Supplementary Table 1. Historical Timeline of the Clinical Conceptualizations of Psychopathy, Comparted by the Inclusion of the Concept of Fear in the Theories. [1]

Author	Source	Abstract
Pinel	(Pinel, 1806)	*Manie sans delire* [Insanity without delusion]; I was surprised to find many maniacs who at no period gave evidence of any lesion of the understanding, but who were under the dominion of instinctive and abstract fury, as if the faculties of affect alone had sustained injury. Werlinder (1978) states that in the examples given by Pinel, "violent uncontrolled emotion" is the common denominator.
Rush	(Rush, 1812)	Cognitively intact; antisocial behavior is explained by moral derangement: "In all these cases of innate, preternatural moral depravity, there is probably an original defective organization in those parts of the body, which are occupied by the moral faculties of the mind" (p. 360).
Prichard	(Prichard, 1835)	*Moral insanity*; these individuals are cognitively intact but affect is disordered (Hervé & Yuille, 2007, p. 33). It is important to note that "moral" does not denote "ethical." With "moral insanity," Prichard meant to say that the deficits lie in the emotional and conative side of the psyche, not in the intellectual.
Campagne	(Campagne, 1869)	Basis is an egoistic character. As children, they are disobedient and cannot be influenced by parents or teachers. No respect for authority. They lack friends (unless they can profit from them) and are unable to experience love in any other form than the directly sensual. Provoke others constantly. Cognitively intact, although they often lack true originality in their thoughts. They cannot endure the same job for long periods.
Maudseley	(Maudseley, 1874)	Cognitively intact (no illusions, delusions, or hallucinations); symptoms are mainly exhibited in the active and moral powers, namely, feelings, affections, propensities, temper, habits, and conduct. Affective life is profoundly deranged. All impulses and desires are egoistic and there is no desire to resist them.
Koch	(Koch, 1891)	*Psychopathische Minderwertigkeiten* [Psychopathic inferiorities]; first to see psychopathy as a personality disorder but also very overinclusive.
Birnbaum	(Birnbaum, 1909)	Importance for the concept of psychopathy: (a) established the term Psychopathische Persönlichkeiten [Psychopathic personalities], (b) argued that individuals with psychopathy were born with an abnormal personality, and (c) concentrated on the tendency of the psychopathic individual to engage in criminal behavior.
Kraepelin	(Kraepelin, 1915)	Several subtypes: the *born criminals* (morally blind individual, lacks social feelings or remorse), the *unstable* (lacking drive to carry out tasks), the *morbid liars and swindlers* (superficial subjects that enjoy deception), the *psuedo-quarulants* (self-centered egocentric individuals with subclinical forms of paranoia), the *excitable* (individuals with labile and dramatic

		emotions), the impulsive (impulsive or compulsive actions), and the *eccentrics* (lack of uniformity or consistency in mental lives).
Partridge	(Partridge, 1930)	Antisocial behaviors; immature values, interests, and activities; emotional instability; disturbed social emotions. Importantly, Partridge is the first to stress that chronic social maladjustment is one of the most important features of psychopathy.
Henderson	(Henderson, 1939)	Those with psychopathy cannot live in society because they lack social emotions. They are antisocial, unstable and irresponsible, impulsive, explosive, egocentric, unempathic, and entitled.
Schneider	(Schneider, 1923)	Several subtypes of psychopathy-like disorders, including the self-assertive (entitled, boastful, manipulative, and deceptive), the explosive (unprovoked impulsive, explosive affective outbreaks), and the affectionless (callous, remorseless, deceptive, incorrigible, emotional dullness, propensity for criminal behavior).
Karpman	(Karpman, 1941, 1948a, 1948b)	Antisocial lifestyle; need for immediate gratification; lack of anxiety, guilt, or remorse; grandiose and entitled; callous; impulsive; irresponsible. Also noted the child-like immaturity in social emotions. "They only experience simple emotions like tension, worry, frustration that have no future implications" (Hervé & Yuille, 2007, p. 33), and therefore they are likely to act in the spur of the moment. Karpman also divided the construct into two different types: the symptomatic and the idiopathic.
Arieti	(Arieti, 1963)	Need for immediate gratification, callousness; lack of anxiety or guilt; grandiosity; irresponsibility; inability to learn from experience; lack of loyalty to group, persons, or code; and antisociality. *Short-circuited anxiety/emotion*: Individuals with psychopathy experience superficial emotions that are related to current situations. The lack of long-circuited emotions (related to future events) makes them act at the spur of the moment, which relieves any tension they may experience and therefore reinforces this behavior. Again, the emotional system is thought to be immature. Like Karpman, he speaks of symptomatic and idiopathic individuals with psychopathy.
McCord & McCord	(McCord & McCord, 1964)	Dangerous, maladaptive personality disorder with a deep-rooted lack of social emotions (empathy, love, guilt, remorse), egocentric manipulative attitude, callous, aggressive, impulsive. Individuals with psychopathy are prone to tension and frustration and experience intense but transitory emotions: The emotional deficits in psychopathy are confined to long-circuited emotions. According to Werlinder (1978), two features are most important: guiltlessness and lovelessness.
Craft	(Craft, 1966)	Identified traits that he thought were distinctive of psychopathy: *Positive*—Primary features: (a) lack of feeling quality to other humans (affectionless), (b) liability to act on impulse and without forethought. Secondary derived

		features: (a) aggression, (b) lack of shame or remorse, (c) inability to learn from experience (e.g., punishment), (d) lack of drive or motivation, (e) viciousness/will to damage things or persons. *Negative*—(a) lack of psychoses (schizophrenia or depression), (b) lack of pure intellectual deficit, (c) lack criminal motivation of planning of actions in the light of risks.
Cleckley	(Cleckley, 1976)	Cleckley's description of psychopathy resembles the one described by Karpman and Partridge (p. 164 Werlinder, 1978). Cleckley Checklist: (a) superficial charm and good "intelligence," (b) absence of delusions, (c) absence of nervousness, (d) unreliability, (e) untruthfulness and insincerity, (f) lack of remorse or shame, (g) inadequately motivated antisocial behavior, (h) poor judgment and failure to learn by experience, (i) pathological egocentricity and incapacity for love, (j) general poverty in major affective reactions, (k) specific loss of insight, (l) unresponsiveness in general interpersonal relationships, (m) fantastic and uninviting behavior with/without drink, (n) suicide rarely carried out, (o) sex life impersonal, (p) failure to follow any life plan.
Hare	(Hare, 2003)	Psychopathy Checklist (PCL-R). Starting from the Cleckley checklist, Hare constructed a 20-item list capturing interpersonal-affective and antisocial lifestyle features.
		Theories including a fear deficit
Lykken	(Lykken, 1957)	Primary psychopathy is typified reduced fearfulness, ultimately leading to the development of psychopathy.
Patrick et al.	Patrick, Fowles, & Krueger, 2009)	The triarchic model of psychopathy includes boldness, meanness, and disinhibition. Boldness includes toleration of stressful situations, self-confidence, and social assertiveness.

Hoppenbrouwers, S. S., Bulten, B. H. & Brazil, I. A. Parsing fear: A reassessment of the evidence for fear deficits in psychopathy. Psychol. Bull. 142, 573–600 (2016).

Supplementary Box 1. Primary and Secondary Variants of Psychopathy.

Psychopathy is a heterogeneous disorder, although there is substantial evidence of more homogeneous subtypes that can be reliably identified. Indeed, a 'secondary' variant of psychopathy has been identified that is distinguished by high anxiety levels, childhood maltreatment, and/or elevated Factor 2 scores and associated personality traits (impulsivity, hostility and negative emotionality)[2,3]. Despite sharing the same callous and antisocial behavioural phenotype, the putative environmental aetiological pathway (childhood maltreatment) for secondary psychopathy contrasts with 'primary' or 'classic' psychopathy[4], which is characterised by low anxiety and theoretically develops from a complex interplay of genetic, temperamental, and neurocognitive factors. We can think of individuals with 'secondary' psychopathy as a behavioural phenocopy of classic 'primary' psychopathy, but with a distinct developmental route to and neurocognitive profile associated with their psychopathic behavioural profile.

Notably, one prospective longitudinal study of a UK birth cohort found that childhood primary variants of callous-unemotional (CU) traits defined based on elevations on conduct problems, CU traits, low anxiety and low childhood victimization, showed DNA methylation in the vicinity of *OXTR* (encoding the oxytocin receptor) at birth compared with those with high CU and high anxiety (secondary variant), who had prenatally exposure to intimate partner violence and family conflict but did not show *OXTR* methylation[5]. Cross-sectional research has also found greater dispositional risk in primary variants and environmental risk in secondary variants; in childhood and adolescence, primary variants have cognitive and emotional processing anomalies (emotional attention and recognition deficits and attenuated fear-potentiated startle) relative to secondary variants who have hyper-reactive affective processing and salivary hormone profiles that are consistent with chronic stress exposure[6]. Similarly, functional MRI (fMRI) studies in youths[7,8] and adults[9] suggest that these variants might also be associated with distinct neurocognitive mechanisms. Crucially, high rates of institutional misconduct and violence, substance-related problems and comorbid psychiatric illness highlight the clinical utility of identifying secondary

psychopathy variants. Despite the complexity in clinical presentation of psychopathy, some researchers[3,10] hypothesized that those with secondary psychopathy are amenable to treatment due to the acquired nature of their affective disturbance relative to those with primary psychopathy who lack the basic foundation of conscience, although empirical tests are equivocal.

Supplementary Box 2. Disorder-specific versus cross-disorder functional impairments.

Much early work on psychopathy and other psychiatric disorders aimed to identify functional impairments in patients with the disorder with limited consideration regarding whether these impairments were also found in other conditions. The Research Domain Criteria exercise has served as a more recent counter-balance to this problem, and has addressed issues regarding the high levels of comorbidities of psychiatric disorders and the functional impairments that are seen across disorders[11,12].

For psychopathy, the emotional impairment[13], the low empathic responding,[14,15] fear,[1,13] and potentially social affiliation[16] seem disorder-specific and severity of functional impairment relates to severity of the core emotion disruption symptoms. In contrast, *reduced* neural responsiveness within the striatum and ventromedial prefrontal cortex during the anticipation of reward is not limited to psychopathy and is, for example, also seen in patients with attention-deficit/hyperactivity disorder (ADHD)[17] or addiction[18] and severity of impairment has not typically related to severity of psychopathic traits[19–21]. Similarly, studies have often,[22,23] though not always,[24] found that individuals with psychopathic traits show impairment in response inhibition relative to *healthy* comparison individuals (that is, they respond impulsively to stimuli that they are instructed not to respond to). This impairment is often seen in non-psychopathic offenders[25] and is a core component of the pathophysiology of ADHD[26].

Of course, all these forms of disruption are critical to understand and recognize, even if they are not unique features of psychopathy. A particular individual's treatment plan will likely need to address these forms of impairment, if they are present in that individual, even if they do not reflect the pathophysiology *specific to* psychopathic traits.

Supplementary Box 3. The main goal of assessing psychopathic traits in children and young people?

How antisocial behaviour should be considered within the construct of psychopathy is debated: it can be considered as either as a core part of the construct, as psychopathy being a risk factor for the later development of antisocial behaviour, and/or as psychopathy being a specifier that designates a unique and important subgroup of antisocial individuals[27]. This debate has also influenced how psychopathic traits have been assessed and used in psychiatric diagnosis for children and young people (CYP). That is, the interpersonal and lifestyle facets (Facets 1 and 3) are the dimensions of psychopathy that are most highly associated with antisocial behaviour (such as conduct problems and delinquency) in CYP and share many of the risk factors that are associated with conduct problems in general[28,29]. Thus, interpersonal and lifestyle dimensions are critical for conceptualizations that consider psychopathy and antisocial behaviour as single constructs or as psychopathy being a risk factor for antisocial behaviour. By contrast, the affective dimension of psychopathy (CU traits, meanness or limited prosocial emotions) in CYP, is less strongly associated with antisocial behaviour. As a result, this dimension is better at predicting outcomes independent of general antisocial behaviour[30] and for designating distinct subgroups of antisocial CYP with conduct problems that differ on important risk factors, such as emotional responses to fearful faces[31,32].

This debate has important implications for early assessment and diagnosis of psychopathy. That is, if the goal is to predict future antisocial behaviour (a general risk factor), it would be important to ensure that the interpersonal and lifestyle facets of psychopathy are assessed given evidence supporting their incremental predictive utility[33]. However, if the goal is to designate distinct subgroups of antisocial individuals who show potentially very different causal factors and responses to treatment, and who either do or do not display the affective features that set individuals with psychopathy apart from the wider antisocial phenotypes, it would be important to

focus on the CU facet more specifically and to have measures with enough items to assess this facet reliably. Table 1 provides a summary of both types of measures that have been used with CYP.

Supplementary Box 4: Limited Prosocial Emotions Specifier within DSM-5 and ICD-11

DSM-5

This specifier is applied to children who meet diagnostic criteria for conduct disorder (CD) (can be childhood-onset or adolescent-onset) and who also show two or more of the following symptoms for ≥12 months and across multiple relationships and settings:

- Lack of remorse or guilt
- Callous — lack of empathy
- A lack of concern about educational or occupational performance
- Shallow emotions

ICD-11

Meets all definitional requirements for childhood-onset Conduct-dissocial disorder or Oppositional Defiant Disorder. In addition, the individual exhibits characteristics that are sometimes referred to as 'callous and unemotional'.

These characteristics include:

- a lack of empathy or sensitivity to the feelings of others and a lack of concern for others' distress
- a lack of remorse, shame or guilt over their own behaviour (unless prompted by being apprehended),
- a relative indifference to the probability of punishment
- a lack of concern over poor performance in school or work
- limited expression of emotions, particularly positive or loving feelings toward others, or only doing so in ways that seem shallow, insincere, or instrumental.

Data from Refs [34] and [35].

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