The Psychopath's Blueprint: Cracking the Code of Criminal Profiling

Anjaly Biju* and Thanga Sharmila.M *

Division of Criminology and Forensic Science,
Karunya Institute of Technology and Sciences, (Deemed University),
Karunya Nagar, Coimbatore – 641 114, Tamil Nadu, India.

E-mail: anjalybiju@karunya.edu.in, thangasharmila@karunya.edu.in

Abstract:

One of the trickiest and most difficult subjects in forensic psychology is psychopathy. It represents a complex interaction of behavioural tendencies, neurological effects, personality qualities, and crime-related risks many of which are hidden beneath the surface and difficult to identify during normal tests. Over the years, many researchers have worked to understand the condition more clearly. This paper examines how forensic psychology supports the development of structured profiles for individuals with psychopathic traits. It also traces how the concept has evolved, moving from early clinical descriptions to more detailed models that focus on interpersonal dominance, emotional detachment, and behavioural instability. Neurobiological studies have found unusual activity in the amygdala, ventromedial prefrontal cortex, and surrounding the paralimbic regions. These finding helps understand the problems like lack of empathy, issues in emotional processing and difficulties in moral decision-making. When matched with behavioural findings, these traits show patterns like instrumental aggression, a greater risk of reoffending, and unique offending methods. Findings on development and gender reveal that psychopathy can appear differently, showing the value of personalised assessment. To tackle these challenges, the paper proposes an Integrated Neurobehavioral Profiling Framework (INPF). It integrates neurobiological signs, behavioural patterns and the context of risk. Its goal is to help experts build better case profiles, better risk evaluations, and make sound ethical decisions. This paper also looks at evidence from forensic settings to understand the interventions, especially for particular groups. Overall, this paper introduces a scientifically and ethically thoughtful framework for improving forensic assessment of psychopathic individuals.

Keywords: Forensic Psychology, Psychopathy, Paralimbic Dysfunction, Instrumental Aggression, Neurobehavioral Profiling.

1. Introduction

Psychopathy involves certain personality features like coldness, no remorse, acting without thinking, also dishonesty these often go hand-in-hand with rule-breaking or illegal actions [1]. People showing strong signs usually feel less compassion or regret, show flat emotions, plus struggle to form real connections, making harmful or aggressive acts more likely [2]. While these traits exist on a spectrum throughout society, those at the high end mostly turn up in prison systems or therapy clinics [1]. Right now, experts see psychopathy as made of several parts how someone.

D. R. Reddy et al. (eds.), *Proceedings of the First International Conference on Advances in Forensics and Cyber Technologies (ICFACT 2025)*, Advances in Computer Science Research 127,
https://doi.org/10.2991/978-94-6239-610-4_48

relates to people, handles feelings, behaves, lives day-to-day all influenced by brain function and early life experiences [3].

Studies keep showing that signs of psychopathy can appear young, follow clear brain and behaviour patterns, yet stay mostly unchanged over time [2]. Kids who act cold or show no guilt early on tend to develop serious behavioural issues later so tracking them step by step matters a lot [2]. Looking at how these behaviours shift through life helps spot danger zones for rule breaking actions while shaping smarter ways to help sooner [3].

The idea of psychopathy has changed a lot lately. Older views based on actions have been replaced by broader ones combining traits, growth patterns, and brain science [4]. A well-known framework - the Triarchic Model - breaks it down into three parts: boldness, cruelty, and poor impulse control [4]. Brain studies show unusual activity in areas like the amygdala and lower frontal cortex, tied to weak emotions, faulty judgment, and less fear learning in these people [5,6,7]. Reviews confirm current data has shifted old ideas, pushing experts toward layered theories linking character, conduct, and brain function [4,8,9].

Even with progress, today's tools for spotting psychopathy still focus on behaviour lists and personal opinions. Though things like the PCL-R get used a lot in legal settings, they miss key brain-related and emotional problems tied to the condition [6,7]. On top of that, older methods don't really show how risks develop over time info we need to grasp how psychopathic traits appear and grow [1,3]. Because of these flaws, it makes more sense to see psychopathy as a brain-based issue needing mixed approaches like watching actions, testing thinking skills, plus checking biological signs [3]. More often now, courts want tests that hold up under legal questioning. Today's forensic work relies less on gut feelings instead it leans on solid science from psychology and brain studies [4]. So upcoming tools should mix behaviour checks, thinking patterns, and brain data to judge psychopathy more fairly and consistently [4,8]. These upgrades could sharpen how we predict danger, weigh guilt, guide therapy choices all helping connect real research with courtroomuse. As seen in the Figure.1.Explains about Psychopathy is depicted as the result of personality traits, brain abnormalities, and developmental influences coming together, as shown in the picture. The schematic highlights emotional processing, behavioural regulation, and decision-making deficits that lead to criminal and antisocial behaviour.

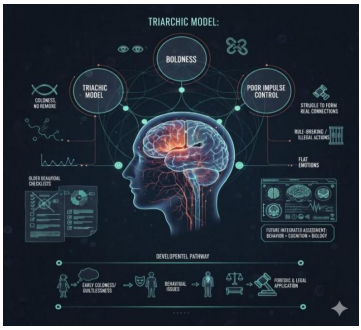

Figure.1.Introduction to Psychopathy's Blueprint

1.1 Background

One of the initial personality disorders to be recognised, psychopathy has a long history going back to the 1700s, when it was referred to as diseases like manie sans delire and congenital delinquency. Early philosophers and psychiatrists coined concepts like moral insanity in the 1670s to explain how someone with normal intelligence might exhibit extreme immorality. By the late 19th century, academics became particularly interested in the recurring criminal behaviours associated with psychopathy, linking it to characteristics like malice, dishonesty, and poor judgement [10].

The conceptual understanding of psychopathy as part of a broader personality disturbance developed over time through various academic contributions. A major milestone was the work of Hervey Cleckley, who characterised psychopaths as exhibiting superficial charm, emotional poverty, lack of remorse, and reckless lifestyles features that strongly influenced later diagnostic instruments [11]. Early versions of the DSM attempted to accommodate psychopathy using broader labels such as sociopathic personality disorder or antisocial tendencies before gradually shifting toward classifications that emphasised behavioural and interpersonal criteria [12]. Parallel to this, international systems such as the ICD also offered descriptions that captured both behavioural and emotional characteristics [13].

A major shift occurred in the 120s with the creation of standardised assessment tools such as Hare's Psychopathy Checklist (PCL), which clarified the distinction between psychopathy focused on core personality traits and antisocial personality disorder, which emphasised observable behavioural patterns [12][14]. Over time, ASPD in the DSM became more behaviour-based, whereas psychopathy came to be evaluated using forensic clinical instruments like the PCL-R [14].

Research interest in psychopathy grew rapidly during the 2000s and into the DSM-5 era, leading to the development of modern frameworks like the Triarchic Psychopathy Model, which reconceptualised psychopathy in terms of boldness, meanness, and disinhibition [8]. This contemporary framework integrates historical perspectives with modern personality assessment.

When Christopher J. Patrick formally presented the Triarchic Model in 2009, debates intensified surrounding the boundaries and true nature of psychopathy. Researchers questioned whether psychopathy is dimensional or categorical, whether its traits are unified or configural, and how consistently they manifest across childhood, adolescence, and adulthood [8,1]. Discussion also expanded to topics such as the role of anxiety in psychopathy, the strengths and limitations of self-report versus clinician-rated measures, and distinctions between adaptive traits like boldness and maladaptive behaviours like impulsivity [15].

The idea of "successful psychopathy" individuals who exhibit core psychopathic traits without engaging in overt criminal behaviour also gained attention during this period [15]. A central point of contention was whether criminality should define psychopathy or be viewed merely as a potential outcome. Much of the debate contrasted Cleckley's personality focused description [11] with Hare's PCL-R, which places significant emphasis on antisocial behaviours [14].

Diagnostic systems like the DSM were criticised for relying heavily on behaviour-oriented criteria, which risked conflating causes with outcomes and failed to capture psychopathy in non-forensic or high-functioning individuals [12,15]. The Triarchic Model ultimately emerged as a unifying framework that integrates developmental, structural, and trait-based viewpoints [8].The Following Figure.2. Background of Psychopathy: Evolution of a Concept illustrates the evolution of psychopathy over time, highlighting shifts from formal diagnostic categories found in the DSM and ICD to philosophical ideas like moral insanity. It also illustrates the development of trait-based models and structured evaluation instruments, which presently predominate in modern research

. Figure.2. Background of Psychopathy: Evolution of a Concept

2. Methodology

The sources for this review were obtained by extensively studying academic papers published from 2020 to 2025. The research concentrated on forensic psychology, evaluation of psychopathy, and the legal acceptance of evidence. Academic references were gathered from various databases such as PubMed, Scopus, Web of Science, APA PsycINFO, and Google Scholar. This approach guaranteed a wide range of empirical, clinical, and legal views on assessing psychopathy in forensic contexts.

Essential legal papers, like the Bharatiya Sakshya Adhiniyam (2023), as well as comparative evidence guidelines from various countries such as U.S. Federal Rule of Evidence 702, United Kingdom Criminal Practice Directions, and Canadian "Moore Criteria," were utilized to set the legal foundation for admitting psychological tools and expert opinions. These documents were crucial in determining how courts evaluate the credibility of scientific evidence, the expertise of professionals, and the pertinence to legal matters.

A range of established forensic instruments such as the Psychopathy Checklist–Revised (PCL-R), its Screening Version (PCL-SV), the Psychopathic Personality Inventory–Revised (PPI-R), the Triarchic Psychopathy Measure (TriPM), the Self-Report Psychopathy Scale (SRP-III), along with measures embedded in the PAI and MMPI-2-RF, and structured risk frameworks like the HCR-20 form the core of contemporary psychopathy assessment. Recent work by Blais and Forth (2020)

Marcus and colleagues (2021), Porter and collaborators (2022), and Hare and Neumann (2021) examines how these tools perform in practice, looking closely at their consistency, how well they translate across different populations, their value in forensic and clinical decision-making, and the practical issues that arise when these assessments are presented in court.

Research in neuroscience and behavior conducted from 2020 to 2025, covering various areas like fMRI, brain structure imaging, developmental neuroscience, and connectivity investigations, was used to place psychopathic characteristics within cognitive and neural contexts. Works by Patrick (2022), Anderson & Kiehl (2020), Brazil et al. (2021), Wallace et al. (2022), and Decety et al. (2020) presented concrete evidence to explain the neural connections associated with psychopathy that are important for forensic evaluations.

To illustrate the impact of deficiencies in forensic evaluations on actual cases, this analysis includes instances from Indian and global inquiries. The selected examples demonstrate situations in which behavioral profiling did not succeed in reaching its goal, where psychological techniques were employed in a way that limited their efficiency, or when expert testimonies did not meet court standards. Each instance was chosen for its significance in evaluations concerning psychopathy and for illustrating the concrete results of misreading behavioral signals or relying on inadequately supported opinions. Solely sources that met requirements for scientific validity, legal significance, and forensic applicability were incorporated.

3. Neurobiology, Behaviour & Core Traits of Psychopathy

Psychopathy isn't just about breaking rules or acting out. It's more like a mix of how people think, feel, interact, and live their daily lives. What's going on in the brain plays a big role too, especially areas tied to emotions, choices, right and wrong, plus getting along with others [7,16,17]. Next up are key features, real-life signs, and links to brain patterns such as shape, activity, wiring, and early development all backed by solid studies [7,18,19].

3.1. Core Traits and Behavioural Manifestations

People with strong psychopathic tendencies tend to act cold, show little care for others, have flat emotions, rarely feel bad about wrong actions, seem charming at first glance, play mind games on others, and also keep emotionally distant [17,18]. Because of these features, connecting deeply with people feels hard, plus genuine moral feelings are usually missing [17].

People with psychopathy often act without thinking. They struggle to manage their actions. This can lead to reckless choices. Instead of planning, they chase intense experiences. Taking risks comes naturally to them. Over time, this might turn into ongoing rule-breaking or crime.

These two sides - emotional/social and daily habits/actions, usually show up together, shaping the complete picture of clinical or forensic psychopathy [17,19]. In real life, this means weak empathy or emotional reactions, trouble with right-or-wrong thinking or guilt, along with impulsive choices,

thrill-seeking, or rule-breaking actions [7,18,9]. That fits today's view: psychopathy isn't just breaking rules - it's deeper than that [17,18,19,9].

3.2. Neurobiological Correlates: Brain Structure, Function, Connectivity

Research from developmental trajectory studies, brain injury analysis, neuroimaging research, and cognitive performance evaluations consistently shows structural and functional problems in a variety of non-uniform brain regions. These anomalies are most noticeable in limbic, paralimbic, and frontal brain regions that are involved in emotional processing, socio-affective regulation, and executive control. According to systematic evaluations of neuroimaging research, psychopathic traits are linked to changes in activity and connectivity in areas that are involved in moral reasoning, emotion perception, and decision-making.Atypical learning processes, emotional detachment, and poor behavioural regulation may be impacted by these brain abnormalities, which also appear early, according to research on development and adolescents. The idea that psychopathic traits and associated behaviours are connected to pervasive abnormalities in the brain networks controlling emotion, cognition, and adaptive social functioning is supported by several convergent lines of research [7,16,18].

3.3. Key Brain Regions and Systems

Amygdala handles emotions, especially fear, negative experiences, plus spotting signs of suffering in others. When it doesn't work well, feelings like compassion or remorse tend to fade [7]. Scans reveal a smaller size of this brain area [17], while activity checks find less response when dealing with emotional challenges [16,18].

Prefrontal Cortex (vmPFC/OFC/general PFC): Handles choices, right-or-wrong thinking, managing urges, also behaviour control. Less grey matter here shows up in people with psychopathic features [7,17], which ties into rash actions alongside weak ethical judgment [18].

Broader limbic/paralimbic and limbic–prefrontal connectivity network: Some brain areas, like the front and back parts of the cingulate cortex, deep brain folds, memory-related curves, upper ear-side grooves, along with inner memory hubs, show changes [7,16]. Weaker signal paths, particularly in a curved nerve bundle, hamper how feelings get regulated [17,18]. Brain scans reveal trouble feeling empathy, adjusting actions from rewards, or managing impulses [16,19,9].

3.4. Neurodevelopmental Perspectives and Integrative Models

Neural quirks tied to psychopathy usually come from unusual brain growth early on [9]. Trouble with emotions and personal connections, along with rule-breaking actions, might start in childhood due to shifts in how feelings and thinking develop [20]. Lower cortisol reactions combined with odd stress hormone activity show a broken link between body chemistry and emotional struggles [21].

Paralimbic trouble theory: Psychopathy isn't down to one broken brain part it's about glitches spread through a web linking emotional and control centres [7,17]. Trouble feeling emotions (amygdala/limbic zone), making fair choices or staying on track (prefrontal zones), along with

weak links between these areas, together shape psychopathic features [19,9,20]. That idea lines up with seeing psychopathy as something rooted in how the brain grows or functions mentally [9,20].

3.5. Heterogeneity, Limitations, and Complexity

Research on brain imaging shows that people with psychopathic traits differ significantly in both structural and functional neural features [16,19]. Research indicates that impulsive or antisocial behaviours and emotional processing deficiencies are associated with different brain circuits, emphasising a division between areas supporting executive or behavioural control and affective regulation [17,19]. Therefore, it is better to think of psychopathy as an emergent feature of intricate interactions within widespread neural networks rather than as the outcome of a single brain region's malfunction.These networks evolve over time and are further influenced by personal learning paths, life events, and environmental factors [16,17,9]. The need for caution in interpretation is highlighted by the variation found in findings across several demographics, including adults, adolescents, and people in forensic circumstances. It highlights the significance of taking into account sample characteristics, cultural context, and developmental stage before drawing broad conclusions about the brain correlates of psychopathy [19,9].

3.6. Implications for Conceptualization & Forensic/Clinical Relevance

Looking at psychopathy from a brain-based angle shows it's tied to lasting changes in brain development and thinking skills, not just picked-up disruptive actions [7,16,17]. That idea fits better with mixed methods using behaviour ratings, mind tests, emotion exercises, along with brain scans or hormone levels [16,9]. In real-world cases plus mental health work, seeing all sides helps judge danger, map out care plans, or spot issues fast, particularly in young people showing cold, uncaring behaviours, even though moral concerns and research limits matter too [7,9,20].

4.Forensic Assessment Tools

Forensic assessment tools fall under the broader area of psychological evaluation but differ due to their specialised purpose in legal settings.Psychological assessment, in general, examines a person's past, present, and future psychological functioning to understand behaviour and predict future actions. As a rapidly growing specialty in clinical psychology, forensic evaluation involves psychologists providing, interpreting, and presenting psychological evidence in legal matters [22]**.**Trained forensic evaluators conduct these assessments in criminal and civil courts, correctional centres, and law enforcement contexts. Forensic assessment includes both standard psychological tests and tools created specifically for legal decision-making. Currently, hundreds of thousands of such evaluations are performed each year by psychologists and mental health professionals [23].

4.1. PCL-R (Psychopathy Checklist–Revised)

The PCL-R is presented in the literature as a widely used, evidence-based instrument designed to clarify the construct of psychopathy for clinical, forensic and research settings; authors stress that it synthesises Cleckley's clinical observations with empirical items that map interpersonal,

affective and deviant lifestyle features to a single standardised instrument [24].
Complementary evaluations point out that the PCL-R is essential to risk assessment and forensic decision-making due to its extensive study history and consistent relationships with criminal outcomes, but they also emphasise the importance of interpreting scores in context rather than as the only factors used to determine legal decisions [25].

4.1.1.Structure of the Instrument

Foundational evaluation work characterises the PCL-R as a 20-item clinician-rated checklist, with each question intended to capture a trait or behaviour typical of psychopathy; items are graded 0–1–2 and summed to provide a 0–40 total score that reflects psychopathic traits [26].
Subsequent factor-analytic research has refined the instrument's conceptual structure many papers report that hierarchical or multi-facet models (e.g., interpersonal, affective, lifestyle, antisocial facets or bifactor/hierarchical models) provide a better statistical fit than a simple two-factor arrangement, implying that psychopathy comprises related but distinct subdomains [27].

4.1.2.Administration Procedure

Methodological studies demonstrate that PCL-R ratings are obtained by combining a thorough file/collateral review (criminal records, institutional notes, historical documentation) with a semi-structured clinical interview. This multi-source approach enhances comprehensiveness and lessens reliance on self-report [28]. While carefully conducted file-only ratings can approximate interview-based totals for some facets, measurement-comparison research shows that they tend to underestimate affective/interpersonal nuances. As a result, best practice still combines interviews with collateral information when possible [29].

4.1.3.Scoring and Interpretation

Psychometric summaries explain the 0–2 scoring per item and the interpretation of the summed 0–40 score, noting common forensic cutoffs (e.g., 30+ as a high-severity threshold in some jurisdictions), while authors caution that cutoffs should be applied thoughtfully given sample and legal-context variability [30]. According to complementary analyses, facet and factor patterns rather than just the overall score carry significant interpretive information. For instance, high lifestyle/antisocial facet scores indicate criminal versatility and behavioural risk, while high interpersonal/affective scores indicate core personality traits [31].

4.1.4.Applications in Forensic Settings

Comprehensive evaluations demonstrate that the PCL-R is frequently utilised for risk assessment (predicting violence and recidivism), informing parole and sentence decisions, and directing treatment and management plans in correctional or forensic psychiatric settings [32].
Higher PCL-R scores are consistently linked to an increased risk of violent reoffending and institutional misbehaviour, which explains the instrument's importance in forensic practice. Meta-analytic and longitudinal research corroborate the PCL-R's practical predictive efficacy [33].

4.1.5.Psychometric Properties

Validation studies suggest that when administered by experienced raters with enough file information, the PCL-R exhibits great internal consistency, good inter-rater reliability, and significant predictive validity for antisocial outcomes notably in research environments utilising standardised processes [34]. However, field reliability research indicates that inter-rater agreement and some facet-level reliability can diminish in normal forensic practice where rater training or information quality changes; this highlights the need of training and standardised administration [35].

4.1.6.Benefits of the PCL-R

Authors underline that PCL-R's major strength is its comprehensive, multi-source design integrating interview data, behavioural history and official records which generates a clinically relevant profile that surpasses several self-report measures in forensic prediction [30]. Additionally, decades of empirical investigation including predictive and construct validity studies make the PCL-R one of the most widely validated instruments for studying psychopathy and anticipating recidivism in offender samples [36].

4.1.7. Limitations of the PCL-R

Critical research raises numerous concerns: some studies reveal that the factor structure may vary among samples and that apparent multidimensionality might sometimes reflect methodological artefacts rather than genuine psychological entities, challenging straightforward interpretations of subscales [37]. Measurement invariance testing and culturally sensitive norms are therefore advised prior to cross-population use, as other empirical work reveals limitations on generalisability; many validation samples are male and criminal justice based, and results may differ in female, juvenile, civil, or non-Western populations [27].

4.1.8.Ethical and Legal Considerations

Because PCL-R scores frequently impact high-stakes legal decisions (sentencing, parole, civil confinement), policy and practitioner reviews stress that assessments must be conducted by trained, qualified evaluators with clear reporting of limitations and careful integration of contextual data [38]. Professional statements and critiques warn against sole reliance on PCL-R totals in adversarial legal settings; instead, professionals advocate employing the instrument as one piece of a holistic forensic review and explaining uncertainty and restrictions to courts [39].

4.2. Multidimensional Personality Questionnaire (MPQ)

4.2.1.Introduction to the MPQ

In order to evaluate a variety of normal-range personality qualities, including variations in emotional style, temperament, interpersonal behaviour, and responsiveness, the MPQ was created as a broad-band self-report personality assessment [40].Because it provides a thorough trait profile rather than concentrating solely on pathology or maladjustment, it has been widely used not only in research on individual differences and temperament but also increasingly in applied settings like

public safety screening and forensic psychology contexts [41].

4.2.2.Structure of the Instrument

The MPQ has eleven basic (first-order) characteristic scales that load onto three higher-order temperament dimensions, commonly referred to as Constraint (CON), Negative Emotionality (NEM), and Positive Emotionality (PEM) [42]. The MPQ has 276 items (true/false) in its normal version. Additionally, there are shortened versions, like the 155-item brief form (MPQ-BF), that maintain the higher-order structure and exhibit strong correlations with the trait scales of the full form, making the instrument more useful for extensive or time-limited evaluations [43].

4.2.3.Administration, /Forensic Contexts

Administration is by self-report (true/false format), and the MPQ incorporates validity scores to detect inconsistent responding or socially acceptable response patterns — boosting its utility in circumstances where respondents may seek to falsify or distort results [42].Empirical evaluations in applied screening populations (for example, candidates for law-enforcement positions) demonstrate acceptable construct validity: MPQ factors connect rationally to suitability assessments and post-hire performance results, supporting its efficacy as a personality-screening instrument in public-safety and forensic settings [44].

4.2.4.Psychometric Properties

Research demonstrates that MPQ trait scales, both primary and higher-order, have substantial structural validity and internal consistency; factor-analytic work verifies that the higher-order dimensions (PEM, NEM, CON) represent significant temperament structures with psychobiological meanings. [45]
Additionally, validation of shortened and simplified versions showed sufficient reliability and convergent validity with the standard form, expanding MPQ's applicability in a variety of forensic or institutional contexts by expanding its usability across populations with different literacy or testing constraints. [46]

4.2.5. Applications

Beyond basic personality study, MPQ has been employed in screening for public-safety employment (e.g., police candidates), where specific MPQ profiles can predict suitability and highlight probable danger of maladaptive behavior. [44]
Furthermore, MPQ traits have been utilised as building blocks for derivative scales linked to forensic-relevant constructs. For example, researchers have developed triarchic-model psychopathy scales (boldness, meanness, and disinhibition) from MPQ items (the "MPQ-Tri" scales), connecting forensic psychopathy research with normal-range personality assessment. [47]

4.2.6. Advantages of the MPQ

Because MPQ assesses normal-range personality traits rather than pathology per se, it provides a comprehensive, dimensional personality profile which can complement clinical or forensic assessments especially when one wants to contextualize behavior without pathologizing [42]. Its breadth, empirical backing, availability of full and brief/simplified forms, validity-check scales,

and normative data make it flexible for research, pre-employment screening, and forensic-psychology applications, including in populations where standard psychopathology inventories are less appropriate. [43]

4.2.7.Limitations of the MPQ

Because MPQ is a normal-range trait test, it cannot detect mental illness or disordered personality on its own; high or low scores indicate trait dispositions rather than clinical diagnoses. As a result, care must be taken when interpreting results when making forensic or therapeutic decisions [48]. Additionally, some research highlights limitations in discriminant validity among subscales (e.g., meanness vs. disinhibition), particularly over time or across different populations. This means that derived scores may not completely replace specialised forensic instruments, even though derived scales (e.g., MPQ-Tri) attempt to map forensic constructs like psychopathy onto normal-range traits [49].

4.2.8.Contextual Considerations in Forensic Use of MPQ

Because MPQ responses are self-reported, impression management is always a possibility, particularly in forensic, correctional, or job-screening contexts. Validity scales help reduce but do not completely eliminate this risk, so results should be interpreted in conjunction with behavioural history and collateral data [42]. Moreover, when applying MPQ-derived scales for forensic characteristics (e.g. psychopathy), practitioners should clearly indicate that these are indirect approximations and ideally supplement them with expert forensic assessment instruments, clinical interviews, and contextual evaluation. [49]

4.3Tripm (Triarchic Psychopathy Measure)

4.3.1.Definition & theoretical origin

The Triarchic Model conceptualises psychopathy as a configuration of three partly overlapping phenotypic categories Boldness, Meanness, and Disinhibition — suggested to combine differing historical interpretations of psychopathy and to link descriptive qualities to underlying biobehavioral processes [8]. According to Patrick and Drislane, these three constructs map onto various literatures (e.g., criminal and externalising literatures → Meanness & Disinhibition; Cleckley-style fearless social dominance → Boldness). The model was created to guide etiological and measurement work as well as to reconcile current assessment approaches [50].

4.3.2.Structure of the instrument (TriPM composition)

The widely used TriPM is a self-report questionnaire that was initially set up to generate three scale scores that corresponded to the triarchic constructs: a multi-item Boldness scale, a Meanness scale, and a Disinhibition scale. The items were chosen or created to index the phenotypic content that the model specified [51]. In order to support the TriPM's factorial mapping onto boldness, meanness, and disinhibition and to show that the triarchic constructs may be operationalised from various item pools, complementary work has created triarchic scales employing items from other

existing inventory (e.g., PPI, MPQ) [52].

4.3.3.Administered & scoring

The TriPM is administered as a paper or online self-report questionnaire with items rated on a predetermined Likert scale. Subscale scores, which can be used in conjunction with a total score reflecting broad triarchic psychopathy, are calculated by adding the item responses for each domain [51]. In order to assess construct validity and understand trends (e.g., high Disinhibition + high Meanness → enhanced antisocial risk), researchers employing the TriPM place a strong emphasis on integrating self-report scores with additional data (external criteria, clinical information) wherever feasible [53].

4.3.4.Instrument measures

Boldness is characterised by a propensity for social dominance, low levels of worry or fear, stress tolerance, and a readiness to take risks both physically and interpersonally; Meanness includes predatory behaviour, callousness, exploitativeness, and a lack of empathy; Disinhibition includes emotional dysregulation, poor planning, impulse control issues, and a tendency towards externalising behaviour [8]. Meanness is strongly associated with low agreeableness/empathy, Disinhibition with impulsivity/externalizing, and Boldness with low fear and social potency, according to empirical studies using the TriPM and triarchic scales. These findings support the triarchic distinctions in practice [50,60].

4.3.5.Uses & applications in forensic settings

The TriPM is commonly utilised in research (construct validation, nomological mapping), forensic screening, and risk-related research where researchers want a dimensional self-report tool that explicitly assesses boldness and antisocial/disinhibitory traits. The TriPM has been used in studies to compare groups (forensic versus community), predict antisocial consequences correlatively, and connect features to physiological and neuropsychological indicators [54,55]. According to comparative research, the TriPM can identify profiles related to psychopathy and occasionally offers further or additive information to other instruments (e.g., elucidating the significance of boldness, which is less captured by some standard antisocial-focused measures). [8]

4.3.6.Psychometric properties

Across various samples (community, student, forensic), TriPM subscales generally demonstrate acceptable to good internal consistency and predicted convergent/discriminant validity with other psychopathy and personality measures (though specific coefficients vary by sample and translation) [51,8]. The TriPM consistently distinguishes groups and correlates with criteria measures (externalising, aggressiveness), according to replication and cross-validation study (including ROC and forensic vs. community comparisons). However, psychometric strength is sample-dependent, and several structural issues still need to be addressed. [57,60,61]

4.3.7.Limitations & measurement issues

Factor-analytic and item-level research has revealed structural complexities: several studies have discovered that items, particularly Boldness items, can split into subcomponents or show multidimensionality, and that the simple three-factor item structure does not always fit perfectly across diverse samples and translations. In certain situations, these problems make it more difficult to interpret scale results simply [58,60,61]. Additional drawbacks include the use of self-report, which is susceptible to response bias, cultural and translational variations that impact the functionality of items, and sporadic low endorsement rates for highly antisocial items in nonforensic samples. All of these factors necessitate careful, multi-method evaluation when using TriPM scores to guide decisions [54,56].

4.3.8.Translation and population validity

TriPM translations and validations (e.g., Chinese, Italian, Dutch samples) show the TriPM can be adapted and often retains reasonable reliability and convergent validity, but scale structure and item functioning sometimes differ across cultures for instance Boldness sometimes fails to be unidimensional in non-US samples. These cross-cultural findings underline the requirement for local psychometric validation before practical use [56,59,60,61]. Item-response and structural studies across samples also reveal that some items give little statistical information in particular populations, therefore localised item analysis (and occasionally scale adjustment) enhances interpretability and measurement precision [54,56].

4.3.9. Practical benefits

TriPM is efficient (self-report), theory-driven (maps directly onto triarchic variables), and widely utilised, making it an effective research instrument for mapping psychopathy dimensions and screening large samples. Its explicit inclusion of Boldness helps test hypotheses on fearless/social-dominant qualities that other measures may miss [51]. To avoid relying too much on self-report alone, best practices from the literature include using TriPM in conjunction with collateral or behavioural data when feasible, confirming local psychometric properties (reliability, factor structure, item functioning) for your sample, and interpreting Boldness, Meanness, and Disinhibition in the context of other measures (e.g., PCL-R, PPI) [53,60,61]. Table 1.below depicts how PCL-R, MPQ, and TriPM differ based on their main focus, the way they work, how they are used legally, where their data comes from, the traits they measure, their ability to predict risk, and the best situations where they are used for psychological and forensic evaluations

Aspect	PCL-R	MPQ	TriPM
Main focus	Psychopathy (forensic diagnosis)	Normal personality traits	Psychopathy dimensions
Type	Clinician-rated	Self-report	Self-report
Used in courts	Yes (high legal value)	No	Limited
Data source	Interview + records	Questionnaire only	Questionnaire only
What it measures	Criminal, interpersonal & affective traits	Temperament & personality	Boldness, Meanness, Disinhibition
Risk prediction	Strong (violence, recidivism)	Indirect	Moderate
Best use	Sentencing, parole, risk assessment	Screening & research	Research & screening

Table.1. Comparison Of the Tools PCL-R, MPQ, TriPM

5.Technology & Psychopathic Evaluation

The assessment of psychopathy usually uses set interviews or fixed surveys - these help spot key patterns in character and rule-breaking actions. Still, newer tech has brought fresh options, letting experts look at the condition more clearly and with better accuracy [7,16]. Today's approaches mix brain activity, thinking tests, body signals, along with observed behaviours, giving a fuller and sturdier picture during evaluations [16,17].

5.1.Neuroimaging Approaches

Brain scans like sMRI, fMRI, or PET help scientists study how psychopathy links to brain function [17,19]. When looking at structure, sMRI often shows smaller parts in areas tied to emotions, decision-making, or caring about others - like the amygdala or prefrontal zones [17,9]. During mental tasks involving fear, emotion, or right-or-wrong choices, fMRI detects lower activity in those same spots, hinting at trouble feeling empathy or learning from negative outcomes [19,20]. With PET, researchers can track brain chemicals, showing how dopamine or serotonin systems may drive impulsive actions or strong reactions to rewards [9,62]. Combined, these tools give measurable data that support standard ways of diagnosing psychopathic traits [7,19,20].

5.2.Psychophysiological and Behavioural Technology

Psychophysiological methods track body reactions tied to feelings and thinking, giving clues about psychopathic features [20,63]. Tools like skin conductance (SCR), heart rate shifts (HRV), facial muscle activity (EMG), or eye movement tracking pick up small changes in how people respond emotionally or focus their attention [20,62]. Take this: people high in these traits usually have weaker skin responses when scared, copy fewer signs of others' pain on their faces, and look at emotional faces differently [62,63]. Scientists and doctors use these readings to gauge problems in caring for others, paying attention, or controlling actions, adding value alongside brain scans and mental health checks [20,63].

5.3.Artificial Intelligence and Computational Approaches

Artificial intelligence is being used more often to study psychopathy by pulling together different kinds of data - like brain scans, body signals, and actions [64,65]. Instead of relying solely on standard tests, computer-based tools can spot subtle signs of impulsive behaviour, trouble making ethical decisions, or a tendency to take risks [64]. These tech-powered systems might help predict psychopathic traits, improve safety evaluations in legal cases, or guide personalised treatments [65,66]. Even though this field's just starting, it shows how blending digital analysis with classic methods could work well [64,65].

5.4.Digital Behaviour and Social Media Analytics

Online actions, like how people interact or post on social platforms, can hint at their personality or even signs of psychopathy [66,67]. Tools that process language, such as those that spot emotions or detect lies, help experts study communication styles for hints of deceit or control tactics [12]. By checking these messages, researchers might catch behaviours tied to recklessness, coldness, or playing others. Still, while this info adds value alongside standard tests, there's a need to handle user data carefully due to privacy risks [66,67].

5.5.Applications in Forensic and Clinical Settings

The use of tech tools in assessing psychopathy plays a real role in legal and mental health settings. Because brain scans and body-response tests help build reliable results, they're useful when judging danger level, decision-making ability, or guilt in crime cases [17,19,20]. When teens show cold-hearted or unfeeling behaviours, spotting them early with digital methods means care can start sooner, maybe stopping serious rule-breaking patterns later on [9,62]. Since smart algorithms predict likely paths for individuals, therapists and justice workers get clearer guidance, not just guesses, for planning care that actually works [64,65].

5.6. Limitations and Future Directions

Even though tech-driven ways show promise, they come with hurdles. Costly setups, spotty access, plus reliance on rare skills slow broad use [16,20]. On top of that, differences in how psychopathic features appear - and mixed study methods - make findings tough to compare [9,63]. Next steps need clear guidelines, testing blended systems in varied groups, also linking digital

tools with classic behaviour checks. Merging brain data, computer analysis, along with real-world actions, could give clearer insights into psychopathy's complexity [7,16,64,65].Table.2.gives an overview of modern ways such as brain scans, body response tests, artificial intelligence, and digital behavior analysis and the tools used to examine emotions, behavior, risk prediction, and decision-making in legal contexts

Approach	Technology Used	Main Purpose
Neuroimaging	sMRI, fMRI, PET	Studies brain areas related to emotion, empathy, and decision-making
Psychophysiological methods	SCR, HRV, EMG, eye tracking	Measures emotional and fear responses
Artificial Intelligence (AI)	Machine-learning analysis	Identifies behaviour patterns and predicts risk
Digital behaviour analysis	Language & social-media analysis	Detects manipulation, deceit, and antisocial traits
Forensic application	Combined technologies	Supports risk assessment and legal decisions

Table.2. Technology & Psychopathic Evaluation

6. Forensic Truth Verification in India

6.1.Polygraph Examination

The polygraph monitors autonomic nervous system activity (heart/respiratory rates, blood pressure, skin conductance) as an examinee answers event-relevant and control questions; the technique is based on the assumption that deceptive answers produce distinct physiological arousal patterns that a trained examiner can identify and interpret [68]. Large scientific reviews and meta-analyses have concluded that polygraph tests can perform above chance for some event-specific uses but are vulnerable to false positives/negatives and to countermeasures, so their accuracy varies by technique, question design, examiner skill, and testing conditions which limits their reliability as conclusive proof in forensic contexts [69] .Figure 3. Provides a Visual Representation of how a polygraph test operates by tracking physiological reactions such as skin conductivity, breathing, and heart rate. It is predicated on the scientific idea that psychological stress or dishonesty causes quantifiable bodily changes that are captured and examined by sensors and a data recorder

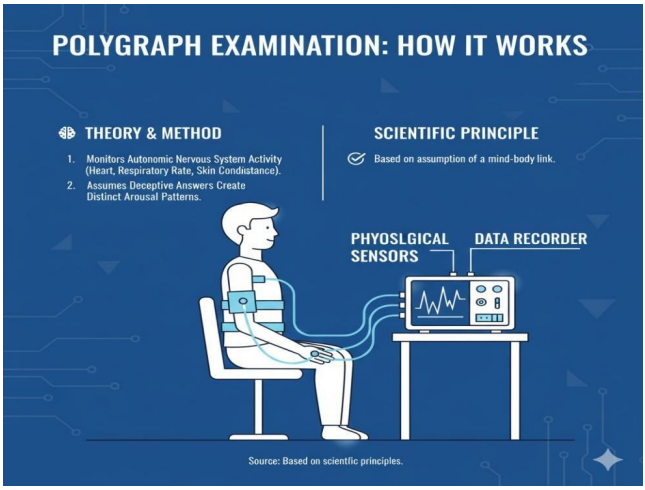

Figure.3.Polygraph Examination : How it works.

6.2.Narcoanalysis

Narcoanalysis uses intravenous sedative/hypnotic agents (historically barbiturates such as sodium pentothal or sodium amytal, as well as other sedatives) to induce a reduced-inhibition state in order to facilitate recall or disinhibit responses; proponents claim it can help elicit memories or leads that would otherwise be concealed during normal interrogation [18].
Clinical and forensic analyses and Indian expert commentary emphasise that narco-elicited statements are influenced by suggestibility, confabulation, and impaired judgement under sedation; therefore such statements are unreliable as direct evidence and are primarily useful, if at all, as investigative leads rather than admissible proof. The scientific and ethical constraints of these methods were also brought to light by the Supreme Court of India's examination. [70]

6.3.Brain Electrical Activation Profile / Brain Electrical Oscillation Signature

Investigative brain-mapping techniques (often referred to as BEAP/BEOS or "brain-fingerprinting" when based on P300/"MERMER" event-related potentials) assess whether a subject's brain exhibits recognition responses to crime-relevant probes. These techniques rely on electrophysiological signatures (such as P300 amplitude/latency) that arise when a recognised stimulus is presented, which can indicate experiential knowledge without requiring explicit verbal responses [71]. Although there are few field-level studies, different protocols, and few independent replications and large-sample validations, evidence reviews of brain-fingerprinting and related P300 paradigms show promising laboratory results for detecting recognition (experiential knowledge) in controlled conditions. Therefore, although BEAP/BEOS can suggest familiarity with specific information, its inferential limits (and vulnerability to confounds) require cautious interpretation [72].

6.4.Admissibility under Indian Law

The basic rules of evidence (Indian Evidence Act, 1732) and constitutional protections (such as the right against self-incrimination under Article 20(3) and the right to personal liberty under Article 21) govern whether and how scientific methods may be used in Indian law. Statutes and precedent mandate that courts distinguish between statements that are coerced or untrustworthy and voluntary, validated scientific evidence [73]. In Selvi v. State of Karnataka (Supreme Court, 2010), the Court ruled that the forced administration of narcoanalysis, polygraph, and brain mapping in investigations violated the right against self-incrimination and personal liberty. The ruling made it clear that these tests cannot be forced, that the results are not always admissible as evidence, and that any results obtained voluntarily must be handled with strict safeguards. This effectively limited the evidentiary value of these techniques in Indian courts [74].

6.5. Disadvantages

Across the scientific literature and legal commentaries, key limitations are repeatedly noted

a) Physiological responses measured by polygraphs are not specific to deception and can reflect anxiety, medical conditions, or situational stress.

b) Narcoanalysis may increase suggestibility, confabulation and unreliable recall.

c) Electrophysiological measures (P300/BEOS) indicate recognition, not intent or guilt, and can be confounded by exposure to media, bystanders' knowledge, or neurological/psychiatric conditions [75].

Ethical and procedural problems compound these scientific limits: involuntary testing breaches autonomy and self-incrimination protections, tests are vulnerable to examiner bias and poor standardisation, and without robust protocols and independent validation the risk of miscarriages of justice (false leads, wrongful suspicion) is substantial which is why many experts and courts caution against using these techniques as standalone proof [76].

6.6. Legal Acceptability & Procedural Standards

If these methods are to be used at all, Indian jurisprudence and expert advice require voluntary informed consent, independent medical supervision, and judicial oversight; courts and academics have urged that any testing be accompanied by explicit documentation of consent, the presence of counsel, independent medical supervision, and the preservation of raw data and protocols for future examination [77]. In order to prevent abuse and promote scientific transparency when investigative agencies use such techniques, national reviews and policy documents also suggest that testing be subject to ethical review, that standard operating procedures and accreditation be established for laboratories and experts, and that investigatory use be restricted to generating leads (not for automatic admissibility) [78].

7. Integrated Neurobehavioral Profiling Framework (INPF)

The Integrated Neurobehavioral Profiling Framework (INPF) is aimed at improving the assessment and understanding of psychopathy by integrating neurobiological, behavioural, and contextual information [79]. Conventional evaluations frequently rely on set questionnaires or organised interviews, which record apparent behaviour but may ignore underlying environmental and neurological factors [8]. INPF tackles these shortcomings by merging neuroimaging, behavioural analysis, and contextual data to provide a more full, multi-dimensional picture [7]. This approach allows forensic and clinical professionals to build individualised, evidence-based profiles of individuals with psychopathic tendencies [9].

7.1.Rationale and Conceptual Basis

Psychopathy comprises a complex combination of affective, interpersonal, and behavioural features [20]. Neurobiological studies reveal that anomalies in the amygdala, ventromedial prefrontal cortex (vmPFC), and paralimbic network are related to emotional processing deficiencies, impaired moral reasoning, and problematic decision-making [17,16]. Behavioural qualities such as impulsivity, callousness, and risk-taking interact dynamically with contextual factors, including family dynamics, social exposure, and stressors, impacting the likelihood of antisocial or criminal behaviour [80,81].

7.2.Three main domains are integrated by the INPF:

Neurobiological Signs: Emotional regulation, impulse control, and reward sensitivity can be quantified using structural and functional imaging (sMRI, fMRI, PET) and physiological measurements (HRV, SCR, EEG) [17,18].Behavioural Patterns: Standardised tests, observational instruments, and digital analytics are used to document observable characteristics like hostility, dishonesty, lack of empathy, and social manipulation [9,80].Contextual Factors: Individual history, environmental exposures, peer influences, and situational triggers are investigated to understand how psychopathic tendencies develop in real-life circumstances [7,81]. Because of this comprehensive approach, INPF is able to identify the mechanisms underlying psychopathic behaviour as opposed to just its external manifestations [79,20].

7.3.Integration Process

The procedure for Integration INPF begins with rigorous multi-domain data collection [8]. Brain structure and function are revealed by neurobiological measurements [17,16]. Psychopathy scales, observational recordings, and digital technologies for real-time monitoring are examples of behavioural assessments [80,18]. Environmental exposures, situational triggers, and developmental history are all included in contextual data [7,81]. These multidimensional datasets are analysed using computational methods and machine learning to find patterns that might not be apparent in single-domain evaluations [9,18]. An increased risk of instrumental violence or recidivism, for instance, may be indicated by the combination of high impulsivity (behaviour), hypoactive amygdala responses (neurobiology), and stressful contextual exposure (context) [20,81].

7.4.Applications in Forensic and Clinical Settings

INPF facilitates better risk assessment, decision-making, and reoffending [17,16]. Early Identification: Targeted early therapies are supported when psychopathic tendencies, especially callous-unemotional features, are identified in adolescents or young adults [80,81]. Personalised Interventions: Based on each person's distinct neurobehavioral profile, therapeutic approaches can be tailored with an emphasis on social skill development, moral reasoning, and emotional control [9,18]. Predictive Modelling: AI-driven analysis in INPF helps with proactive rehabilitation planning by forecasting future behaviour patterns [79,18].

7.5.Advantages of INPF

It provides a complete assessment that goes beyond surface-level behavioural observations [79]. It facilitates customised profiling, provides improved forensic utility, and opens up new avenues for studying how brain networks, behaviour, and environment interact [8,7,20]. By incorporating context, INPF promotes ethically informed assessments, minimising reliance on stereotyped behavioural judgments [9,17,81].

7.6.Future Directions

Longitudinal neuroimaging, real-time behavioral monitoring, and enhanced AI-driven predictive algorithms can all help improve the framework [79,8,18]. Its generalizability may be confirmed by cross-cultural research, which may also reveal moderating variables including gender, socioeconomic status, and concomitant conditions [7,20]. Clinical and forensic procedures can be improved by creating feedback loops by connecting INPF with treatment outcomes [9,81]. To sum up, INPF offers a multifaceted, evidence-based, and customized method for assessing psychopathy. It gives researchers, clinicians, and forensic psychologists a precise, predictive, and morally sound instrument for assessing and treating people with psychopathic tendencies by connecting brain, behavior, and context [79,7].Figure.4. Shows a visual overview of how the Integrated Neurobehavioral Profiling Framework (INPF) integrates actions, surroundings, and brain activity to better understand an individual's behavior. It is mostly utilized for the simple, organized study, analysis, and prediction of human behavior.

Figure 4. Integrated Neurobehavioral Profiling Framework (inpf)

8. Critical Case Studies: Failures in Profiling Psychopathic Offenders and Assessment Gaps

When analysing the personality structures, risk factors, and behavioural patterns of violent and repeat offenders, forensic psychology is crucial. However, a number of well-known incidents from various countries show that even scientifically based psychopathy diagnostic instruments and profiling systems can be ineffective when misused, misinterpreted, or utilised without sufficient context. These mistakes underscore the need for multi-method, culturally sensitive, evidence-based assessment methodologies and demonstrate methodological, ethical, and interpretive constraints in forensic practice.

8.1. International Case Failures

Case Study 1:Jack the Ripper (UK, 1888)

Jack the Ripper, who was active in London's Whitechapel area in 1888, is among the first documented serial killers whose actions exposed the shortcomings of initial forensic and profiling techniques. Aiming at women, frequently sex workers, the perpetrator murdered and disfigured his victims, and in spite of multiple investigative efforts by Scotland Yard, he stayed unrecognized, showcasing ongoing forensic misclassification [91][92]. The inquiries depended on basic behavioral observations, testimonies from witnesses, and police documentation, yet the crime patterns were only somewhat identified. Efforts to create a profile of the killer were obstructed by the absence of organized criminological techniques, and misreading the nature of the offenses slowed down prompt response [92]. The Jack the Ripper case exemplifies initial investigative difficulties and highlights the need for organized behavioral profiling to comprehend serial

criminals [91]

Case Study 2: Ted Bundy (USA, 1974–1978)

Ted Bundy, an American serial killer who operated in the 1970s, represents a high-functioning psychopathic criminal whose charisma and intellect enabled him to avoid capture for years [93][94]. Focusing on young women, Bundy kidnapped and killed his victims while projecting a socially acceptable façade. Behavioral observations, witness accounts, and retrospective evaluations of psychopathy uncovered important characteristics of psychopathy, such as superficial charm, manipulativeness, and absence of guilt [95]. Although there were later recognized patterns in victim selection and murder techniques, his case illustrates the difficulties in profiling offenders who effectively conceal their abnormal behavior and emphasizes the necessity of systematic psychopathy evaluation in forensic practices [93][94]

Case Study 3: BTK Killer (USA, 1974–1991)

Dennis Rader, infamously recognized as the BTK killer, took the lives of ten individuals over almost twenty years, highlighting the shortcomings and possible failure of offender profiling [96][97]. His murders, marked by binding, torment, and strangulation, featured lengthy gaps between offenses, making it difficult to identify behavioral patterns. Rader led a socially typical life as a married church official, illustrating the dual persona frequently seen in psychopathic criminals. Behavioral linkage analysis and retrospective examination of case files showed characteristics of manipulation, concealment, and significant psychopathy, but misreading of patterns postponed his apprehension for decades [98]. The BTK case highlights the importance of persistently modifying profiling techniques for structured, enduring criminals [97]

Case Study 4: Cyanide Mohan (India, 1999–2009)

Cyanide Mohan, operating in Karnataka, India, poisoned numerous women over a decade, revealing significant shortcomings in criminal profiling and risk evaluation in Indian settings [99][100]. His deceptive actions, scheming nature, and purposeful utilization of cyanide showcase evident psychopathic characteristics, such as manipulation, absence of compassion, and deliberate hostility. Investigators initially did not identify the serial pattern, revealing a lack of organized psychopathy assessment and constraints in behavioral profiling techniques [99][100]. Examinations of the case highlight the necessity for systematic forensic psychology methods in identifying and comprehending serial criminals, especially within Indian legal and investigative frameworks where organized profiling was traditionally lacking [100] Figure.5.presents a visual illustration of forensic style collage about a serial crime case, mixing a picture of the suspect with symbols representing the victims and parts of the investigation. It highlights the bigger problems in the system, how people behave, and the detailed mental and investigation aspects needed to understand these kinds of crimes.

Figure 5. Case Study 4: Cyanide Mohan (India,1999-2009)

Case Study 5: Koodathayi / Thamarassery Cyanide Murders (India, 2002–2016)

A prime example of female serial killing in India is the Koodathayi cyanide murders in Kerala, which were committed by Jolly Joseph and involved the poisoning of several family members over a fourteen-year period [101][102]. In order to maintain regular social functioning and avoid detection, Joseph displayed strong psychopathy signs, such as long-term planning, manipulation, and criminal concealment. The significance of behavioural profiling and psychopathy evaluation in identifying patterns of female serial killing was highlighted by forensic and criminological analyses that revealed several warning indicators of psychopathy that investigators had missed. The case highlights the importance of systematic forensic evaluation as well as the difficulties in identifying non-violent-looking criminals [102][101].

Case Study 6 : Nithari Killings (Uttar Pradesh, India, 2005–2006)

Serious shortcomings in forensic profiling and psychopathy assessment in India were exposed by the Nithari serial killings, which took place in Noida, Uttar Pradesh, and involved the murder of numerous women and children [103][104][105]. Extreme violence and sexual assault were the hallmarks of the crimes, but because behavioural analysis and psychopathy instruments were not used sufficiently at first, detectives were unable to spot the serial pattern. The case's retrospective analysis revealed structural flaws in Indian investigation techniques, such as the lack of organised forensic analysis and the inadequate identification of criminal characteristics. The Nithari case is still a crucial illustration of how early detection and prevention of serial crimes can be hampered by the lack of a thorough psychopathy assessment [104][103].

9.Result

Several recent studies published between 2020 and 2025 demonstrate strong and consistent support for conceptualising psychopathy as a multidimensional construct encompassing emotional dysfunction, interpersonal dominance, and impaired behavioural regulation rather than a unitary diagnostic entity. The studies suggest that neurobiological evidence repeatedly identified atypical structure, activity, and connectivity within the amygdala, ventromedial prefrontal cortex, and paralimbic networks, particularly during tasks involving fear processing, empathy, moral reasoning, and reward learning, which were associated with diminished emotional responsiveness and impaired affective decision-making. Findings from both forensic and non - forensic sample showed affective–interpersonal traits (e.g., callousness, lack of remorse, manipulation) and antisocial–impulsive traits contribute differentially to offending patterns and risk, with impulsive–antisocial features more strongly predicting violent recidivism and institutional misconduct. In forensic settings forensic instruments such as the PCL-R, TriPM, MPQ-derived scales, and structured risk assessment tools indicated acceptable reliability and predictive utility when administered by trained professionals, however, limitations related to cultural validity, gender differences, and susceptibility to response bias were consistently noted. Emerging technological methods, including neuroimaging, psychophysiological assessment, and AI-assisted analytics, showed potential to enhance assessment precision but remain constrained by ethical, practical, and accessibility concerns. In this review paper we analyse some cases from Indian and international contexts further revealed that profiling failures often resulted from overreliance on behavioural indicators without sufficient integration of neurobiological and contextual information. Overall, the findings show the need for integrative approaches, such as the Integrated Neurobehavioral Profiling Framework (INPF) to improve forensic accuracy and ethical decision-making.

10.Discussion

Interstingly, the findings reviewed in this paper support the conceptualization of psychopathy as a multidimensional and complex construct rather than a unitary disorder. Across recent studies, there is consistent evidence that psychopathy comprises affective, interpersonal, and behavioral components, which interact dynamically with neurobiological substrates and environmental factors. Emotional dysfunction such as reduced empathy, impaired fear processing, and diminished moral sensitivity, seems to remains a central feature of the disorder. This may help explain why some individuals consistently struggle with ethical decision making. So emotional dysfunction aligns with neuroimaging findings indicating atypical structure, activity, and connectivity within the amygdala, ventromedial prefrontal cortex (vmPFC), and paralimbic networks. In addition these brain regions are critical for integrating emotional signals and guiding decision-making in social and moral contexts, and their dysfunction provides a mechanistic explanation for the affective and moral deficits observed in psychopathic individuals. The convergence of behavioral and neurobiological evidence highlights that psychopathy cannot fully understood just by looking at their actions. For instance someone may appear charming and socially adept while exhibiting significant underlying emotional deficits.

From a behavioral perspective, the literature consistently indicates that affective-interpersonal traits, such as callousness, superficial charm, and manipulativeness, contribute differently to

offending patterns compared to antisocial-impulsive traits.In other words, affective- interpersonal traits manifest differently from antisocial- impulsive traits in criminal behaviour. Impulsive and antisocial characteristics appear more predictive of violent recidivism and institutional misbehavior, whereas affective-interpersonal traits often correlate with strategic criminality and the capacity to avoid detection. This differentiation underscores the importance of multidimensional assessment in forensic settings, as relying exclusively on observable behavior risks overlooking individuals who possess psychopathic traits but are capable of high-functioning or socially adaptive manipulation. The use of standardized forensic instruments, including the PCL-R, Triarchic Psychopathy Measure (TriPM), and MPQ-derived scales, demonstrates acceptable reliability and predictive utility when administered by trained professionals. However, these tools have notable limitations, such as potential cultural bias, gender-related variability, and vulnerability to self-report distortions, which necessitate careful interpretation within the broader context of clinical and situational data.

The introduction of technological advances in the assessment of psychopathy represents an important evolution in the field. Neuroimaging techniques, including structural MRI (sMRI), functional MRI (fMRI), and PET scans, allow for the visualization of structural and functional anomalies associated with psychopathic traits, particularly in areas related to emotional regulation, reward processing, and executive control. Psychophysiological measures, such as heart rate variability, skin conductance, and facial electromyography, provide complementary insights into emotional reactivity and attentional processes. In addition, AI-assisted analytics offer the potential to integrate multidomain datasets and identify subtle behavioral and neurobiological patterns that may elude conventional evaluation methods. While these methods are promising, their widespread implementation is currently constrained by ethical considerations, cost, accessibility, and the need for rigorous validation across diverse populations.

The review of international and Indian case studies further highlights the practical challenges and limitations inherent in psychopathy assessment and offender profiling. Historical cases, such as Jack the Ripper and Ted Bundy, demonstrate how high-functioning psychopathic individuals can evade detection for extended periods, emphasizing the shortcomings of purely behavior-based investigative approaches. More recent Indian cases, including the Cyanide Mohan and Nithari killings, reveal similar gaps, where the absence of systematic forensic psychological evaluation and integration of neurobehavioral data delayed pattern recognition and hindered early intervention. These examples underscore the limitations of purely behavior-based approaches. These instances collectively underline the necessity of an integrated, multidimensional approach that combines behavioral observation, neurobiological assessment, and contextual analysis to improve accuracy in identifying psychopathic tendencies, particularly in forensic contexts.

The Integrated Neurobehavioral Profiling Framework (INPF) seems to offer a practical way to forward. It combines brain-based indicators, observed behaviors, and contextual information to create a more holistic approach to understanding psychopathy. Interestingly the framework allows for individualized profiling, enhancing both predictive validity and ethical decision-making in legal and clinical settings. Importantly, INPF emphasizes the dynamic interaction of intrinsic traits with environmental influences, acknowledging that risk factors such as childhood adversity, social exposure, and situational stressors can modulate the expression of psychopathic behavior. Early identification of callous-unemotional traits, particularly in adolescents, enables targeted interventions that can potentially mitigate long-term antisocial outcomes. Furthermore, the

integration of AI-driven predictive modeling within INPF supports proactive rehabilitation planning, optimizing the allocation of resources for treatment and supervision.

As research suggests, several challenges remain. Psychopathy is inherently heterogeneous, with neural, behavioral, and contextual presentations varying across individuals, genders, and cultural backgrounds. High-functioning or non-criminal psychopathic individuals may elude standard forensic instruments, highlighting the need for continuous refinement of assessment tools. Ethical considerations are also paramount, particularly when employing neuroimaging or AI-based predictive models in legal contexts. Consent, transparency, and the avoidance of deterministic labeling are essential to ensure that scientific advancements are applied responsibly. However longitudinal research, cross-cultural validation, and integration of real-time behavioral monitoring represent promising avenues for future development, with the potential to enhance the precision and applicability of frameworks like INPF.

Taken together, the evidence supports a reconceptualization of psychopathy as a multidimensional and neurobehaviorally grounded construct. Forensic assessment benefits from moving beyond behavior-only evaluations, incorporating neurobiological, psychological, and contextual data to generate more accurate, individualized profiles. Ultimately, the integration of technological innovations with established instruments, as exemplified by INPF, offers significant potential to improve predictive accuracy, inform tailored interventions, and support ethical decision-making. Ultimately, a multidomain, integrative approach is essential to advancing both the scientific understanding of psychopathy and its practical application in forensic and clinical settings. Such an approach bridges the gap between theoretical research and real-world application, enhancing the ability of forensic professionals to identify, assess, and manage individuals with psychopathic traits while maintaining ethical and evidence-based standards.

11. Conclusion

The study emphasises how forensic psychology evaluation is still developing as a specialised field that demands a high degree of ethical responsibility, transparency, and scientific rigour. Reliability and fairness in legal settings are nevertheless challenged by inconsistent practice, poor documentation, and a lack of adherence to standardised procedures, even with the increasing availability of organised instruments and scientifically backed methodologies. Enhancing the credibility of forensic evaluations still requires integrating evidence-based recommendations, strengthening basic competencies, and improving evaluator training.

In general, improving forensic assessment necessitates a dedication to best-practice concepts, such as understanding the boundaries of competence, using assessment tools appropriately, and thinking clearly. Forensic psychological evidence can significantly aid the legal system while lowering the possibility of prejudice, error, and unethical behaviour when assessors adhere to rigorous professional integrity and scientifically informed procedures.

Acknowledgment

We are grateful to Karunya Institute Of Science and Technology for providing the necessary facilities and resources to complete this work. We sincerely thank our faculties and friends for their support and cooperation during this project especially Dr. A. Obadiah and Ms. Iyda Jenifer D for their constant support and guide. Finally, We express our heartfelt gratitude to our parents and family for their constant encouragement.

References

1.Patrick, C. J. (2022). *Psychopathy: Current knowledge and future directions*. Annual Review of Clinical Psychology, 18, 437–465. https://doi.org/10.1146/annurev-clinpsy-081219-102807

1.Anderson, N. E., & Kiehl, K. A. (2020). *Psychopathy: Development, brain, and behaviour*. Annual Review of Clinical Psychology, 16, 493–519. https://doi.org/10.1146/annurev-clinpsy-071119-115850

2.Brazil, I. A., Glenn, A. L., & Blair, R. J. R. (2021). *Psychopathy as a neuropsychiatric disorder: Integrating cognitive and neural evidence*. Neuroscience & Biobehavioral Reviews, 125, 207–225. https://doi.org/10.1016/j.neubiorev.2021.01.019

3.Wallace, L., Viding, E., & Seara-Cardoso, A. (2022). *A systematic review of current conceptualisations of psychopathy*. Psychological Medicine, 52(12), 2213–2229. https://doi.org/10.1017/S00332917210051002

4.Blair, R. J. R. (2021). *Psychopathy: Cognitive and neural dysfunction*. Nature Reviews Neuroscience, 22(8), 536–550. https://doi.org/10.1038/s41583-021-00485-4

5.Decety, J., Michalska, K. J., & Kinzler, K. D. (2020). *A neuroscience perspective on empathy and psychopathy*. Trends in Cognitive Sciences, 24(10), 874–886. https://doi.org/10.1016/j.tics.2020.07.001

6.Johanson, M., Vaurio, O., Tiihonen, J., & Lähteenvuo, M. (2020). *A systematic literature review of neuroimaging of psychopathic traits*. Frontiers in Psychiatry, 10, 1027. https://doi.org/10.3389/fpsyt.2019.01027

7.Patrick, C. J., Fowles, D. C., & Krueger, R. F. (2009). *Triarchic conceptualization of psychopathy: Developmental origins of disinhibition, boldness, and meanness*. Development and Psychopathology, 21(3), 913–938. https://doi.org/10.1017/S0954579409000492

8.Deming, P. (2024). *Psychopathy and medial frontal cortex: A systematic review*. Neuroscience & Biobehavioral Reviews, 160, 105298. https://doi.org/10.1016/j.neubiorev.2024.105298

9. Jones, D. W. (2017). *Moral insanity and psychological disorder: The hybrid roots of psychiatry*. History of Psychiatry, 28(4), 389–405. https://doi.org/10.1177/0957154X17732020

10.Cleckley, H. (1941). *The mask of sanity: An attempt to clarify some issues about the so-called*

psychopathic personality. Mosby.

11. American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). American Psychiatric Association.

12. World Health Organization. (1992). *The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines*. WHO.

13. Hare, R. D. (1980). *A research scale for the assessment of psychopathy in criminal populations*. Personality and Individual Differences, 1(2), 111–119. https://doi.org/10.1016/0191-8869(80)90028-8

14. Venables, N. C., Hall, J. R., & Patrick, C. J. (2014). *Differentiating psychopathy from antisocial personality disorder: A triarchic model perspective*. Psychological Medicine, 44(5), 1005–1013. https://doi.org/10.1017/S003329171300161X

15. Aguiar, R. J., Vitacco, M. J., Porter Staats, M. L., & Dzurny, T. (2023). *Psychopathy and callous-unemotional traits in adolescence: A systematic review of cultural inclusion and meta-analysis of fMRI neural correlates*. Journal of Criminal Justice, 86, 102067.

16. Miglin, R., Rodriguez, S., Bounoua, N., & Sadeh, N. (2021). *A multidimensional examination of psychopathy traits and gray matter volume in adults*. Social Cognitive and Affective Neuroscience, 17(7), 662–672.

17. Thomas, E., Wagner, K., Henson, R., et al. (2025). *Dissecting how psychopathic traits are linked to learning in different contexts: A multilevel computational and electrophysiological approach*. Cognitive, Affective, & Behavioral Neuroscience.

18. Dugré, J. R., & Potvin, S. (2024). *Functional connectivity of the nucleus accumbens across variants of callous-unemotional traits: A resting-state fMRI study in children and adolescents*. Research on Child and Adolescent Psychopathology.

19. Myznikov, A., Korotkov, A., Zheltyakova, M., et al. (2024). *Dark triad personality traits are associated with decreased gray matter volumes in 'social brain' structures*. Frontiers in Psychology, 14, 1326946.

20. Waller, R., Dotterer, H. L., Murray, L., et al. (2020). *Amygdala–prefrontal cortex connectivity and callous-unemotional traits in children and adolescents: A systematic review of structural and functional MRI studies*. Neuroscience & Biobehavioral Reviews, 112, 307–325. https://doi.org/10.1016/j.neubiorev.2020.01.022

21. iResearchNet. (n.d.). *Forensic assessment*. iResearchNet: Psychology. https://psychology.iresearchnet.com/forensic-psychology/forensic-assessment

22. Indira Gandhi National Open University. (n.d.). *Forensic psychology: Block 1 – Nature and scope of forensic psychology* [Course material]. eGyanKosh. https://egyankosh.ac.in/bitstream/123456789/89873/1/Block-1.pdf

23. Hare, R. D., & Neumann, C. S. (2008). *Psychopathy as a clinical and empirical construct*.

Annual Review of Clinical Psychology, 4, 217–246. https://doi.org/10.1146/annurev.clinpsy.3.022806.091452

24. Salekin, R. T., Rogers, R., & Sewell, K. W. (1996). *A review and meta-analysis of the Psychopathy Checklist and Psychopathy Checklist–Revised: Predictive validity of dangerousness*. Clinical Psychology: Science and Practice, 3(3), 203–215. https://doi.org/10.1111/j.1468-2850.1996.tb00071.x

25. Cooke, D. J., & Michie, C. (2001). *Refining the construct of psychopathy: Towards a hierarchical model*. Psychological Assessment, 13(2), 171–188. https://doi.org/10.1037/1040-3590.13.2.171

26. Mokros, A., Neumann, C. S., Stadtland, C., Osterheider, M., Nedopil, N., & Hare, R. D. (2011). *Assessing measurement invariance of PCL-R assessments from file reviews of North American and German offenders*. International Journal of Law and Psychiatry, 34(1), 56–63. https://doi.org/10.1016/j.ijlp.2010.11.009

27. Grann, M., Långström, N., Tengström, A., & Stålenheim, G. (1998). *Reliability of file-based retrospective ratings of psychopathy with the PCL-R*. Journal of Personality Assessment, 70(3), 416–426. https://doi.org/10.1207/s15327752jpa7003_2

28. Olver, M. E., & Wong, S. (2015). *Field inter-rater reliability of the Psychopathy Checklist–Revised in a sample of federal sex offenders*. Psychological Assessment, 27(2), 447–456. https://doi.org/10.1037/pas0000048

29. Hemphill, J. F., Hare, R. D., & Wong, S. (1998). *Psychopathy and recidivism: A review*. Legal and Criminological Psychology, 3(1), 139–170. https://doi.org/10.1111/j.2044-8333.1998.tb00323.x

30. Debowska, A., Boduszek, D., Dhingra, K., Sherretts, N., & Willmott, D. (2018). *The PCL-R family of psychopathy measures: Dimensionality and predictive utility*. Journal of Criminal Psychology, 8(1), 1–18. https://doi.org/10.1108/JCP-08-2017-0015

31. Hare, R. D. (1991). *The Hare Psychopathy Checklist—Revised (PCL-R) manual* (2nd ed.). Multi-Health Systems.

32. Cooke, D. J., & Sellbom, M. (2019). *An examination of the Psychopathy Checklist–Revised latent factor structure via exploratory structural equation modeling*. Psychological Assessment, 31(5), 581–591. https://doi.org/10.1037/pas0000676

33. Neumann, C. S., Hare, R. D., & Newman, J. P. (2007). *The superordinate nature of the Psychopathy Checklist–Revised*. Journal of Personality Disorders, 21(1), 102–117. https://doi.org/10.1521/pedi.2007.21.1.102

34. Moreira, D., & Oliveira, A. (2014). *Psychopathy: A comprehensive review of its assessment and issues*. Aggression and Violent Behavior, 19(5), 542–552. https://doi.org/10.1016/j.avb.2014.07.003

35. Olver, M. E., et al. (2020). *Reliability and validity of psychopathy measures in institutional*

settings (review). (Open access review available via institutional repository). https://modlab.yale.edu/sites/default/files/files/Reliability%20and%20Validity%20of%20the%20Psychopathy%20Checklist-Revised.pdf

36. Cooke, D. J., Hart, S. D., & Michie, C. (2018). The dimensionality of the Hare Psychopathy Checklist–Revised, revisited: Its purported multidimensionality might well be artifactual. *Personality and Individual Differences, 138*, 24–32. https://doi.org/10.1016/j.paid.2018.09.007

37. DeMatteo, D., et al. (2020). Statement of concerned experts on the use of the Hare Psychopathy Checklist–Revised in capital sentencing to assess risk for institutional violence. *Psychology, Public Policy, and Law, 26*(2), 133–144. https://doi.org/10.1037/law0000223

38. Ngo, D. A., et al. (2024). Psychopathic traits in adult versus adolescent males: Measurement invariance across the PCL-R and PCL:YV. *Behavioral Sciences, 14*(8), 672. https://doi.org/10.3390/bs14080672

39. Tellegen, A. (2003). The Multidimensional Personality Questionnaire (MPQ). In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (pp. 1–8). Springer. https://doi.org/10.1007/978-3-319-28099-8_48-1

40. Pearson Clinical & Biopsychosocial Assessments. (2023). *Multidimensional Personality Questionnaire (MPQ) – Professional assessment manual*. Pearson.

41. Patrick, C. J., Curtin, J. J., & Tellegen, A. (2002). Development and validation of a brief form of the Multidimensional Personality Questionnaire. *Psychological Assessment, 14*(2), 150–163. https://doi.org/10.1037/1040-3590.14.2.150

42. Patrick, C. J., Kramer, M. D., & Tellegen, A. (2013). Development and preliminary validation of a simplified-wording form of the MPQ (MPQ-SF). *Assessment, 20*(4), 405–418. https://doi.org/10.1177/1073191112467051

43. Mielniczuk, P. M., Barnhill, J. W., Brady, S., & Keith, B. (2020). Examining the validity of the Multidimensional Personality Questionnaire in the assessment of police candidates. *International Journal of Forensic Mental Health, 19*(3), 193–201. https://doi.org/10.1080/14999013.2020.1746742

44. Krueger, R. F., Caspi, A., Moffitt, T. E., Silva, P. A., McGee, R., & Sharma, A. (1996). Public-domain personality trait scales and their relation to female delinquency. *Journal of Personality and Social Psychology, 71*(2), 305–319. https://doi.org/10.1037/0022-3514.71.2.305

45. Mitchell, S. H., Larsen, H., & Pedersen, J. (2015). Psychometric evaluation of the brief and simplified forms of MPQ in adolescents. *Journal of Personality Assessment, 97*(4), 398–409. https://doi.org/10.1080/00223891.2014.963169

46. Garofalo, C., Weller, J., Kirisci, L., & Reynolds, M. (2021). Elaborating on the longitudinal measurement invariance and construct validity of the Triarchic psychopathy scales from the MPQ (MPQ-Tri). *Psychological Assessment, 33*(9), 890–903. https://doi.org/10.1037/pas0001023

47. Dunedin Study Group. (2023). Use of the Multidimensional Personality Questionnaire in longitudinal developmental research. *Journal of Personality Disorders, 37*(1), 71–94.

48. Sellbom, M., & Drislane, L. E. (2019). Limitations and interpretive challenges of MPQ-derived psychopathy constructs in applied forensic settings. *Journal of Forensic Psychology Research and Practice, 19*(4), 301–317. https://doi.org/10.1080/24732850.2019.1654438

49. Patrick, C. J., Fowles, D. C., & Krueger, R. F. (2009). Triarchic conceptualization of psychopathy: Developmental origins of disinhibition, boldness, and meanness. *Development and Psychopathology, 21*(3), 913–938. https://doi.org/10.1017/S0954579409000492

50. Patrick, C. J., & Drislane, L. E. (2015). Triarchic model of psychopathy: Origins, operationalizations, and observed linkages with personality and general psychopathology. *Journal of Personality*. https://doi.org/10.1111/jopy.12119

51. Brislin, S. J., Drislane, L. E., Smith, S. T., Edens, J. F., & Patrick, C. J. (2015). Development and validation of triarchic psychopathy scales from the Multidimensional Personality Questionnaire. *Psychological Assessment, 27*(3), 838–851. https://doi.org/10.1037/pas0000087

52. Hall, J. R., Drislane, L. E., Patrick, C. J., Morano, M., Lilienfeld, S. O., & Poythress, N. G. (2014). Development and validation of Triarchic construct scales from the Psychopathic Personality Inventory. *Psychological Assessment, 26*(2), 447–461. https://doi.org/10.1037/a0035665

53. Drislane, L. E., Patrick, C. J., & Arsal, G. (2014). Clarifying the content coverage of differing psychopathy inventories through reference to the Triarchic Psychopathy Measure. *Psychological Assessment, 26*(2), 350–362. https://doi.org/10.1037/a0035152

54. Stanley, J. H., Wygant, D. B., & Sellbom, M. (2013). Elaborating on the construct validity of the Triarchic Psychopathy Measure in a criminal offender sample. *Journal of Personality Assessment, 95*(4), 343–350. https://doi.org/10.1080/00223891.2012.735302

55. Sellbom, M., & Phillips, T. R. (2013). An examination of the triarchic conceptualization of psychopathy in incarcerated and nonincarcerated samples. *Journal of Abnormal Psychology, 122*(1), 208–214. https://doi.org/10.1037/a0029306

56. Somma, A., Borroni, S., Drislane, L. E., & Fossati, A. (2016). Assessing the triarchic model of psychopathy in adolescence: Reliability and validity of the Triarchic Psychopathy Measure (TriPM) in three samples of Italian community-dwelling adolescents. *Psychological Assessment, 28*(4), e36–e48. https://doi.org/10.1037/pas0000184

57. van Dongen, J. D. M., Drislane, L. E., Nijman, H., Soe-Agnie, S. E., & Van Marle, H. J. C. (2017). Further evidence for reliability and validity of the Triarchic Psychopathy Measure in a forensic sample and a community sample. *Journal of Psychopathology and Behavioral Assessment, 39*(1), 58–66. https://doi.org/10.1007/s10862-016-9567-5

58. Eichenbaum, A. E. (2019). *Item response theory analysis of the Triarchic Psychopathy Measure* (Doctoral dissertation). [Repository/institutional thesis — item-level/IRT findings summarized in IRT literature].

59. Shou, Y., Sellbom, M., Xu, Y., Chen, H., & others. (2016). Development and validation of the Chinese Triarchic Psychopathy Measure. *Assessment/Personality Disorders* (Chinese TriPM psychometrics reported). https://doi.org/10.1521/pedi.2016.30.4.436

60. Sleep, C. E., Weiss, B., Lynam, D. R., & Miller, J. D. (2019). An examination of the Triarchic Model of psychopathy's nomological network: A meta-analytic review. *Clinical Psychology Review, 71*, 122–137. https://doi.org/10.1016/j.cpr.2019.04.005

61. Collison, K. L., Miller, J. D., & Lynam, D. R. (2021). Examining the factor structure and validity of the Triarchic Model of Psychopathy across measures. *Personality Disorders: Theory, Research, and Treatment, 12*(2), 115–126. https://doi.org/10.1037/per0000394

62. Dugré, J. R., & Potvin, S. (2024). Functional connectivity of the nucleus accumbens across variants of callous-unemotional traits: A resting-state fMRI study in children and adolescents. *Research on Child and Adolescent Psychopathology*. (Published online 2023).

63. Viding, E., Jones, A. P., Frick, P. J., et al. (2022). Neurodevelopmental pathways of callous-unemotional traits in children and adolescents: A review. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 7*(3), 234–247.

64. Blair, R. J., Jones, A. P., Clark, F., et al. (2021). Psychophysiological markers of empathy and moral decision-making in individuals with high psychopathic traits. *International Journal of Psychophysiology, 162*, 1–12.

65. Cecchi, G. A., et al. (2023). Artificial intelligence and computational approaches for predicting antisocial and psychopathic behavior. *Journal of Forensic Sciences, 68*(4), 1450–1462.

66. Larrimore, K. E., et al. (2022). Machine learning applications in psychopathy research: Integrating behavioral, physiological, and neuroimaging data. *Frontiers in Psychiatry, 13*, Article 899876.

67. Abbasi, A., Chen, H., & Salem, S. (2020). Social media analytics for personality and psychological profiling: Opportunities and challenges. *Information Systems Frontiers, 22*, 1591–1611.

68. Ross, S., Hollis, C., & Hennig, J. (2021). Digital behavioral markers of psychopathy: Language analysis and online activity patterns. *Computers in Human Behavior, 115*, 106611.

69. National Research Council. (2003). *The polygraph and lie detection*. Committee to Review the Scientific Evidence on the Polygraph. The National Academies Press. https://www.nap.edu/catalog/10420/the-polygraph-and-lie-detection

70. Gordon, P. N. (2012). Meta-analytic review of criterion accuracy of validated polygraph techniques (report). American Polygraph Association. Executive summary and criterion accuracy review. https://www.polygraph.org/docs/meta_analytic_review_polygraph_404.pdf

71. Math, S. B. (2011). Supreme Court judgment on polygraph, narco-analysis & brain-mapping: A boon or a bane? *Indian Journal of Medical Research, 134*(1), 4–7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3171915/

72. Mukundan, C. R. (n.d.). Brain Electrical Oscillation Signature Profiling (BEOS) [Technical description/profiling report]. ResearchGate. https://www.researchgate.net/publication/320642905_Brain_Electrical_Oscillation_Signature_Profiling_BEOS

73. Farwell, L. A. (2012). Brain fingerprinting: A tutorial review. *Forensic Science International: Mind and Law* (tutorial/review). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3311838/

74. Government of India. (1872/Consolidated). *The Indian Evidence Act, 1872*. Government of India. https://www.indiacode.nic.in/bitstream/123456789/15351/1/iea_1872.pdf

75. Manupatra (2010). Selvi & Ors. v. State of Karnataka — judgment analysis and legal implications (case note / commentary). Manupatra. https://www.manupatracademy.com/LegalPost/MANU_SC_0325_2010

76. Langleben, D. D., & Moriarty, J. C. (2012). Using brain imaging for lie detection: Where science, law and policy collide. *Psychology, Public Policy, and Law* (review on fMRI and deception). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3680134/

77. Hartwig, M., & Bond, C. F., Jr. (2011). Lie detection from multiple cues: A meta-analytic review of cue validity and diagnostic weight. *Journal of Applied Research in Memory and Cognition.* https://doi.org/10.1016/j.jarmac.2011.08.002

78. LawSkills. (n.d.). Selvi v. State of Karnataka — commentary: Selvi judgment commentary and procedural implications. https://www.lawskills.in/FreeRes/Cases/Selvi-v.-State-of-Karnataka.pdf

79. Misra, G. J., & Government of India (Ministry of Home Affairs). (2010). *Perspective plan for Indian forensics* (report describing forensic lab roles, procedural recommendations and institutional capacity). Government of India / MHA. https://www.mha.gov.in/sites/default/files/IFS%282010%29-FinalRpt_0%5B1%5D.pdf

80. Blair, R. J. (2001). Neurocognitive models of aggression, the antisocial personality disorders, and psychopathy. *Journal of Neurology, Neurosurgery & Psychiatry, 71*(6), 727–731.

81. Government of India. (2023). Bharatiya Sakshya Adhiniyam, 2023. Ministry of Law & Justice.

82. Saks, M. J., & Faigman, D. L. (2020). Expert evidence after scientific reforms. Annual Review of Law and Social Science, 16, 1–20.

83. Neal, T. M. S., & Grisso, T. (2021). The cognitive and ethical foundations of forensic psychological assessment. Psychology, Public Policy, and Law, 27(1), 1–15.

84. Blais, J., & Forth, A. E. (2020). The PCL-R in court: Updated perspectives on admissibility and application. Journal of Forensic Psychology Practice, 20(4), 267–290.

85. Marcus, D. K., Lilienfeld, S. O., & Edens, J. F. (2021). Self-report measures of psychopathy in forensic practice. Psychological Assessment, 33(6), 543–556.

86. Porter, S., ten Brinke, L., & Wilson, K. (2022). Forensic applications of psychopathy assessment: International perspectives. International Journal of Forensic Mental Health, 21(3), 213–227.

87. Rogers, R., & Shuman, D. (2020). Forensic assessment in criminal and civil law. Guilford Press.

88. Watts, A. L., & Salekin, R. T. (2023). Limitations of psychopathy assessment in legal contexts: A critical review. Law and Human Behavior, 47(2), 85–100.

89. Hare, R. D., & Neumann, C. S. (2021). Psychopathy in clinical and legal settings: International developments. Annual Review of Clinical Psychology, 17, 391–421.

90. Brussel, J. A. (1968). *Casebook of a Crime Psychiatrist.* Bernard Geis Associates.

91. Douglas, J. E., & Olshaker, M. (1995). *Mindhunter: Inside the FBI's Elite Serial Crime Unit.* Scribner.

92. Hazelwood, R. R., & Warren, J. I. (2003). Linkage analysis: Modus operandi, signature, and fantasy in serial sexual crime. *Journal of Police and Criminal Psychology, 18*(1), 17–27.

93. Ressler, R. K., Burgess, A. W., & Douglas, J. E. (1988). *Sexual Homicide: Patterns and Motives.* Lexington Books.

94. Keppel, R. D., & Birnes, W. J. (2005). *The Riverman: Ted Bundy and I Hunt for the Green River Killer.* Pocket Books.

95. Canter, D. V. (1994). *Criminal Shadows: Inside the Mind of the Serial Killer.* HarperCollins.

96. Canter, D. V., Alison, L. J., Alison, E., & Wentink, N. (2004). The organized/disorganized typology of serial murder: Myth or model? *Psychology, Public Policy, and Law, 10*(3), 293–320.

97. Pennebaker, J. W., & Chung, C. K. (2011). Expressive writing: Connections to mental and physical health. *Oxford Handbook of Health Psychology*, 417–437. (Used in offender linguistic pattern studies)

98. Fitzgerald, J., & Joseph, A. (2007). Profiling the Unabomber: The forensics of written documents. *Forensic Linguistics, 14*(1), 45–67.

99. Turvey, B. E. (2011). *Criminal Profiling: An Introduction to Behavioral Evidence Analysis* (4th ed.). Academic Press.

91. Evans, S., & Rumbelow, D. (2006). *Jack the Ripper: Scotland Yard investigations 1888–1892*. Sutton Publishing.

92. Waddell, C. (2019). Jack the Ripper and the myth of the Whitechapel murders. *Journal of Victorian Culture, 24*(3), 336–355.

93. Michaud, S., & Aynesworth, H. (2019). *Ted Bundy: Conversations with a killer*. Authorlink Press.

94. Rule, A. (2000). *The stranger beside me*. W. W. Norton.

95. Hare, R. D., & Neumann, C. S. (2008). Psychopathy and forensic phenomena: The case of Ted Bundy. *Criminal Justice and Behavior, 35*(10), 129–145.

96. Douglas, J., & Olshaker, M. (2017). *Mindhunter: Inside the FBI's elite serial crime unit*. Scribner.

97. Ramsland, K. (2016). *Confession of a serial killer: The untold story of Dennis Rader, the BTK killer*. University Press of New England.

98. Schlesinger, L. B. (2017). Serial homicide: The BTK killings. *Journal of Aggression, Conflict and Peace Research, 9*(4), 279–288.

99. Menon, N. (2010). Serial killings in Karnataka: The case of Cyanide Mohan. *Indian Journal of Criminology, 38*(2), 45–58.

100. Nambiar, S. (2014). Criminal profiling challenges in Indian serial murder cases: Lessons from Cyanide Mohan. *Journal of Forensic Psychology Practice, 14*(3), 254–267.

101. Varghese, T., & Joseph, A. (2020). Female serial homicide in India: The Koodathayi cyanide murders. *Journal of Indian Academy of Forensic Medicine, 42*(4), 213–219.

102. Kumar, R. (2021). Psychopathy indicators in female-perpetrated serial killings: A case analysis of the Kerala cyanide murders. *International Journal of Offender Therapy and Comparative Criminology, 65*(12), 1372–1390.

103. Sharma, R. (2012). The Nithari serial killings: A forensic and criminological analysis. *Indian Journal of Forensic Sciences, 6*(2), 55–63.

104. Banerjee, S., & Mohanty, S. (2013). Child victim serial homicides in India: Profiling errors in the Nithari case. *Journal of Child Sexual Abuse, 22*(5), 587–603.

105. Singh, A. (2010). Lessons from Nithari: Gaps in forensic profiling in India. *Criminal Law Journal, 116*(3), 78–89.