinquent or violent behavior is particularly relevant when considering a particular class of aggression, namely sexual offenses, including rape and molestation (Tiberi et al., 2019). Indeed, sexual offending may be facilitated if the aggressor is unable to empathize with or recognize the emotions expressed by the victim. However, in individuals convicted of sexual offenses (ICSOs), deficits in emotional face recognition have been variously associated with larger deficits in social cognition. A previous study that investigated violent behavior has shed light on the difficulty of drawing conclusions about the association between sexual offenders and the decline in emotional recognition skills observed in violent offender

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samples (Chapman et al., 2018). Furthermore, a major source of heterogeneity among ICSOs in terms of emotional face recognition may be related to different etiological factors, which may differ for different subtypes (Marshall & Barbaree, 1990). It is particularly important to consider and distinguish ICSOs who have committed sexual offenses against children from those who have committed sexual offenses against adults. The studies that questioned the etiology of ICSOs against children reported that psychiatric comorbidities or adverse childhood experiences were more common among ICSOs against children than ICSOs against adults (Gerwinn et al., 2018). This etiological heterogeneity among ICSOs has direct consequences that can be observed at the behavioral level. Previous studies have already underlined the possibility of discriminating between ICSOs with and without child victims based on social cognitive abilities (Gillespie et al., 2021).

1.1. Adult and child sexual offenders

Statistics on sexual assault can vary depending on the definitions used and the methods of data collection, but overall available statistics for Western countries, including Europe and the United States, report that 8 % to 18 % of women and 3 % to 4 % of men are victims of attempted or completed rape at some point in their lives (DeVore & Sachs, 2011; Krug et al., 2002; Nevala, 2014) and that 97.8 % of those convicted of the offense are male (Cortoni et al., 2017). According to the World Health Organization (WHO, 2013), sexual violence is defined as acts ranging from verbal harassment to forced penetration and a range of forms of coercion, from social pressure and intimidation to physical violence. The psychological impact on victims is a major public health concern, given the devastating effects on mental health, with the development of disorders such as major depressive disorder, anxiety and post-traumatic stress disorder (Chivers-Wilson, 2006; Dworkin, 2020; Mason & Lodrick, 2013).

ICSOs are a heterogeneous population in terms of motivation, sexual behavior, and recidivism. Several typologies segregate ICSOs, but there is no universally accepted typological classification. Although there is no consensual classification to differentiate categories of ICSOs, the age of the victim allows for a distinction between adult and child offenders (Wojcik & Fisher, 2019). Sexual violence against children is a global public health problem, with 19.7 % of women and 7.9 % of men having experienced sexual violence before the age of 18 (Pereda et al., 2009). The consequences include physical injuries, mental disorders (anxiety and depression), substance abuse and behavioral problems (Banvard-Fox et al., 2020). Although there are some differences between countries, the criminal law definition of sexual violence against children is characterized by the fact that the victim is <11–15 years old and the offender is at least >16–18 years old. Sexual offenders against children can be divided into two distinct categories: pedophiles (PEDs) and non-pedophile (N-PED) child offender.

Pedophilia is not a criminal or legal term, but a psychiatric disorder referenced in the *Diagnostic and Statistic Manual of Mental Disorder (DSM)* (American Psychiatric Association et al., 2013). The disorder is characterized by persistent and recurrent sexually arousing fantasies or urges (lasting >6 months) involving prepubescent children under the age of 13 (Fisher & Marwaha, 2022; Seto, 2012). Pedophilia is associated with a high prevalence of child sexual abuse, with 22 % to 43 % of these patients admitting to having had sexual contact with a child (Seto, 2009). These self-reports are supported by the fact that 50 % of convicted child offenders report a pedophilic preference (Gerwinn et al., 2018; Whitaker et al., 2008). The risk of reoffending is also strongly associated with diagnosis, ranging from 10 % to 50 % for PEDs (Hall & Hall, 2007). For N-PED child abusers, recidivism remains high, with estimates ranging from 8 % to 30 % in the 20 years following the first offense (Hanson et al., 2003; Rettenberger et al., 2015).

1.2. Facial emotional recognition in sexual offenders

It is generally accepted that at least six basic emotions, namely anger, disgust, fear, happiness, sadness and surprise, play a key role in the formation and regulation of human relationships (Ekman, 1993; Elflein & Ambady, 2002). Accurate recognition of these emotions is an important skill for appropriate social interactions. Unsurprisingly, it has been a perennial topic of interest in the scientific literature dealing with individuals who have committed crimes and offenses. The literature on this topic is based on the hypothesis that a deficit in emotional recognition may be an important factor in the development of aggressive behavior (Hall, 2006; Marshall et al., 1995). Previous research has linked aggressive behavior to problems in recognizing and responding to social cues, such as emotional faces expressing fear or sadness (Marsh & Blair, 2008). In violent or sexual offenders, this reduced ability to recognize emotions may lead to an inability to understand when a potential victim is in distress, thereby facilitating offending (Gillespie et al., 2021). Several studies have examined facial emotion recognition skills in individuals convicted of sexual offenses (ICSOs), including child sex offenders (PEDs, N-PEDs) and adult sex offenders (ASOs). Across studies, results are relatively inconsistent, suggesting that subgroups of sex offenders may be heterogeneous in their processing of emotional faces. As a reduced ability to recognize emotional expressions may influence sexual offending behavior, the aim of the current paper is to review studies investigating the facial emotional abilities of adult (ASO) and child (PED and N-PED) ICSOs to clarify whether or not subtypes of ICSOs share a common deficit in facial emotion recognition.

2. Method

2.1. General information

The systematic review was conducted according to the recommendations of the Cochrane Collaboration (Chandler et al., 2013) and the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Page et al., 2021). This review has been pre-registered in July 2022 (PROSPERO 2022 CRD42022341015).

2.2. Search and identification

We conducted a systematic search of the PubMed, Web of Science, PsycInfo, Embase, Théséas and Google Scholar databases using a list of terms that included words related to individuals convicted of sexual offenses (ICSOs) and facial emotion recognition. We used words with a combination of thesaurus [MeSH terms] related to Medical Subject Headings description, [Other term] related to keywords used in studies, and [Title/Abstract] related to words in titles and abstracts of studies. The full list of search terms is available in the supplementary material. We searched for full-length original articles published in English and peer-reviewed journals between January 1990 and April 2023. No other search filters were used. In addition, the reference lists of the articles evaluated in the full-text analysis were screened to identify potentially eligible articles not retrieved by the database search.

2.3. Screening and eligibility

Two reviewers (JV and LR) independently screened the results against the eligibility criteria, first by screening titles and abstracts and then by full-text analysis. Studies were retained if they included ICSOs and if the task design allowed for a measure of facial emotion recognition. Thus, the eligibility criteria for inclusion were: (1) original data, (2) fully published, (3) peer-reviewed, (4) inclusion of ICSOs, (5) inclusion of a control group, (6) original measure of facial emotion recognition using a validated face battery. In terms of populations, any type of sexual offense was included for ICSOs against adults (ASOs) or children (PEDs or N-PEDs), and the control group could be either the general population

or a non-ICSOs specific population (non-sexual offenders (NSOs)).

2.4. Quality assessment

The Standard Quality Assessment Criteria for Evaluating Primary Research Papers (Kmet et al., 2004) were used to assess the quality of the included studies. Two reviewers (LR et WV) assessed the quality of the included studies. The checklist was used in its original form, each study was scored on the 14 items using a 3-point scale, with 2 being fully met, 1 being partially met and 0 being a study that did not meet the criterion. A summary score was calculated for each paper using the equation: (actual score / potential maximum score) * 100. The potential maximum score takes into account items that do not apply to some studies. The scores obtained were calculated as a linear score from 0 to 100 and divided into three categories: studies of low (<= 49), moderate (50–74) or high (>= 75) quality. Disagreements between reviewers were resolved by discussion with a third reviewer (JB). For the total score of each study, a pre-consensus inter-rater agreement was calculated using Cohen's kappa score (Landis & Koch, 1977). The inter-rater agreement was then interpreted qualitatively using standardized recommendations (Byrt et al., 1996). Note that the quality assessment was not used to determine study eligibility in the systematic review but is reported to support the interpretation of the results.

2.5. Selection of studies

Of the 727 abstracts screened, 156 duplicates and 554 abstracts were removed due to the exclusion criteria. A manual search of the reference lists of the included studies completed the systematic search and 2 studies were finally included. Reasons for exclusion are shown in the PRISMA flowchart (Fig. 1). The remaining 13 studies were then assessed for eligibility using full-length articles.

2.6. Quality assessment of the included studies

The overall quality of the included studies after consensus between the two assessors (LR and WV) was good (mean score = 81.70 %, standard deviation SD = 7.51, ranging from 62.5 to 87.5 %). A score between 90 % and 75 % was considered good quality (n = 11), and a score between 55 % and 75 % was considered adequate (n = 2). Inter-rater agreement for the global score was 'strong' according to the interpretation of Cohen's kappa score interpretation (mean k = 0.815, SD = 0.134, ranging from 0.5882 to 1). The score and weighted Cohen's kappa associated with the checklist for assessing the quality of quantitative studies are available in the supplementary material.

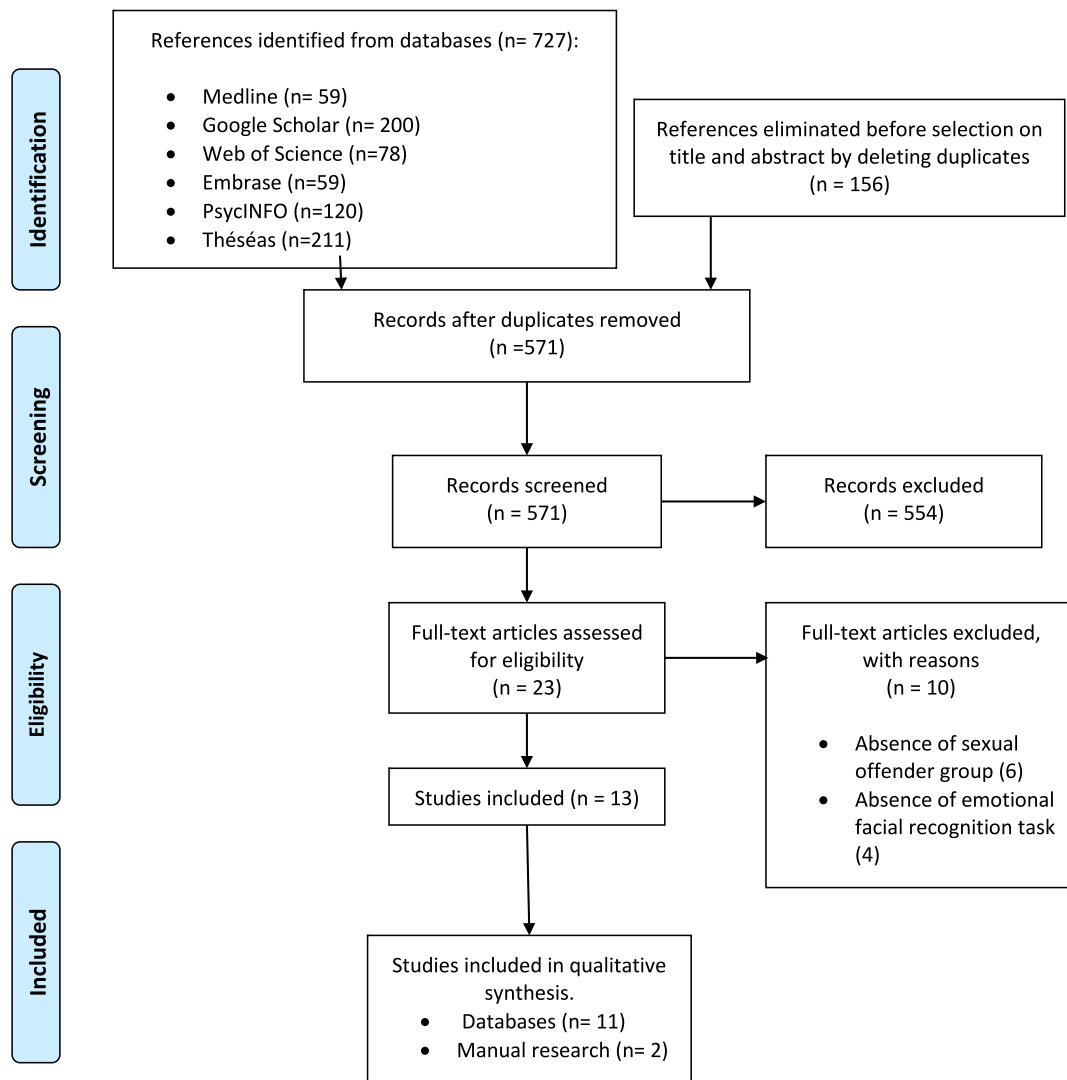


Fig. 1. Flowchart of the PRISMA searching process.

2.7. Screening of sample

Of the 13 studies included in the review, 12 focused on adult populations (Francis & Wolfe, 2008; Gery et al., 2009; Gillespie et al., 2015, 2021; Hudson et al., 1993; Lisak & Ivan, 1995; Oliver et al., 2009; Rodriguez & Ellis, 2018; Seidel et al., 2013; Suchy, Rau, et al., 2009; Wegrzyn et al., 2017) and one on adolescent populations (Racey et al., 2000). Regarding the characteristics of the populations included in the studies, 5 studies included a sample of ICSOs against adults (ASOs (Gillespie et al., 2021; Lisak & Ivan, 1995; Racey et al., 2000; Suchy, Rau, et al., 2009)), 8 studies included a sample of ICSOs against children without a diagnosis of pedophilia (N-PEDs (Francis & Wolfe, 2008; Gery et al., 2009; Gillespie et al., 2021; Hudson et al., 1993; Oliver et al., 2009; Rodriguez & Ellis, 2018; Suchy, Rau, et al., 2009; Wegrzyn et al., 2017)), 1 study included ICSOs with a diagnosis of pedophilia (PEDs (Suchy, Rau, et al., 2009)), 2 studies included a composite sample with N-PEDs and ASOs (Gillespie et al., 2015; Hudson et al., 1993) and 1 study included a composite sample with PEDs and ASOs (Seidel et al., 2013).

2.8. Offenders sample

The total sample across the 13 included studies consists of $n = 321$ male sex offenders ($n = 122$ (ASOs), $n = 177$ (N-PEDs), $n = 22$ (PEDs)) with a mean age of 42.1 years old, $SD = \pm 6.35$. Specifically, when excluding the composite sample of studies without specific demographic information on offenses, the total sample consists of $n = 159$ (N-PEDs) with a mean age of 43.2 years old ± 7.62 and $n = 90$ ASOs with a mean age of 24.1 years old ± 4.1 . One study included a sample composed of only $n = 18$ PED individuals with a mean age of 34.11 ± 7.48 . Regarding the population of origin of the total ICSOs, 206 were prisoners, 17 were recruited from the community, 8 were patients and 7 were institutionalized (3 studies did not report this information). Surprisingly, medication information was only reported as an exclusion criterion (Rodriguez & Ellis, 2018) and as a covariate for emotion accuracy (Seidel et al., 2013) in 2 of the 13 studies. It should be noted that the entire sample is composed of male subjects. This result is in line with studies reported that men make up the vast majority of ICSOs, with 97.8 % being male sex offenders (Cortoni et al., 2017).

2.9. Controls sample

Regarding comparison groups, 9 studies included control groups from the general population (Francis & Wolfe, 2008; Gillespie et al., 2015, 2021; Hudson et al., 1993; Lisak & Ivan, 1995; Seidel et al., 2013; Suchy, Rau, et al., 2009; Wegrzyn et al., 2017), 1 study had a control group of prison guards (Gery et al., 2009), 1 study had a control group of hospital staff (Oliver et al., 2009) and 2 studies had a control group of NSOs (Hudson et al., 1993; Racey et al., 2000). The total control group consisted of $n = 299$ control subjects ($n = 222$ healthy males and $n = 77$ NSOs) with a mean age of 39.02 years ± 15.44 years.

2.10. Screening of participants

Most of the studies included screened ICSOs with a variety of questionnaires on intelligence quotient (IQ and reading comprehension), cognitive abilities (empathy and impulsivity), personality disorders (psychopathy and antisociality), psychiatric disorders (depression, anxiety, alexithymia), social desirability, sexual practices, and preferences. The studies examined the ICSO population and the control sample with regard to these dimensions, which are known to influence emotional processing.

2.11. Intellectual quotient and reading comprehension

In the sample, 7 studies (Hudson et al., 1993; Oliver et al., 2009;

Rodriguez & Ellis, 2018; Seidel et al., 2013; Suchy, Rau, et al., 2009) screened the ICSOs sample for IQ using the Wechsler Abbreviated Scale of Intelligence (WASI (Wechsler, 1999)), the Rasch homogeneous version of Raven's Standard Progressive Matrices (SPM (Van Der Ven & Ellis, 2000)), the Wechsler Adult Intelligence Scale 3rd Edition (WAIS-III (Wechsler, 1997)), the Shipley Institute of Living Scale-Revised (SILS (Zachary & Shipley, 1986)) and the Wechsler Adult Intelligence Scale-Revised (WAIS-R (Wechsler, 1981)). One study (Oliver et al., 2009) reported significantly lower IQ in the N-PEDs sample compared to controls. The remaining ICSO samples were comparable to controls in IQ. In addition, 2 studies (Racey et al., 2000; Suchy, Rau, et al., 2009) reported reading comprehension capacity in the ICSO sample using the Reading Comprehension (RC) subtest of the Peabody Individual Achievement Test (Markwardt, 1997) and the Wide Range Achievement Test-III (WRAT (Wilkinson, 1993)). Poorer performance among the ICSOs compared to controls regarding reading capacity was reported in the study of Suchy, Rau, et al. (2009). In Racey et al.'s (2000) study, the WRAT was used to ensure that ICSOs had a sufficient level to understand the consignments.

2.12. Cognitive abilities - empathy, alexithymia, anger and aggressive behavior

The studies included in the current review often examined empathy in ICSOs in addition to emotional accuracy and sensitivity. To assess empathic capacities, the included studies (Francis & Wolfe, 2008; Gery et al., 2009; Hudson et al., 1993; Lisak & Ivan, 1995; Seidel et al., 2013) used the Interpersonal Reactivity Index (IRI (Davis, 1980)), the Empathy Scale (ES-IVE-7 (Eysenck et al., 1985)), the Empathy Quotient (EQ (Lawrence et al., 2004)) and the Questionnaire Measure of Emotional Empathy (QMEE (Mehrabian & Epstein, 1972)). In the sample of ICSOs included in the review, reduced empathic capacities were reported on these different questionnaires and subscales. Specifically, ICSOs report more personal distress than healthy controls and NSOs based on the IRI-PD subscale (Gery et al., 2009; Seidel et al., 2013). This subscale assesses self-oriented feelings of distress or anxiety in emergency situations or in response to someone else's negative emotions. N-PEDs also displayed a significantly reduced ability to take another person's perspective or to feel empathy for another person, as measured by the IRI-PD and IRI-EC, compared to healthy controls (Francis & Wolfe, 2008; Gery et al., 2009; Hudson et al., 1993). Overall lower affective empathy was also found in ICSOs compared to healthy controls, as measured by the QMEE, EQ and ES-IVE (Gery et al., 2009; Lisak & Ivan, 1995). Regarding empathy, one study (Lisak & Ivan, 1995) also examined alexithymia using the Toronto Alexithymia Scales (TAS (Bagby et al., 1988)) in a sample of ASOs. Alexithymia refers to the ability to verbally identify and express one's emotional states. Compared to healthy controls, no significant result was found in the ASO sample.

To a limited extent, anger and aggression were also assessed in 2 studies (Francis & Wolfe, 2008; Wegrzyn et al., 2017) using the Appetitive and Facilitative Aggression Scale (AFAS) and the State-Trait Anger Expression Inventory-2 (STAXI-2 (Spielberger, 2010)). In both studies, the N-PED samples were more likely to express anger and physically aggressive behavior than the control groups.

2.13. Personality disorders - psychopathy and antisociality

Screening for personality disorders such as psychopathy traits has also been extensively explored in the ICSO samples. Psychopathy is known to have a strong impact on emotional processing (Blair, 2018; De Brito et al., 2021; Jusyte & Schönenberg, 2017; Kosson et al., 2002). It is characterized by a set of affective, relational, and behavioral symptoms that result in a specific pattern of difficulties in the successful adjustment of behavior to social rules and norms. The typological classification models described the existence of two distinct subtypes: primary and secondary psychopathy. In this classification, primary psychopathy is

most commonly reported as a subtype that includes features of emotional hypo-reactivity, a lack of anxiety, and typical abnormalities in attentional functioning, whereas secondary psychopathy groups together emotional hyper-reactivity features and impulsivity. In many ways, this classification reflects current clinical tools' conception and theoretical characterizations of psychopathy. In the current sample of studies, psychopathic personality traits were assessed using the Triarchic Psychopathy Measure (TriPM (Patrick et al., 2009)), the Levenson Self-Report Psychopathy Scale (LRSP (M. R. Levenson et al., 1995)), the Psychopathy Personality Inventory-Revised (PPI-R (Lilienfeld et al., 2005)), and the Psychopathy Check List – Revised (PCL-R (Hare, 2003)).

The PCL-R includes interpersonal-affective items (Factor-1) and impulsive-antisocial items (Factor-2). The LRSP, as the PCL-R, assesses also psychopathy using a two-factor conceptualization.

In the same way, The PPI-R concept is based on two factors, fearless dominance (FD) and self-centered impulsivity (SCI) composed of eight subscales.

A second type of model used to assess psychopathy refers to the separate dimensional constructs of the triarchic model (Patrick et al., 2009). This model integrates three distinct phenotypic constructs: Disinhibition, Boldness and Meanness. The Boldness and Meanness phenotypic constructs are associated with the PCL-R F1 whereas the Disinhibition construct is close to the PCL-R F2 (Wall et al., 2015). The Boldness subscale is also related to the Fearless Dominance (FD) construct, which is indexed by scores on the PPI-R. These scores are an operationalization of a similar construct (Drislane et al., 2014).

In the current sample of studies, significant between-group differences in the psychopathy traits are found between NSOs, ASOs and healthy controls. In terms of scores on the PPI-R for general psychopathy, N-PEDs appear to have greater psychopathic tendencies than PEDs (Suchy, Rau, et al., 2009). Regarding the dimensional constructs, it appears that the group of NSOs used as controls in the included studies tends to have high psychopathic traits, as 2 studies report higher scores on secondary psychopathy compared to ASOs and healthy controls, whereas no difference is reported between ASOs and healthy controls (Gillespie et al., 2015; Wegrzyn et al., 2017). One study reported that ASOs have higher TriPM disinhibition scores than healthy controls (Gillespie et al., 2021). In addition, using the PCL-R, Seidel et al. (2013) reported raw scores in a composite ASOs+PEDs sample (total score: 21.5 (7.23)). In terms of diagnosing psychopathy with the PCL-R, these scores are below the commonly used cut-off (30 in the United States and 25 in Europe). Finally, in one study (Wegrzyn et al., 2017), participants were screened for antisocial personality disorder (ASPD) using the SCID-II (First et al., 1997), with ASOs scoring higher than healthy controls.

2.14. Psychiatric disorders – depression, anxiety and pedophilia

Due to the status of the perpetrators, mostly prisoners, psychiatric screening seems to be a central prerequisite, especially when studying emotional processing. Depression and anxiety were the most investigated disorders in the current sample of studies. Depression was assessed using the Depression, Anxiety, and Stress Scales (DASS (Lovibond & Lovibond, 1995)), the Beck Depression Inventory (BDI (Beck et al., 1974)), and the Brief Symptom Inventory (BSI (Derogatis, 1975)). Of the included studies, 2 report higher depression scores in ASOs than in controls (Gery et al., 2009; Rodriguez & Ellis, 2018) and 1 finds no difference but compares N-PEDs with NSOs individuals (Francis & Wolfe, 2008).

Anxiety was also assessed using the State-Trait Anxiety Inventory (STAI-Y (Spielberger, 1983)), the Liebowitz Social Anxiety Scale (LSAS (Liebowitz, 1987)), the Brief Symptom Inventory (BSI (Derogatis, 1975)) and the Depression, Anxiety, and Stress Scales (DASS (Lovibond & Lovibond, 1995)). Based on the included studies, 1 sample showed significantly higher anxiety scores in the ASO group than in the control group (Gery et al., 2009), while the other 3 samples were not statistically different (Francis & Wolfe, 2008; Gillespie et al., 2021; Rodriguez &

Ellis, 2018).

It should be noted that only 2 studies (Seidel et al., 2013; Suchy, Rau, et al., 2009) reported the diagnosis of pedophilia, which is covered by the DSM-5 (American Psychiatric Association et al., 2013).

2.15. Social desirability, sexual practices and preferences

Social desirability, which refers to the tendency of individuals to present themselves in a generally favorable manner, was assessed in 3 studies using the Marlowe-Crowne Form-C (MC-C (Reynolds, 1982)) and the Social Desirability Scale (SDS (Crowne & Marlowe, 1960)). The 3 studies do not report significantly greater social desirability in ICSO samples than in control groups (Gery et al., 2009; Gillespie et al., 2015, 2021).

Marginally, sexual practices and preferences were also explored in 1 study (Lisak & Ivan, 1995) using a battery of questionnaires including the Bem Sex Role Inventory (BSRI (Bem, 1981)) and the Rape Myths Acceptance Scale (RMA (Burt, 1980)). The results showed no difference on the BSRI scale. However, ASOs reported significantly more acceptance of rape than healthy controls on the RMA scale.

2.16. Screening of paradigm

Experimental paradigms used to assess emotion recognition ability are mainly of the facial affect recognition type (Ekman et al., 1971). Participants were generally asked to categorize emotional faces into emotion categories. Of the studies included in the analysis, 3 studies asked participants to respond as quickly as possible (Gillespie et al., 2021; Rodriguez & Ellis, 2018; Suchy, Rau, et al., 2009) and 1 study primed the emotional faces with either a written sexual or neutral phrase (Oliver et al., 2009). The emotional faces used in the studies generally expressed basic emotions such as neutral, anger, disgust, fear, happiness, sadness and surprise. One study used atypical emotional stimuli expressing "interest, joy, contentment, passive, sad, cautious-shy, shame-guilt, disgust-dislike, anger, distress, fear, and other" (Francis & Wolfe, 2008). Almost all included studies used male and female faces and all stimuli were selected in standardized batteries (Table 1). Two studies used emotional faces of children (Francis & Wolfe, 2008; Racey et al., 2000). Most of the studies included in the review used pictures of emotional faces and one study used morphed faces (Gillespie et al., 2021). In addition, one study used a gradient of emotional intensity as an independent variable (Gillespie et al., 2015).

Regarding the outcome used in the included studies to test differences between groups, accuracy and sensitivity were the variables that integrated the experimental paradigm as a dependent variable. Accuracy to emotional faces corresponds to the proportion of correct responses per emotional categories presented during the task. Sensitivity to emotional faces corresponds to accuracy analyzed according to the principles of signal detection theory (Green & Swets, 1966), where increasing values of d' refer to greater sensitivity to a given emotional face category.

2.17. Characteristics of the victims

Given that victim characteristics are an important source of information on the etiology of sexual offending, the included studies report very little information on the victim's age, sex and parentage with the offender. Only one study (Oliver et al., 2009) provided full information on age '16 years and younger', sex 'the majority of offenders had offended only against females ($n = 20$), although 3 offended against both females and males' and the parentage '14 child sexual abusers offended within their families, 9 offended outside of their families, and of these, 2 offended both within and outside of their families'. The remains studies report partial information about the age of the victim without information regarding sex and parentage. Three studies reported information on the age of the victim, including ICSOs against a person under the age of 16 (Gillespie

Table 1
Characteristics of included studies.

Reference	Sample test	Status	Offense	Age	Control	Task	Battery	Results	Quality score
Gillespie et al., 2021	11 ASOs 11 N-PEDs	Prisoner	Contact sexual offense	36.2 ± 11.1	25 healthy	Morphed recognition	NimStim	No difference with control group	87.5 %
Rodriguez & Ellis, 2018	34 N-PEDs	Prisoner and community-based sex offender	Contact sexual offense	62.3 ± 6.6	32 NSO	FEEST	Ekman	No difference with NSO	83.33 %
Wegrzyn et al., 2017	15 N-PEDs	Prisoner	Contact sexual offense	42.07 ± 8.87	17 healthy	Recognition	NimStim	No difference with control group ↓ Sexual offenders showed reduced sensitivity to emotion compared to NSO and control group	87.5 %
Gillespie et al., 2015	13 (ASOs, N-PEDs)	Prisoner	Contact sexual offense	50.05 ± 5.09	19 healthy 16 NSO	Recognition	NimStim	No difference with control group	83.33 %
Seidel et al., 2013	Na (ASOs, PEDs)	Prisoner	Contact, Exhibitionism and Unspecified	Na	Na NSO	Recognition	Gur et al., 2002	No difference with control group	62.5 %
Gery et al., 2009	10 N-PEDs	Prisoner	Contact sexual offense	38.01 ± 3.81	10 healthy (prison staff)	FAR	Ekman	↓ Sexual offenders showed reduced accuracy to emotion	87.5 %
Suchy, Rau, et al., 2009	39 ASOs	Na	Na	32.41 ± 7.09	10 healthy	FAR	Ekman	Ns tendency to reduced accuracy than control group.	87.5 %
Suchy, Whittaker, et al., 2009	23 N-PEDs 18 PEDs	Prisoner	Contact sexual offense	31.0 ± 6.61 34.11 ± 7.48	21 healthy	FAR	Ekman	↓ Sexual offenders showed reduced accuracy to emotion than healthy and PED No difference for PED with control group	70.83 %
Francis & Wolfe, 2008	24 N-PEDs	Na	Contact sexual offense	38.44 ± 7.54	32 NSO	IFEEL	Butterfield & Ridgeway, 1993	↓ Sexual offenders showed reduced accuracy to emotion ^a	83.33 %
Oliver et al., 2009	23 N-PEDs	16 prisoners and 7 Institutionalized	Contact sexual offense	45.8 ± Na	26 healthy (hospital staff)	Priming + Recognition	Ekman	No difference with control group	87.5 %
Racey et al., 2000	36 ASOs	28 Prisoners and 8 Patients	Contact sexual offense	15.7 ± 1.10	8 NSO	Recognition	Nowicki & Duke, 1994 ^b	↓ Sexual offenders showed reduced accuracy to emotion ↓ Sexual offenders showed reduced accuracy to male emotion	79.17 %
Lisak & Ivan, 1995	15 ASOs	Community	Contact sexual offense	Na	15 healthy	FAR	Ekman	↓ ICSO showed reduced accuracy to emotion than NSO	83.33 %
Hudson et al., 1993	21(10 ASOs 11 N-PEDs) 20 N-PEDs	Prisoner Na	Contact sexual offense	Na 44.7 ± 12.3	21 NSO 20 healthy	FAR Recognition	Ekman O'Sullivan & Guilford, 1976 ^c	↓ N-PED showed reduced accuracy to emotion compared to control group	79.17 %

Note: ASOs (individuals convicted of sexual offenses again adult), PEDs (pedophile), N-PEDs (ICSOs non pedophile), NSOs (nonsexual offender), FEEST (Facial Expression of Emotion: Stimuli and Tests (Calder et al., 2002), FAR (facial affect recognition (Ekman et al., 1971)).

^a N-PEDs (abusive fathers) gave more responses falling in the Anger, Fear, and Other categories, and fewer falling in the Interest category.

^b Receptive Facial Expressions Subtest.

^c The Emotional Expression subtest.

et al., 2021), against children under the age of 13 (Suchy, Rau, et al., 2009) and against children with a mean age of 10.8 years (range 6–14 years; Hudson et al., 1993). One study reported information on victim sex and parentage, with 53 % being male and 21 % being incest (Rodriguez & Ellis, 2018). Finally, one study reported information on age and parentage, including ICSOs who physically abused a biological or stepchild under the age of 12 years (Francis & Wolfe, 2008).

3. Results

The quality assessment of the sample of studies included in the review showed that, overall, the studies were of high quality. Additional information on Kmet scoring can be found in the supplementary

material.

Of the studies included in the current systematic review, 9 reported significantly reduced emotional recognition abilities in the overall sex offenders' population compared with controls or NSOs, 1 reported a non-significant trend, and 7 reported no significant results. Strikingly, most studies including ASOs report significant findings with reduced facial emotion recognition capacities in offenders (7 out of 9 included samples), whereas studies including N-PEDs and PEDs report no significant difference between offenders and controls (6 out of 12 samples report no significant findings). In terms of available demographic data, the N-PEDs sample differs significantly from the ASO group in terms of mean age, with a mean deviation of 19 years. The same difference is also reported in studies included in the current review where ASOs and NSOs

were younger than N-PED (Gery et al., 2009; Gillespie et al., 2015, 2021; Hudson et al., 1993).

Interestingly, 4 out of the 5 studies (Francis & Wolfe, 2008; Gery et al., 2009; Hudson et al., 1993; Lisak & Ivan, 1995) reporting a significant reduction in empathic capacities among ICSOs show significantly reduced emotional accuracy compared to healthy controls. The study by Seidel et al. (2013), which also reports reduced empathic capacities in the offender group (NSOs+ASOs+PEDs) compared to healthy controls, has the feature of using NSOs as a control group for PEDs in the emotional accuracy task. This design feature may partly explain why no significant result is found between the two groups of offenders.

3.1. Accuracy and sensitivity to emotion in sexual offenders

In the study by Gillespie et al. (2021), a sample composed of 11 ASOs male prisoners was compared to 25 healthy controls and 11 N-PEDs in a morphed emotional recognition task. Participants were asked to categorize the morphed emotional faces as quickly and accurately as possible. No significant differences in categorization accuracy were found between the three groups. It is important to note that the control group in this study showed pronounced impairments in the recognition task, with more errors in categorizing fearful emotional faces compared to other healthy populations tested on the same battery of stimuli. The inaccuracy of the control group in the task may be a major limitation regarding the absence of a group effect in the emotional recognition task. Indeed, the results on emotional accuracy reported by Gillespie et al. (2021) contrast with other studies that have included a sample of ASOs. For example, in the study of Racey et al. (2000), a sample of 36 ASOs recruited from prisons and mental health centers and 8 NSOs were asked to categorize the emotion displayed on slides of children's faces. The results showed a significantly reduced categorization accuracy for emotional faces in the ASOs group, with more errors compared to NSOs. Similarly, Lisak and Ivan (1995), in a prison sample of 15 ASOs compared with 15 healthy controls, reported a significantly reduced categorization accuracy in the ASOs group. Interestingly, this effect was restricted to emotional male faces in the subgroup of violent ASOs compared to non-violent ASOs and healthy controls. In addition, Suchy, Rau, et al. (2009) report a non-significant trend towards reduced categorization accuracy in a sample of 39 ASOs compared to 10 healthy controls who were instructed to respond as quickly as possible to classify emotional faces.

The same pattern of reduced sensitivity and categorization accuracy is also reported by studies using composite samples of ASOs. The study by Gillespie et al. (2015) reported a slight reduction in emotional sensitivity in ASOs (ICSOs against adults and children) compared to controls. Furthermore, the results showed that the reduction in sensitivity interacted with gender and emotion with ASOs showing a specific impairment for fearful female faces. The deficit in emotion recognition also appears to be found when comparing ASOs to NSOs, as the composite sample of ASOs from the Hudson et al. (1993) study showed less sensitivity and accuracy in emotion recognition than NSOs. However, this effect is not replicated in the Seidel et al. (2013) study, where an unspecified composite group of ICSOs showed non-significant differences in emotional recognition accuracy compared to NSOs. It is important to note that the composition of the sample of ICSOs in the study by Seidel et al. (2013) is not reported, as no data is provided on the proportion of adult and child ICSOs that make up the sample. Consequently, the interpretation of these results in terms of sample composition remains uncertain.

3.2. Accuracy and sensitivity to emotion in N-PED offenders

Regarding the current findings on accuracy and sensitivity to emotions in the N-PEDs sample, there is no clear pattern across studies, with 4 studies (Francis & Wolfe, 2008; Gery et al., 2009; Hudson et al., 1993; Suchy, Rau, et al., 2009) reporting a significant reduction in emotional

sensitivity and accuracy to emotions, while the other 4 (Gillespie et al., 2021; Oliver et al., 2009; Rodriguez & Ellis, 2018; Wegrzyn et al., 2017) show no difference with controls. Even when considering the composite sample including N-PEDs, there is no trend, with 1 reporting no difference (Gillespie et al., 2015) and 2 reporting a difference from controls (Hudson et al., 1993; Seidel et al., 2013).

However, the medical condition between N-PED samples differs significantly. In fact, of the 4 studies that reported significant deficits in the N-PEDs sample, 2 studies reported significant differences in depression rates between the N-PEDs sample and the control group (Francis & Wolfe, 2008; Gery et al., 2009), while of the 4 studies that reported no significant findings, 2 studies reported the same level of depression rates between the N-PEDs sample and the control group (Rodriguez & Ellis, 2018; Wegrzyn et al., 2017). Given that depression is known to have a strong impact on emotional recognition (Krause et al., 2021), this medical condition in the N-PEDs sample may have contributed to the heterogeneous results observed in these studies. In addition, N-PEDs appeared to be more prone to psychopathy (Suchy, Rau, et al., 2009) and anger (Francis & Wolfe, 2008) than PEDs.

Particular heterogeneity remains in terms of sample composition, as the sample of N-PEDs included by Gillespie et al. (2021) included 4 individuals previously convicted of sexual offenses against adults, and 2 studies (Francis & Wolfe, 2008; Oliver et al., 2009) included a subgroup composed of individuals convicted of incest.

3.3. Accuracy and sensitivity to emotion in PED offenders

In the study of Suchy, Rau, et al. (2009), no significant results between PEDs and control groups were reported regarding the accuracy to emotional faces. The inclusion of only one study investigating emotional skills in PEDs is symptomatic of the difficulties in obtaining a homogeneous sample of sex offenders or collecting information on the medical condition of sex offenders. It appears that the assessment of pedophilia is not systematized in the ICSOs or is not accessible or reported in the studies. Of the 199 individuals included in the current analysis who were convicted of sexual offenses against children, only 22 individuals were reported to meet the DSM criteria for a diagnosis of pedophilia. Therefore, based on the currently available scientific literature, it is not possible to draw a trend in PED individuals with regard to emotional recognition abilities.

3.4. Accuracy and sensitivity to specific emotion

Specific categories of emotional faces may have an impact on the overall ability to categorize or recognize emotions as measured in the studies. In the current sample of studies, 5 of the 7 included studies reporting significant results provide results for specific emotional faces. Of these studies, ICSOs and NSOs showed reduced sensitivity to disgust, fear and anger emotions compared to controls (Gillespie et al., 2015). A trend towards reduced sensitivity to disgust was also observed in ICSOs compared to NSOs. ASOs were less accurate in recognizing expressions of disgust and fear compared to NSOs and healthy groups (Gery et al., 2009). ASOs were also more likely to categorize faces expressing fear as surprise emotion. In the N-PEDs sample, Suchy, Rau, et al. (2009) reported that N-PEDs showed poorer recognition of facial disgust and were more likely to misinterpret happiness and anger. Similarly, Francis and Wolfe (2008) found that N-PEDs (abusive fathers) were less accurate for emotional faces of disgust. The study by Hudson et al. (1993) did not report significant results for sensitivity and false alarms per emotional category. Regarding the categories of emotion, further studies are needed to investigate whether one type of emotion, among others, would make it possible to discriminate between the different population groups.

3.5. Effect of psychiatric and personality disorder on emotion recognition accuracy and sensitivity

Numerous studies have already highlighted the link between socio-affective disorders, such as psychopathy, and emotional processing (Dolan & Fullam, 2006; Vallet et al., 2020). However, in the current sample of studies, psychopathy scores are rarely included as a covariate in statistical models examining emotion recognition accuracy. Only one study reported psychopathy scores in relation to individual emotion accuracy. The results showed significant correlations, with higher TriPM boldness being associated with poorer recognition of sad faces. In addition, higher LSAS scores were associated with poorer recognition of fearful faces (Gillespie et al., 2021). The remaining studies only analyze psychopathy or anxiety scores as a main effect between group variables.

4. Discussion

We designed this systematic review specifically to address the question of the capacity for emotional recognition in ICSOs, taking into account the typologies that distinguish ICSOs against adults from those against children. Using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers evaluation tool, we found that the overall quality of the included studies was good, ranging from 62.5 to 87.5 %, with only two studies below the cut-off for good quality (< 75 %). These results may appear to be overestimates given the limited sample sizes reported in the included studies, and a more conservative approach should have been applied. However, although numerous tools are available to assess the quality of studies included in reviews and meta-analysis (Delavari et al., 2023), the tool we used has the advantage of providing a score with high inter-rater reliability, being applicable to non-randomized studies without clinical outcomes, and being widely used in several other publications and fields increasing the level of comparability between the studies included in the current review, and between the studies included in numerous other reviews and meta-analyses. Beyond this limitation, the current review highlights the lack of homogeneity in studies investigating emotional processing in ICSOs. This heterogeneity is mainly due to the diversity of populations constituting the sample of offenders.

4.1. Psychiatric illness in sexual offenders

One of the main findings of the current review is the lack of psychiatric screening or limited information on diagnoses of paraphilias, such as pedophilia, in studies examining emotional functioning in the ICSO population. Of the studies included in the current review, only one included a sample of ICSOs with a reported diagnosis of pedophilia (Suchy, Rau, et al., 2009). The other study that included ICSOs with a diagnosis of pedophilia reported findings on a composite sample of ICSOs (on adults and children) and did not provide a specific analysis of the pedophilic population (Seidel et al., 2013). In the current review, 10 samples of N-PEDs are reported in the included study without mention of a paraphilia diagnosis. Given that 50 % of N-PEDs report a pedophilic preference (Gerwinn et al., 2018; Whitaker et al., 2008), it is clear that individuals with pedophilia are part of the N-PEDs sample reported in these studies. This situation is one of the major confounding factors in the current field of research. Individuals with pedophilia represent a specific subgroup that differs from N-PEDs and ASOs by the two main characteristics of (1) sexual fantasies/urges/behaviors regarding prepubescent children, and (2) acting on or being negatively affected by these experiences. In addition, the aetiological pathways leading to pedophilia are dissociated from those leading to aggressive or sexual offenses against children. The literature identifies an environmental and a biological pathway leading to pedophilia. The first one hypothesized that the mechanisms involved in pedophilia are environmental and include some psychological factors. The second one is a framework of etiological mechanisms associated with sexual preference for

prepubescent children and includes biological, neurological and genetic factors (Gannon, 2021). Indeed, studies using structural MRI to define regions with grey matter deficits in pedophilia and their functional connectivity have reported that morphologically altered areas in pedophilia are functionally linked primarily to areas important for sexual responsiveness (Poepl et al., 2015). Two structures are also frequently reported in imaging studies: the frontal lobe, including the orbitofrontal and left and right dorsolateral prefrontal cortex, due to their involvement in impulse control, and the temporal-limbic structures, which have been reported as putative markers of pedophilia due to their involvement in hypersexuality (Mendez et al., 2000; Tenbergen et al., 2015).

The importance of sample composition regarding the heterogeneity that can be introduced into the results can be demonstrated by studies that report interactions between groups of ASOs and sensitivity or accuracy in emotional recognition. For example, in the study by Lisak and Ivan (1995), the sample of violent ASOs on adults reported specific deficits for emotional male faces, whereas, in the study by Gillespie et al. (2015), the sample of ASOs composed of ICSOs on adults and children reported a specific deficit for emotional female faces.

This example highlights another limitation in this area of research identified in the current review; the characteristics of victims are generally not reported in the studies. However, the age, sex and relationship of the victims to the ICSOs are relevant information for the typological classification. In the current sample of studies, the age range of victims varied from 6 to 16 years. Even if the aggressors share a common attractiveness to children and a presumed common aetiological profile, a major limitation remains. A 6-year-old child has no signs of sexual maturity, whereas a 16-year-old child is in puberty (Parent et al., 2003). At a minimum, information on the age and sex of victims should be reported. At best, specific groups should be formed according to the following classification (Seto, 2017): nepiophilia (attraction to young children), hebephilia (attraction to pubescent children), ephiphilia (attraction to post-pubescent children).

Other psychiatric comorbidities may affect the ability of the ICSOs to recognize emotions. The most common of these are major depressive disorder (MDD) and anxiety disorders, including PTSD. According to available epidemiological data on prisoners, the prevalence of MDD among convicted and incarcerated prisoners ranges from 23 % to 51 % of the total prison population (Baranyi et al., 2022; Majekodunmi et al., 2017; Naidoo & Mkize, 2012). Therefore, MDD is a potential confounding factor when studying emotional processing in the prison population. In a recent meta-analysis (Krause et al., 2021), individuals with MDD and severe symptom levels were characterized as less accurate in facial expression recognition compared to individuals with moderate symptom levels. Particularly, individuals with MDD were less accurate at recognizing happy facial expressions compared to sad and disgusted facial expressions.

In the included studies, anxiety disorder is the second most commonly reported psychiatric comorbidity. Very few studies have looked at the anxiety trait in the general incarcerated population, or DSM diagnoses of anxiety disorders. The partial data that are available on the incarcerated population report a prevalence of this disorder between 36 % and 77 % (Butler et al., 2005; Osasona & Koleoso, 2015). Anxiety disorders appear to have a specific effect on emotion recognition, depending on the population and the emotion expressed. Meta-analyses examining emotion recognition in patients with anxiety disorders have reported significant impairments in emotion recognition compared to healthy controls (Baez et al., 2023; Demenescu et al., 2010). Anxiety disorders also have a specific impact on emotion recognition skills, depending on the emotion expressed. For example, a previous study reported that participants with anxiety disorders recognized fearful expressions significantly better than healthy controls (Surcinelli et al., 2006).

The impact of psychiatric illness on incarcerated ICSOs has further implications for studies of emotional processing. Prisoners are generally treated with tailored pharmacological care for psychiatric disorders

such as depression or anxiety. Most antidepressants in current clinical use are selective serotonin reuptake inhibitors (SSRIs). These medications, which target the activity of serotonin (5-HT), are known to improve performance on emotion recognition tasks (Harmer et al., 2013; Merens et al., 2007).

4.2. Personality disorders

The second element to emerge from the current literature review relates to the potential confounding factor of personality disorders and measures of emotional accuracy and sensitivity in samples of ICSOs. The prevalence of psychopathy reported in the literature varies between 10 % and 15 % in N-PED and PED samples. In ASO samples, the prevalence of psychopathy rises to 50 % (Gretton et al., 2001). Psychopathy therefore appears to be associated with sexual assault. However, there is also strong evidence that psychopathy is associated with impaired emotion recognition, particularly the recognition of negative emotional faces such as fearful, disgusted and sad expressions (Blair, 2018; De Brito et al., 2021; Jusyte & Schönberg, 2017; Kosson et al., 2002).

Psychopathy in sexual offenders is therefore a fundamental aspect to be assessed when evaluating emotion recognition abilities. Models based on a typological or dimensional concept of psychopathy highlight the heterogeneity among psychopathic individuals and the differences between individuals in terms of emotional processing. The modern concept, such as the higher-order dimensional structure of psychopathy assessed by the PCL-R has two higher-order dimensions, an interpersonal-affective dimension (Factor 1) and an impulsive-antisocial dimension (Factor 2). Individuals with high scores on the affective factor of psychopathy were not less accurate at recognizing emotional faces. A previous meta-analysis reported a significant deficit for fearful faces, but not for other emotions. The psychopathy dimension also seems to be related to the typology of the ICSOs. Indeed, ICSOs with child and adult victims are reported to score higher on the impulsive-antisocial and interpersonal-affective dimensions than N-PEDs (Brown et al., 2015).

4.3. Additional results to emotional accuracy and sensitivity

Findings that complement those on emotional accuracy and sensitivity to emotional faces, such as behavioral, cognitive, or physiological measures, may be of interest to inform general emotion processing in ICSOs.

In addition to emotional accuracy, Gillespie et al. (2021) also examined the eye scan paths behavior through the time spent looking at different regions of interest on the emotional faces. The findings indicated a significant decrease in the amount of time N-PEDs spent gazing at the eyes of emotional faces compared to ASOs. Given that gaze analysis plays an important role in emotion recognition, it is possible that ASOs in Gillespie et al. (2021) needed more time than N-PEDs to identify emotions, but still had enough time to match N-PEDs accuracy. Furthermore, these differences in eye scan paths suggest that, even when differences in accuracy of emotion recognition cannot be found between ASOs and N-PEDs, these two groups do not examine emotional faces similarly. Therefore, it seems relevant to draw attention in future studies on how different ICSOs' subgroups assess emotions rather than focusing on accuracy. The relevance of eye-tracking should also be considered for PEDs populations, as previous studies have already emphasized that PEDs exhibit a higher number and duration of fixations on children compared to control groups (Hall et al., 2015; Vásquez Amézquita et al., 2019). Additionally, PED showed a quicker initial eye movement response to child stimuli compared to adult stimuli (Fromberger et al., 2013). These findings indicate that the visual scanning pattern can serve as a relevant indicator of automatic and controlled attention processes in individuals with a sexual interest in children.

The relationship between emotion recognition skills and other cognitive variables was explored by Suchy, Rau, et al. (2009). The results showed a relationship between reading comprehension and

emotion recognition. In this study, the sample of ASOs with reduced emotion recognition abilities also showed reduced ability in reading comprehension. Similarly, a relationship between prosody perception and emotional recognition was investigated in the study by Suchy, Rau, et al. (2009). No significant association was found between these variables, but PEDs and N-PEDs performed worse than healthy controls in recognizing prosodic sadness. Finally, physiological variables have also been investigated in relation to emotional recognition. In the study by Seidel et al. (2013), skin conductance showed significantly reduced responses in the offender group compared to the control group only when fearful faces were presented.

4.4. Implications of the review for practice in future studies

From the current review of the literature investigating emotion recognition abilities in ICSOs, it appears that the heterogeneity of the offenders included in the studies is a strong limitation. With regard to comorbidity, personality disorders, cognitive abilities, medication, victim status and characteristics, the screening of ICSOs needs to be systematized in order to provide a meta-understanding of the phenomenon and to form new avenues for future remedial action. Based on the studies included in the current review, we propose a systematic offender screening as a standard assessment for future research involving ICSOs. We have also provided a list of standard instruments for each assessment. In addition, given the high prevalence of early childhood trauma in sexual offenders (Levenson et al., 2016) and its strong impact on emotional recognition skills (Bérubé et al., 2023), we propose the inclusion of the Childhood Trauma Questionnaire (Bernstein et al., 1998) in the screening battery.

1) Screening for psychiatric illness:

Pedophilia: DSM-5

Chronophilia: Seto, 2017

Depression: DSM-5 and evaluation of depression severity with the self-reported Beck Depression Inventory (BDI (Beck et al., 2024), the Montgomery-Asberg Depression Rating Scale (MADRS (Montgomery & Åsberg, 1979))).

Anxiety: DSM-5 and evaluation of the severity with the State-Trait Anxiety Inventory (STAI-Y(Spielberger, 1983)), the Liebowitz Social Anxiety Scale (LSAS (Liebowitz, 1987))

2) Screening for personality disorder:

Psychopathy and antisocial behavior: The Triarchic Psychopathy Measure (TriPM (Patrick et al., 2009)), the Levenson Self-Report Psychopathy Scale (LRSP (Levenson et al., 1995)), the Psychopathy Personality Inventory-Revised (PPI-R (Lilienfeld et al., 2005)), and the Psychopathy Check List – Revised (PCL-R (Hare, 2003)).

3) Screening for cognition abilities:

Intellectual quotient: The Wechsler Abbreviated Scale of Intelligence (WASI (Wechsler, 1999)), the Rasch homogeneous version of Raven's standard progressive matrices (SPM (Van Der Ven & Ellis, 2000)), the Wechsler Adult Intelligence Scale 3rd Edition (WAIS-III (Wechsler, 1997)), Shipley Institute of Living Scale-Revised (SILS (Zachary & Shipley, 1986)), the Wechsler Adult Intelligence Scale-Revised (WAIS-R (Wechsler, 1981))

Empathy: The Interpersonal Reactivity Index (IRI (Davis, 1980)), the Empathy Scale (ES-IVE-7 (Eysenck et al., 1985), the Empathy Quotient (EQ (Lawrence et al., 2004)) and the Questionnaire Measure of Emotional Empathy (QMEE (Mehrabian & Epstein, 1972))

Reading comprehension: The Peabody Individual Achievement Test (Markwardt, 1997), the Wide Range Achievement Test-III (WRAT (Wilkinson, 1993))

Handedness: Edinburgh inventory (Oldfield, 1971)

4) Screening for medication:

IRSS: Yes or No

Benzodiazepine: Yes or No

5) Screening for status:

Incarcerated: Yes or No

Repeated offender: Yes or No

Outpatient or inpatient.

6) Screening for Victims Characteristics:

Age, sex, and relationship of the victims to the offender.

7) Screening for childhood trauma:

The Childhood Trauma Questionnaire (CTQ (Bernstein et al., 1998))

8) Analysis

As far as possible, the psychometric score and rating on clinical tools should integrate the statistical models in addition to the main outcome of accuracy or sensitivity in emotion recognition.

5. Conclusions

Based on the current review, it remains difficult to conclude on the putative difference in facial emotion recognition abilities of ICSOs in adults (ASOs) and children (PEDs and N-PEDs) although most studies including ASOs report a significant reduction in facial emotion recognition abilities. The main limitation remains the non-discrimination of ASOs and N-PEDs in the sample composition and the lack of pedophilia diagnoses in the N-PED sample. In addition, personality disorders and medications that directly affect emotional processing are not systematically assessed in the ICSO sample. In addition, individuals convicted of a child exploitation material offense or self-declared pedophilia represent 2 subgroups that are rarely explored in the scientific literature exploring emotional processing. In the current review, only one study included a subgroup based on child exploitation material offenses (Rodríguez & Ellis, 2018). With regard to non-offending pedophiles who are sexually attracted to children but have no known sexual contact with children, these individuals remain a difficult population to reach and are rarely included in experimental studies. Most studies of non-offending pedophiles have used online questionnaires (Cantor & McPhail, 2016). In a self-selected sample of 8718 German-speaking adult men recruited online, 2.4 % reported having sexual fantasies involving children (Dombert et al., 2016). These studies collect responses anonymously, preventing any possibility of sample composition from the responses collected.

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CRedit authorship contribution statement

Jordan Virolle: Writing – original draft, Methodology. **Sabine Mouchet:** Writing – review & editing. **Lilas Robert:** Writing – review & editing, Methodology. **Charles Denis:** Writing – review & editing. **Jérôme Brunelin:** Writing – review & editing. **William Vallet:** Writing – review & editing, Writing – original draft, Supervision, Methodology.

Declaration of competing interest

The authors declare no financial/personal interest or belief that could affect their objectivity.

Data availability

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Appendix A. Supplementary data

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