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# COMPARISON OF SOCIO-AFFECTIVE PROCESSING ACROSS SUBTYPES OF ANTISOCIAL PSYCHOPATHOLOGY

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Antisocial behavior is characterized by a wide variety of actions that violate social norms. These actions range from relatively minor behaviors, such as lying or intimidating others, to more disruptive behaviors, such as selling drugs or physically assaulting others. Individuals chronically engaging in antisocial behaviors are at risk for a variety of adverse life outcomes, such as suicide, school dropout, unemployment, psychopathology, substance abuse, and incarceration (Caspi et al. 1998; Fergusson et al. 2005). Moreover, estimates of the financial impact of antisocial behavior (e.g., the cost of law enforcement, incarceration, property damage, loss of wages, healthcare) on society exceeds $2 trillion annually in the United States alone (Kiehl and Hoffman 2011). Given the profound personal, economic, and social impacts of antisocial behavior, determining which individuals are at the greatest risk for chronic engagement in these behaviors is essential.

Of note, research has demonstrated that there are two clinically meaningful subtypes of individuals engaging in high levels of antisocial behavior (Hyde et al. 2013; Viding et al. 2012; Drislane and Patrick 2013; Brennan et al. 2017). The first subtype we term "psychopathy"; these individuals are infamous for their prolific antisocial behavior and their ability to be interpersonally manipulative and charming. They engage in elaborate cons, callously assault others, impulsively look for adventures, and chronically commit antisocial acts in order to obtain their goals (e.g., money, power, thrills). For adults, in both clinical and research settings, the gold standard assessment of psychopathy is Hare's Psychopathy Checklist-Revised (PCL-R; Hare 2003), an interview-based measure of the four characteristics (interpersonal, affective, impulsive, and antisocial) of this disorder. The PCL-R rates individuals on 20 different items that cut across these four characteristics on a scale from 0 to 2 for each item. In the United States, individuals with a score of 30 or above are diagnosed with psychopathy. Notably, psychopathy impacts approximately 15–25% of incarcerated adult, male offenders, but only 1% of the general population (Hare 2006; Hare and Neumann 2008; Hare 2003).

Moreover, there is a growing body of research demonstrating that the interpersonal, affective, and behavioral characteristics of psychopathy emerge during childhood and often persist throughout development (Raine et al. 2010; Blair et al. 2006; Gao et al., 2009). Researchers theorize that, in youth, the presence of callous-unemotional traits (CU; e.g., callous use of others, a lack of remorse or guilt, and an absence of empathy; in DSM-5 a specifier of conduct disorder called "limited prosocial emotions"), grandiose narcissism, and impulsive-antisocial traits, increase risk of developing psychopathy (Frick et al. 2014; Frick and White 2008; Frogner et al. 2016; Viding et al. 2012; Viding et al.

2009;Viding and McCrory 2015;Viding and McCrory 2018). Similar to adults with psychopathy, CU traits are present in, on average, 9–25% of youth offenders (Frick et al. 2014; Frick and White 2008; Frogner et al. 2016).

The second subtype, which we term "antisocial-only," are defined by their chronic impulsive, irresponsible, reactively aggressive, and antisocial behavior. Individuals in this subtype are typically assessed using formal diagnostic criteria or through personality trait models. First, individuals in this subtype can be identified diagnostically by assessing children for conduct disorder (CD; in the absence of CU) or adults for antisocial personality disorder (APD; in the absence of psychopathy) using the diagnostic criteria put forth by the DSM. According to the DSM-5, youth with CD are characterized by a chronic pattern of behaviors that violate the rights of others or societal norms in several ways (e.g., aggression to people or animals, destruction of property, theft, rule violations). APD is a continuation of CD, requiring this pattern of impulsive, irresponsible, and antisocial behaviors that began in childhood to persist into adulthood (American Psychiatric Association 2013). Second, individuals in this subtype can be identified as individuals high on a measure of latent trait externalizing. Externalizing is conceptualized as a continuous, heritable predisposition to engage in maladaptive, disinhibitory behaviors (e.g., crimes, substance abuse; Gorenstein and Newman 1980; Iacono et al. 2008). Assessments of latent trait externalizing typically either tap the common variance associated with symptoms of CD, APD, and substance use disorders (Iacono et al. 2008), or use personality/temperament measures to assess predisposing personality traits (e.g., constraint, impulsivity, negative emotionality; Krueger et al. 2007; Patrick et al. 2002). In terms of prevalence, estimates suggest that between 50–66% of male prisoners meet criteria for APD, more than double the prevalence of psychopathy (Moran 1999; Fazel and Danesh, 2002).

Both of these subtypes of individuals are known to act on impulse and engage in antisocial behaviors. Perhaps, though, one aspect of their behavior that distinguishes them from other antisocial individuals is the presence of significant interpersonal difficulties (e.g., callousness, hostility, affective idiosyncrasies) that impedes their ability to form and maintain, meaningful, long-term relationships. The combination of chronic antisocial behavior and interpersonal dysfunction produces suffering, for the individual, for their family members, for their community, and for society at large. Interestingly, despite similarities in behavior, a growing body of research suggests that the underlying neurocognitive processes contributing to these behavioral and interpersonal difficulties are relatively distinct (Hyde et al. 2013;Viding et al. 2012; Drislane and Patrick 2013; Brennan et al. 2017; Moffitt 2017; Lobbestael et al. 2013; Schönenberg and Jusyte 2014; Baskin-Sommers and Newman 2013; Estrada et al. 2018). Accordingly, a closer examination of the underlying processes could tell us *why* a particular individual continues to engage in these behaviors and have interpersonal difficulties despite the persistence of suffering.

The primary goal of this chapter is to review neurocognitive processes, specifically socio-affective processes, which contribute to the behavioral and interpersonal difficulties in these antisocial subtypes. To this end, we (1) briefly describe the specific components of socio-affective processing that will be examined in this chapter; (2) review existing literature examining these components of socio-affective processing within each antisocial subtype; and (3) discuss the limitations of the current research and potential future directions.

## Socio-Affective Processing

Socio-affective processes encompass a set of interrelated, yet distinct, neurocognitive processes that support intra- and inter-personal functioning. They can vary from basic facial recognition (i.e., recognizing and identifying a familiar face) to judging another agent's beliefs, goals, or intentions (e.g., theory of mind). Within antisocial populations, research primarily has been limited to two specific domains of socio-affective processes, which we will refer to as emotion recognition and theory of mind.

Emotion recognition is a set of processes involved in assessing an agent's emotional state based upon an affectively valenced cue displayed by the agent. These cues can be facial cues (e.g., facial expression) or non-facial cues (e.g., body language, vocal pitch, prosody, or intonation).

Emotion recognition can be assessed in two ways: explicitly or implicitly. On the one hand, explicit emotion recognition, an individual's ability to explicitly identify, or label, another agent's emotional state when directly asked to do so, is often assessed behaviorally using facial affect recognition tasks (Munoz 2009; Sharp et al. 2015; Stevens et al. 2001; Fairchild et al. 2009). These tasks involve presenting participants with an image of a face displaying an emotional expression (e.g., happiness, anger, fear) and asking the participant to identify the expression being displayed. On the other hand, implicit emotion recognition, an individual's ability and/or inclination to automatically attend to, evaluate, and respond to another's emotional state without being instructed, is assessed using physiological or behavioral responses during tasks where affective cues are presented but do not form the basis of evaluation for the required task. In the former context, affective cues are displayed, and often participants are asked to passively view those cues while physiological responses are recorded. Differentiation between types of affective cues based on physiological measures are inferred to reflect implicit recognition of those cues (Vuilleumier et al. 2001). In the latter context, affectively valenced cues (e.g., fearful face cues) are presented peripherally to other goal-relevant information (e.g., press one button for eyes looking left and one for eyes looking right) and may inform performance but are not explicitly evaluated (e.g., participants are not instructed to name the emotion) during the task (Baskin-Sommers and Newman 2014).

Measurement of neural activity during implicit or explicit emotion recognition tasks also informs our understanding of the neurocognitive underpinnings of emotion recognition. The amygdala is central to understanding emotion recognition, as it is important for the detection of affectively salient information (Sergerie et al. 2008; Cunningham and Brosch 2012). Additionally, frontal regions including the medial prefrontal cortex (mPFC), specifically the ventromedial prefrontal cortex (vmPFC), and orbital frontal cortex (OFC) are implicated in both implicit and explicit emotion recognition (Sabatinelli et al. 2011). Together, these form key neural regions that support emotion recognition.

Emotion recognition, whether explicit or implicit, is critical to everyday social interactions. These processes allow individuals to understand and predict how others are feeling in order to respond to others appropriately and adapt their own behavior accordingly.

Theory of Mind (ToM) is a set of socio-affective processes involved in assessing another agent's emotions, beliefs, goals, or intentions within a given situational context. During ToM tasks, participants are presented with scenarios or scenes, and are asked to use and integrate information about the situational context of a scene and/or the agent's actions to evaluate the agent's feelings or thoughts (e.g., Character A just told Character B s/he could not have a piece of candy; how does Character B feel?).

Much like emotion recognition, ToM can be assessed explicitly or implicitly. Tasks explicitly evaluating ToM typically expose participants to a scenario (either by having them read a vignette, view a cartoon image or photograph, or watch a film clip), then ask participants about different characters' feelings (i.e., affective ToM), or ask participants about the characters' beliefs, goals, or intentions (i.e., cognitive ToM; e.g., Sally-Ann type false belief task; Leslie et al. 2004; Shamay-Tsoory and Aharon-Peretz 2007). In contrast, tasks implicitly evaluating ToM assess the degree to which an individual automatically assesses another agent's feelings, beliefs, goals, or intentions during an apparently unrelated task (e.g., see Samson et al. 2010).

Additionally, during all types of ToM tasks, affective or cognitive ToM judgments can vary in their level of complexity, depending upon the number of "minds" (i.e., different individuals/agents) the participant needs to represent and track. For example, a first-order judgement is when an individual evaluates another agent's thoughts or feelings, only requiring that the individual represents one other agent's feelings or thoughts (e.g., evaluate if Character A likes Object X). A second-order judgement, however, is when an individual judges what another agent thinks about a third agent's thoughts or

feelings, requiring the individual to simultaneously represent two other agent's feelings or thoughts (e.g., evaluate if Character A thinks Character B likes object X).

At a neurobiological level, both affective and cognitive ToM rely on dynamic integration of information between a variety of cortical structures. Specifically, the mPFC, precuneus, and right temporoparietal junction are implicated in an individual's ability to judge another agent's feelings, beliefs, goals, or intentions (Spreng and Grady 2010; Spreng et al. 2009; Jack et al. 2013).

ToM is crucial for human development. Perspective-taking allows individuals to both understand and predict how other agents will respond in social situations. It provides a foundation for the formation and maintenance of social relationships that are mutually constructive.

## Psychopathy and CU/PP

Generally, individuals with psychopathic traits display deficits in their implicit and explicit assessment of facial, vocal, and bodily affective information, particularly when that information is reflecting distress (e.g., fear or sadness; Dawel et al. 2012; Wilson et al. 2011; Marsh and Blair 2008). More specifically, there is clear support for emotion recognition problems in psychopathic individuals throughout developmental stages. Starting as young as 2 to 5 years old, youth with CU traits exhibited blunted implicit neural detection of fearful prosody (as measured by mismatch negativity; Hoyniak et al. 2018). Pre-adolescents and adolescents with CU traits, and adults with psychopathy, were slower and less accurate at explicitly identifying emotions displayed by other agents (e.g., displayed in faces, voices; Blair and Coles 2000; Blair et al. 2001; Munoz 2009; Sharp et al. 2015; Stevens et al. 2001; Dadds et al. 2018; Fairchild et al. 2009; Jusyte et al. 2015; Rehder et al. 2017; Woodworth and Waschbusch 2008; Sharp and Vanwoerden 2014; Blair et al. 2005; Bagley et al. 2009; Blair et al. 2004; Blair et al. 2002; Dolan and Fullam 2006; Eisenbarth et al. 2008; Hastings et al. 2008; Kosson et al. 2002; Montagne et al. 2005; Sandvik et al. 2014; Stanković et al. 2015). Additionally, youth with CU traits and adults with psychopathy showed diminished amygdala responses during implicit emotion recognition (e.g., when assessing the gender of a face; Marsh et al. 2008; White et al. 2012; Decety et al. 2014; Hyde et al. 2014; Deeley et al. 2006). Further, in support of these findings, multiple meta-analyses have reported small, but significant, effect sizes for the relationship between CU traits and psychopathy with difficulties in emotion recognition (Dawel et al. 2012; Wilson et al. 2011).

While there is good support for psychopathy-related impairments in emotion recognition, there are some inconsistencies across studies. Several studies reported that adults with psychopathy compared to those without do not exhibit significant differences in either response speed or accuracy during explicit facial emotion recognition tasks (Richell et al. 2005; Glass and Newman 2006; Mowle et al. 2018; Kunecke et al. 2018; Dolan and Fullam 2004). Additionally, psychopathy-related difficulties in emotion recognition may not reflect a specific deficit in emotion recognition *per se*, but rather a more general deficit in attention that impedes their ability to spontaneously attend to affectively relevant information (Gillespie et al. 2015; Dargis et al. 2018; Boll and Gamer 2016; Luckhurst et al. 2017; Olderbak et al. 2018; Dawel et al. 2015; Dadds et al. 2008; Bedford et al. 2017; Dadds et al. 2006).

For example, the eye region of the face provides the most relevant information for evaluating emotional distress cues (e.g., fear cues; Adolphs, 2008, Johnson, 2005). However, eye tracking research suggests that youth with CU and adults with psychopathy did not attend to the eyes when viewing another's face (Gillespie et al., 2015, Dargis et al., 2018, Boll and Gamer, 2016, Bedford et al., 2017, Dadds et al., 2008, Dadds et al., 2006), even when explicitly instructed to evaluate another agent's overall facial expression (Dadds et al., 2008, Dadds et al., 2006). Instead, youth with CU and adults with psychopathy attended to other parts of the face, such as the mouth, which do not convey as much affective information (Gillespie et al., 2015, Dargis et al., 2018, Boll and Gamer, 2016, Bedford et al., 2017, Dadds et al., 2008, Dadds et al., 2006). However, when their attention was drawn to the eyes (e.g., by explicitly instructing them to attend to the eyes), both youth with CU traits and adults

with psychopathy did not differ from controls during emotion recognition tasks (Dadds et al., 2008, Dadds et al., 2006, Richell et al., 2005). Similarly, if psychopathic individuals were instructed to physically mimic facial expressions displayed prior to evaluating the facial cue, they were able to accurately recognize others' emotional expressions (Luckhurst et al., 2017). Together, these findings suggest that individuals with psychopathy, regardless of developmental stage, have difficulty implicitly evaluating others' emotions, or spontaneously attending to the most relevant information. However, they appear capable of emotion recognition when their attention is drawn to very specific (e.g., eyes), salient affective cues. It seems that while individuals with psychopathy are able to recognize emotions, their natural ability to do so is inadequate. Ultimately, this may result in inaccuracies in recognizing how others feel or failing to fully appreciate the complex emotional expression being displayed by others. The fact, though, that individuals with psychopathy are able to recognize emotions, with deliberate supports, also highlights a potential target for intervention.

Research examining ToM in psychopathy produces a divergent pattern of results for cognitive and affective ToM. Across studies, neither youth with CU nor adults with psychopathy showed neural differences or behavioral deficits in cognitive ToM, suggesting intact cognitive ToM in psychopathy (Sebastian et al. 2012; Jones et al. 2010; O'Nions et al. 2014; Sommer et al. 2010; Blair et al. 1996; Dolan and Fullam 2004; Sharp and Vanwoerden 2014; Shamay-Tsoory et al. 2010). By contrast, the evidence regarding the relationship between affective ToM and psychopathy is more mixed.

To date, three studies reported that individuals with psychopathy were able to successfully assess another agent's affective state during affective ToM tasks (Sebastian et al. 2012; O'Nions et al. 2014; Sommer et al. 2010), suggesting that psychopathic individuals did not display deficits in affective ToM. In contrast, two other studies reported psychopathy-related behavioral abnormalities during affective ToM tasks. First, Sharp and Vanwoerden (2014) demonstrated that, after viewing a 15-minute long video clip depicting a dinner party, adolescents high on CU were significantly worse than adolescents low on CU at evaluating what the characters in the film were feeling. Second, Shamay-Tsoory et al. (2010) showed that after viewing a static cartoon image, adults with psychopathy were able to successfully make simple, first-order affective evaluations (e.g., Character A loves X object), but exhibited difficulty completing more complex, second-order affective evaluations (e.g., Character A loves the same object that Character B loves).

At first glance, these two studies appear to contradict the studies suggesting that individuals with psychopathy show intact affective ToM. However, it is possible that these apparently contradictory findings were actually the result of differences in task complexity. For example, Sharp and Vanwoerden (2014) used a video of a dinner party as their task stimulus, requiring participants to process and track various pieces of information over the 15-minute duration of the video. By contrast, other studies examining affective ToM in psychopathy used relatively simple, static cartoon images, requiring participants to process and track, at most, three frames of information (Sebastian et al. 2012; O'Nions et al. 2014; Sommer et al. 2010; Shamay-Tsoory et al. 2010). Similarly, Shamay-Tsoory et al. (2010) report that psychopathy-related difficulties in affective ToM were limited to complex, second-order judgements, which were not examined in any of the other studies. Collectively, these findings suggest that psychopathic individuals exhibit difficulties with affective ToM, but only when evaluating affective information that is embedded in a particularly complex stimulus (e.g., a movie), or when the judgment itself is highly complex or multilayered (e.g., second-order affective evaluations). This pattern of results suggests that when presented with more complex stimuli or scenarios, either the complexity of the scenario, the complexity of the affective judgments, and/or the amount of information they need to process and track, impairs psychopathic individuals' ability to successfully evaluate or predict other agents' affective states.

Neural examinations of affective ToM in psychopathy yield similarly mixed results. On the one hand, O'Nions et al. (2014) reported that youth with CU did not significantly differ from healthy controls, either behaviorally or neurally, during an affective ToM task. On the other hand, both Sebastian et al. (2012) and Sommer et al. (2010) reported that while individuals with psychopathy

were able to successfully perform an affective ToM task (i.e., psychopathic individuals showed no behavioral differences compared to controls), they exhibited distinct neural abnormalities while performing the task. Sebastian et al. (2012) specifically found that adolescents with CD who were high on CU (CD+CU) showed blunted amygdala responses during an affective ToM task that required participants to view and evaluate a static cartoon image. However, in their analysis, Sebastian et al. (2012) examined amygdala reactivity across entire trials (i.e., during the initial presentation of the image and the judgement). This type of analysis made it difficult to determine what precise component of the trial was driving the blunted amygdala reactivity in adolescents with CD+CU. It is possible that the CD+CU-related blunting of the amygdala response was driven by neural differences when these youth initially saw (and affectively responded to) the cartoon images, rather than any CD+CU-related neural abnormalities in affective ToM (judgement).

Sommer et al. (2010) reported that, during an affective ToM task, adults with psychopathy showed blunted responses in cortical regions associated with action observation and execution (i.e., the bilateral supramarginal gyri and superior frontal gyrus; Van Overwalle and Baetens, 2009) and heightened responses in cortical regions generally associated with socio-affective processing, such as the orbitofrontal cortex, temporoparietal junction, and mPFC (Spreng and Grady 2010; Spreng et al. 2009; Jack et al. 2013). This finding suggests that while adults with psychopathy were able to engage in affective ToM, they required more (or at least different) socio-affective neural resources to do so (Sommer et al. 2010). While speculative, this need for additional neural resources to complete relatively simple (i.e., first-order) affective ToM judgments could potentially explain psychopathic individuals' apparent difficulties with more complex (i.e., second-order) affective evaluations (Shamay-Tsoory et al. 2010). More specifically, it is possible that psychopathic individuals are able to engage enough neurocognitive resources to compensate for psychopathy-related difficulties in affective ToM during relatively simple, first-order, affective ToM evaluations. However, the additional neural resources needed to compensate for affective ToM deficits during more complex, second-order, affective evaluations may exceed the available neurocognitive resources for psychopathic individuals.

Taken together, these findings suggest that individuals with psychopathy exhibit intact cognitive ToM and only exhibit difficulties in affective ToM during complex evaluations, or when another agent's affective state is embedded in a complex stimulus. However, these studies exclusively examine tasks which explicitly instruct participants to engage in ToM, and do not assess whether individuals with psychopathy spontaneously engage in ToM (i.e., they have not assessed whether these individuals implicitly evaluate other agents' feelings, beliefs, goals, or intentions, without being explicitly instructed to do so).

A recent study by Drayton and colleagues (2018) helped address this gap in the literature by examining the impact of psychopathy on an implicit measure of cognitive ToM in an incarcerated sample. In this study, Drayton and colleagues (2018) had inmates complete a cognitive ToM task (Samson et al. 2010). During this task, participants were presented with static scenes depicting a gender- and race-matched avatar in a room with varying numbers of dots on the walls. The dots appeared in front of the avatar (i.e., the avatar had complete information), behind the avatar (i.e., the avatar had no information), or both (i.e., the avatar had partial information); however, the participant always saw all of the dots on every trial (i.e., the participant always had complete information). On some trials, participants were asked to evaluate how many dots the avatar could see (other-trials) and on some trials participants were asked to evaluate how many dots they personally could see (self-trials). The other-trials provided a measure of explicit ToM: could the participant take the avatar's perspective? The self-trials provided a measure of implicit ToM: did the avatar's perspective automatically affect the participant's perspective? Consistent with previous research, inmates higher on psychopathy were able to engage in explicit ToM and performed similarly to inmates lower on psychopathy in the other-trials. However, inmates higher on psychopathy compared to inmates lower on psychopathy displayed significantly less interference on the self-trials (i.e., their reaction time was not affected by

the information available to the avatar). These findings suggest that psychopathic individuals do not implicitly evaluate others' mental states (i.e., they do not implicitly engage cognitive ToM; Drayton et al. 2018), but can do so explicitly.

Another study examining pain perception in psychopathy suggests a similar pattern of psychopathy-related impairment in implicit affective ToM. Meffert et al. (2013) used fMRI to examine neural responses to hand pain in three different conditions: passive viewing of a clip of a hand being hurt (i.e., implicit affective ToM), imagining what the person in the clip might be experiencing (i.e., explicit affective ToM), and physically experiencing the actual scenarios depicted in the clips. Meffert et al. (2013) reported that, when adults with psychopathy passively viewed the pain clips, they did not exhibit significant neural overlap with their actual experience of pain (relative to controls), which the authors interpreted as evidence that adults with psychopathy did not implicitly engage in affective ToM. In contrast, however, Meffert et al. found that individuals with psychopathy showed similar overlap in neural responses to controls when instructed to imagine what the person was feeling (i.e., explicit affective ToM) and when physically experiencing the pain. These two findings suggest that adults with psychopathy are able to engage in affective ToM, but do not do so implicitly (i.e., without instruction).

While the purely neural nature of these findings makes this interpretation somewhat speculative, these findings and interpretations are consistent with both prior research demonstrating psychopathy-related neural abnormalities in pain perception in others (Decety et al. 2013), and Drayton et al.'s (2018) findings indicating that adults with psychopathy do not implicitly engage in cognitive ToM. Thus, the current literature examining ToM in psychopathy provides strong evidence that individuals with psychopathy largely are able to engage in ToM when instructed to do so, but do not do so implicitly. This is an important distinction because it helps in explaining why psychopathic individuals can so easily manipulate others' thoughts and feelings when conning them (as the act of conning someone explicitly requires ToM), yet have difficulty with more everyday social interactions, which may require more implicit ToM.

Overall, individuals with psychopathy exhibit clear deficits in both emotion identification, and certain types of affective ToM. However, in both instances, these deficits are limited to specific contexts. In the case of emotion identification, if attention is explicitly directed to relevant affective information, individuals with psychopathy are able to accurately recognize others' emotions based on socio-affective cues (Dadds et al. 2008; Dadds et al. 2006; Richell et al. 2005; Luckhurst et al. 2017). Similarly, when presented with relatively simple, first-order scenarios, individuals with psychopathy exhibit intact affective ToM (O'Nions et al. 2014; Sebastian et al. 2012; Sommer et al. 2010; Shamay-Tsoory et al. 2010). These findings suggest that individuals with psychopathy may not have a complete deficit in either of these socio-affective processes *per se*, but rather a more general impairment in processing and/or attending to relevant affective cues embedded in complex situations or stimuli. Moreover, a recurrent finding across various aspects of socio-affective processing in psychopathy is that, even if individuals with psychopathy are able to normatively engage various different socio-affective processes (in specific circumstances), they tend to only do so when instructed. The failure to implicitly attend to, and process, others' emotions or mental states may explain how psychopathic individuals are able to callously harm others during goal-pursuit, but also able to charm, con, and manipulate others when necessary.

## Antisocial-Only

The research examining socio-affective processing in antisocial-only individuals is fairly limited, particularly in comparison to the extensive literature examining socio-affective processing in psychopathy. However, the existing literature generally shows that youth with CD (in absence of CU) and adults with APD may exhibit difficulties in explicit emotion recognition. Several studies have shown that youth with conduct problems, in general, or CD, in particular, are slower and/or less accurate at

labeling facial expressions, particularly anger (Fairchild et al. 2010; Sharp 2008; Leist and Dadds 2009; Fairchild et al. 2009). Similarly, Schönenberg et al. (2013) and Dolan and Fullam (2004) both reported that adults with APD exhibit difficulties recognizing basic emotions (e.g., angry and sad) from facial cues. Taken together, these findings suggest that, much like individuals with psychopathy, antisocial-only individuals, regardless of developmental stage, exhibit difficulties explicitly recognizing others' emotions, particularly negative ones.

This apparent consistency between the research examining antisocial-only individuals and research examining psychopathy raises the possibility that deficits in explicitly identifying others' emotions may not be inherently related to either antisocial-only or psychopathic individuals, specifically. Rather, difficulty explicitly identifying others' emotions may index a more general risk factor for antisociality (Marsh and Blair 2008). In fact, several studies reported that more general measures of antisociality predict both behavioral and neural abnormalities in emotion identification, and that these relationships are not moderated by factors such as group status (e.g., antisocial-only vs. psychopathic individuals), or levels of CU traits (Pfabigan et al. 2015; Schönenberg et al. 2016; Hyde et al. 2016). Accordingly, difficulty explicitly assessing and labeling affective cues may reflect developmental or environmental risk-factors common to both antisocial subtypes, such as early maltreatment, or a poor social environment leading to minimal exposure to social cues early in development, either of which could impair early socio-affective development and produce long-lasting deficits in socio-affective functioning (Leist and Dadds 2009; Dadds et al. 2018).

Interestingly, however, while both antisocial-only and psychopathic individuals exhibit similar difficulties explicitly identifying others' emotions, unlike psychopathic individuals, antisocial-only individuals appear to implicitly recognize socio-affective cues. Baskin-Sommers and Newman (2014) found that, during a gaze cueing task, adult inmates high on externalizing (a latent trait associated with antisocial-only individuals) committed significantly more errors when asked to ignore affectively valenced faces (particularly fearful faces) compared to neutral faces, suggesting that they not only implicitly recognized the fear emotion in the stimuli, but over-responded to it. In line with this finding, Hyde et al. (2014) reported that, during an fMRI face-matching paradigm, adults higher on APD symptoms (controlling for CU traits) exhibited significantly enhanced amygdala reactivity to emotional faces. These two studies suggest that antisocial-only individuals implicitly recognize socio-affective cues, and seem to over-respond to these cues, both behaviorally and neurally (Hyde et al. 2014; Baskin-Sommers and Newman 2014). Thus, antisocial-only individuals' difficulties evaluating other agent's emotions do not appear to be due to a failure to implicitly attend to relevant affective content (as seems to be the case in psychopathy), but rather, may reflect a true impairment in explicitly recognizing socio-affective cues they are exposed to.

Research suggests that ToM is largely intact in antisocial-only individuals. When assessed behaviorally, several studies demonstrated that antisocial-only individuals, across all developmental stages, exhibit intact cognitive and affective ToM (Woodworth and Waschbusch 2008; Jones et al. 2010; Sebastian et al. 2012). However, one study partially contradicts this set of findings.

Dolan and Fullam (2004) reported that, while antisocial individuals (regardless of whether they had APD or psychopathy) were able to successfully complete traditional false belief tasks and identify subtle violations of social norms (e.g., identify when someone accidentally said something that should not have been said; i.e., social faux pas), they exhibited difficulties with affective ToM within the context of these subtle norm violations. More specifically, both adults with APD and adults with psychopathy displayed difficulties assessing characters' affective states after a subtle norm violation. The singular nature of this finding within the antisocial-only subtype makes it hard to reconcile with the various other studies showing that antisocial-only individuals exhibit intact affective ToM. However, if replicated, this result can be viewed as consistent with the affective ToM patterns in psychopathy showing that psychopathic individuals exhibit intact affective ToM, unless presented with more complex stimuli or scenarios. Collectively, these studies seem to suggest that, if

antisocial-only individuals exhibit any deficits in affective ToM, it is limited to the context of complex social situations.

Beyond these studies examining potential behavioral issues with ToM in antisocial-only individuals, only one study examined neural differences in these individuals during a ToM paradigm. Sebastian et al. (2012) reported that, during an affective ToM fMRI paradigm, CD symptomology (controlling for CU traits) in adolescents, was unrelated to behavioral task performance. However, in contrast to CU traits (which were associated with diminished amygdala reactivity during this task), CD symptomology (controlling for CU traits) was associated with increased amygdala reactivity (Sebastian et al. 2012). However, as with the CU findings reported above, the fact that Sebastian et al. (2012) examined the amygdala response across entire trials (rather than specifically during the affective ToM judgment), makes it unclear whether the CD-related increase in amygdala activity is truly the result of neural abnormalities in affective ToM, or simply the product of increased amygdala reactivity when initially seeing (and affectively responding to) the affectively valenced scenes. Regardless of the specific interpretation, however, the existing research examining ToM in antisocial-only individuals suggests that these individuals exhibit largely intact cognitive and affective ToM, albeit with potentially atypical neural responses during affective ToM judgments[1].

Generally, research examining socio-affective processing in antisocial-only individuals shows that these individuals exhibit deficits in explicitly recognizing others' emotions based upon socio-affective cues, but generally intact ToM and intact implicit recognition of others' emotions. Specifically, unlike psychopathic individuals, antisocial-only individuals appear to spontaneously attend to and process socio-affective cues and even potentially over-respond to these cues, both behaviorally and neurally (Hyde et al. 2014; Sebastian et al. 2012; Baskin-Sommers and Newman 2014; Baskin-Sommers and Newman 2013). However, antisocial-only individuals display a specific deficit in explicitly recognizing others' emotions. This specific difficulty explicitly recognizing others' facial expressions, in combination with their tendency to over-respond to affective content, may partially explain the hostile interpersonal interactions characteristic of antisocial-only individuals. It is possible that antisocial-only individuals' difficulties recognizing facial expressions may lead them to label faces as negatively valenced or hostile, even when they are not. Subsequently, these individuals may then affectively over-respond to this perceived hostile facial expression and act in a hostile manner in return (Lobbestael et al. 2013; Schönenberg and Jusyte 2014).

## Considerations for Future Research and Conclusions

There is both clinical and empirical support for socio-affective disruptions in psychopathic and antisocial-only individuals. However, close examination of the available data suggests that the specific types of dysfunction vary between subtypes of individuals. Psychopathic individuals appear capable of socio-affective processes, such as emotion recognition and cognitive ToM, but they do not engage these processes automatically. Instead, psychopathic individuals seem to require instructions to explicitly draw their attention to relevant socio-affective cues in order to respond normatively. By contrast, antisocial-only individuals' socio-affective difficulties appear limited to a specific deficit in explicitly recognizing socio-affective cues (e.g., facial expressions). Overall, it seems that the neurocognitive processes underlying socio-affective dysfunction in these two subtypes of individuals are distinct.

While there is quite a bit of research examining certain socio-affective processes, such as emotion recognition and ToM in antisocial subtypes, other socio-affective processes receive little attention. Socio-affective functioning spans a wide array of neurocognitive processes, including basic facial recognition (i.e., recognizing and identifying a familiar face), impression formation (e.g., how trustworthy is a given individual), social status evaluation (e.g., how important is this individual to others/society), and social valuation (e.g., how important is this person to me). Given the profound interpersonal difficulties exhibited by individuals who engage in chronic antisocial behavior, having a more holistic understanding of the various potential socio-affective dysfunctions present in these

individuals, and the relationships among these dysfunctions, may be critical to fully understanding how aberrant socio-affective functioning may be contributing to their antisocial psychopathology.

For example, psychopathic and/or antisocial-only individuals' difficulties initially forming meaningful relationships may reflect a fundamental issue during initial impression formation; however, research on this topic is exceptionally limited. More specifically, it is possible that neurocognitive abnormalities lead these individuals to initially view others as inherently untrustworthy and avoid them, reducing opportunities for psychopathic or antisocial-only individuals to interact with others and form new relationships. Alternatively, if psychopathic and/or antisocial-only individuals do not have impairments in impression formation, but rather social valuation, it is possible that their difficulties maintaining meaningful relationships are due to an inability to represent the value of these relationships. Understanding not only if such deficits in impression formation or social valuation exist in antisocial subtypes, but also the specific neurocognitive underpinnings of each deficit within each antisocial subtype, would greatly advance our understanding of the socio-affective dysfunctions displayed across antisocial subtypes.

Beyond specific neurocognitive processes supporting socio-affective functioning, little research in this domain accounts for the contribution of environmental risk factors that are related to both the quality of socio-affective functioning and expression of antisocial psychopathology. For example, early childhood deprivation, maltreatment, and poverty occur at high rates among individuals who chronically engage in antisocial behavior (Braga et al. 2017; Cicchetti et al. 2012). Outside of research on antisocial psychopathology, early childhood maltreatment and other environmental factors, such as concentrated disadvantage, are known to negatively impact socio-affective functioning and development (Cicchetti et al. 2003; Pears and Fisher 2005; Drukker et al. 2003). For example, maltreated children experience substantial deficits and delays in both emotion recognition and ToM (Cicchetti et al. 2003; Pears and Fisher 2005). Accordingly, it is possible that some of the socio-affective deficits associated with antisocial psychopathology, particularly those deficits which span antisocial subtypes, are promoted by certain environmental experiences. However, research examining the intersection of antisocial psychopathology, early environment, and socio-affective processing is limited, making this possibility hard to evaluate, but an exciting endeavor for future research.

The current literature examining socio-affective processing and antisocial psychopathology suggests different antisocial subtypes exhibit distinct patterns of socio-affective disruptions. Moreover, the patterns of socio-affective dysfunction found in each subtype may promote antisocial behaviors in unique ways. For example, psychopathic individuals' failure to implicitly recognize emotion or implicitly engage in ToM may explain why they are able to callously harm others during goal-pursuit, while their intact ability to engage in ToM when explicitly required to do so allows them to also con and manipulate others when necessary. In contrast, antisocial-only individuals' difficulties explicitly recognizing emotion combined with their general hypersensitivity to affective content may lead these individuals to over-react, potentially violently, to misperceived socio-affective cues. Advancing our understanding of the links between socio-affective processing disruptions and antisocial subtypes is crucial to providing unique insight into the development and maintenance of the chronic, disruptive, and costly behaviors exhibited by these antisocial psychopathologies.

## Note

1 To date, no studies have examined implicit ToM in antisocial-only individuals.

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