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Neurocognitive Dysfunction and Criminal Liability: Integrating Neuroscience, Legal Theory, and Islamic Thought

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Abstract

This article examines the relationship between neurocognitive dysfunction, criminal behaviour, legal theory, and Islamic thought, with particular attention to the neurobiological foundations of moral decision-making and criminal responsibility. Employing an interdisciplinary normative approach that integrates cognitive neuroscience, criminal law theory, moral philosophy, and Islamic jurisprudence, this study analyses how neurobiological dysfunctions especially those affecting the prefrontal cortex and amygdala may influence

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impulse control, moral judgement, and antisocial conduct. Drawing exclusively on a critical review of scholarly literature, judicial decisions, and normative legal sources, the article explores the implications of neuroscientific findings for concepts of free will, moral agency, and criminal liability. The analysis demonstrates that while neuroscientific evidence has the potential to inform sentencing mitigation and rehabilitative strategies, its application raises significant ethical and legal challenges, particularly concerning biological determinism, evidentiary reliability, and procedural fairness. From an Islamic legal perspective, sound intellect (ʻaql) constitutes the foundation of taklīf (legal responsibility), yet Islamic jurisprudence recognises circumstances in which responsibility may be diminished or removed, in accordance with the principles of rafʿ al-ḥaraj and maqāṣid al-sharīʻah. The article argues that the absence of clear procedural standards and limited doctrinal integration of neuroscience within criminal justice systems particularly in Indonesia and Malaysia necessitates a more coherent normative framework. Ultimately, this study proposes a holistic and ethically grounded approach to criminal justice reform that integrates neuroscientific insights with legal principles and religious values, aiming to enhance proportionality, procedural justice, and human dignity.

KEYWORDS

Neuroethics, Criminal Law, Neuroscience Evidence, Moral Responsibility, Islamic Justice

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Introduction

The debate about the moral basis of criminal law has long been part of the discourse of legal philosophy. For centuries, the criminal justice system was built on the assumption that human beings are rational beings who have free will and therefore, can be held accountable for their actions[1]. Acts that are in the form of crimes are often the result of various criminogenic factors[2]. However, as cognitive neuroscience advances, the assumption of accountability for these actions is beginning to be questioned. Discoveries about how brain structure, neural function, and neurocognitive activity affect human behavior have challenged the normative foundations of criminal responsibility. This is where an interdisciplinary branch called *Neurolaw*, which is a field that examines how neuroscience findings can and should be used in the legal process, particularly in the context of criminality, punishment, and rehabilitation.

One of the main focuses in neurolaw is aggressive and antisocial behavior, which has historically been a major concern in sentencing. Modern neuroscience suggests that aggression often correlates with abnormalities or dysfunctions in certain areas of the brain, such as the prefrontal cortex (which regulates executive function and impulse control) and the amygdala (which is associated with emotional responses and threats). Individuals with certain Neurolaw or neurochemical disorders, such as MAOA-L gene mutations or frontal control disorders, may show higher propensity for violent behavior, impulsivity, and lack of empathy are all hallmarks of antisocial behaviors[3]. This fact raises serious questions in the realm of law and ethics: can individuals with such Neurolaw conditions be considered fully morally and legally responsible? Or, should the legal system accommodate new understandings of biological determinism?

The implications of this question are not only theoretical, but also practical. The use of Neurolaw evidence in the courtroom is increasing, both for the purpose of mitigating punishment and for the full defense. However, this raises concerns of abuse, stigmatization, or even biological determinism that reduces

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[1] Rinitami Njatrijani, "Law , Development & Justice Review Law , Development & Justice Review," *Law, Development & Justice Review* 3, no. 2 (2022): 1–9.

[2] Harun A badu Darmawati, Rafika Nur, "The Idea Of Legal Reform Implementation Assessment Risks And Criminogenic Needs Of Residivist Inmates In Overcoming Residivism," *IJLR: International Journal of Law Reconstruction* 8, no. 2 (2024): 1–23.

[3] Nathan J. Kolla and Marco Bortolato, "The Role of Monoamine Oxidase A in the Neurobiology of Aggressive, Antisocial, and Violent Behavior: A Tale of Mice and Men," *Progress in Neurobiology* 194, no. 1 (November 2020): 101875, https://doi.org/10.1016/j.pneurobio.2020.101875.

the moral agency of individuals. In addition, courts still face confusion in interpreting complex and often inconclusive neuroscience data.

In this context, this paper aims to critically explore the neurobiological underpinnings of aggression and antisocial behavior, as well as examine how these findings can and should affect the criminal justice system. The main focus is directed at how the concepts of free will, legal responsibility, and rehabilitation are revisited in light of contemporary neuroscience findings. By combining approaches from moral philosophy, law, and neuroscience, this article is expected to contribute to the formation of a legal framework that is more inclusive and adaptive to scientific reality, while upholding the principles of justice and moral autonomy.

Neurolaw is an interdisciplinary field that examines the application of neuroscience findings and methods to the legal system[4], especially in terms of understanding criminal responsibility, proof, and sentencing. Neuroethics, as a branch of bioethics, evaluates the moral and social implications of the application of neuroscience, including in the context of law and public policy[5]. Aggression in this context refers to behavior that aims to hurt or harm others, both physically and psychologically[6], Aggression can be divided into two main types: reactive aggression (reactive, emotional) and instrumental aggression (deliberate and goal-oriented)[7]. Antisocial behavior refers to patterns of behavior that violate social norms, harm others, and are often associated with antisocial personality disorder (ASPD) or psychopathy.

The theoretical framework of this study rests on the main approach of Maslow's hierarchy of needs theory, as cited by [8] Maslow's theory explains that human behavior is driven by efforts to meet basic needs ranging from physiological needs, a sense of security, love/togetherness, self-esteem, to self-

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[4] Zico Junius Fernando et al., "Neurolaw: A Concept in Development and Enforcement of Criminal Law in Indonesia," *Jambura Law Review* 7, no. 1 (2025): 55–87, https://doi.org/10.33756/jlr.v7i1.24144.

[5] Jayatri Das et al., "Neuroscience Is Ready for Neuroethics Engagement," *Frontiers in Communication* 7 (December 2022), https://doi.org/10.3389/fcomm.2022.909964.

[6] Putri Febriana and Nina Zulida Situmorang, "Mengapa Remaja Agresi?," *Jurnal Psikologi Terapan Dan Pendidikan* 1, no. 1 (2019): 16, https://doi.org/10.26555/jptp.v1i1.15128.

[7] Kiran K. Soma et al., "Novel Mechanisms for Neuroendocrine Regulation of Aggression," *Frontiers in Neuroendocrinology* 29, no. 4 (2008): 476–89, https://doi.org/10.1016/j.yfrne.2007.12.003.

[8] Anisyah Rahmadania and Hery Noer Aly, "Implementasi Teori Hirarchy Of Needs Maslow Dalam Meningkatkan Motivasi Belajar Di Yayasan Cahaya Generasi Islam Kota Bengkulu," *Jurnal Pendidikan Dan Konseling (JPDK)* 5, no. 4 (2023): 261–72, https://doi.org/10.31004/jpdk.v5i4.17456.

actualization. When these needs, particularly at basic levels such as security and self-esteem, are not consistently met, individuals can experience psychological frustration that triggers deviant behavior, including aggressive and criminal behavior. If these needs are not met, as is the case with inmates who have difficulty finding jobs, lost family support, or experienced social rejection, then frustrated responses can arise in the form of aggressive or criminal actions. Based on interviews with recidivist inmates, a pattern of reasons related to economic insecurity, social isolation, and loss of direction in life was found[9]. This shows that criminal acts are not solely the result of personality tendencies or Neurolaw disorders, but also in response to the failure of the system to meet human needs as a whole. Thus, legal interventions and assessments must consider not only legal and biological aspects, but also the dimension of basic human needs as significant criminogenic factors. This integrative approach allows for a more thorough evaluation of a fundamental question in the law: Do perpetrators of crimes with Neurolaw disorders still have moral agency?

The results of the research conducted [10] explains Advances in neuroscience provide a new understanding of brain structures and disorders that can affect criminal liability. With a probabilistic approach such as Bayes' Theorem, the jury can assess the defendant's mental state more accurately. The study highlights the role of neurobiological evidence in reducing bias and explaining defendants' cognitive states, as in the Jones case, where brain imaging helped uncover mental disorders that affect intention. This approach supports defenses such as reduced capacity and promotes legal justice, without being trapped in the simplistic view that neuroscience is only about future threats.[11] On the other hand, through an analysis of 331 court cases in New South Wales, it was found that neuroscience only influences sentencing decisions in less than 50% of cases and in the vast majority of those cases are more likely to be lenient than burdensome. Research in the journal "Utilization of Neuroimaging in Criminal Justice: Uncovering the Truth Through Brain Technology" by[12] explores the application of

[9] Darmawati, Rafika Nur, "The Idea Of Legal Reform Implementation Assessment Risks And Criminogenic Needs Of Residivist Inmates In Overcoming Residivism."

[10] Deborah W Denno, "Neuroscience and the Personalization of Criminal Law Symposium: Personalized Law," *University of Chicago Law Review* 86 (2019): 359–402.

[11] Armin Alimardani, "An Empirical Study of the Use of Neuroscience in Sentencing in New South Wales, Australia," *Frontiers in Psychology* 14, no. August (2023): 1–18, https://doi.org/10.3389/fpsyg.2023.1228354.

[12] Achmad Cholidin, Zico Junius Fernando, and Mikhael Feka, *Utilization of Neuroimaging in Criminal Justice: Unveiling Truth Through Brain Technology*, *Indonesian Journal of Criminal Law Studies*, vol. 9, 2024, https://doi.org/10.15294/ijcls.v9i2.50316.

neuroimaging technology in the criminal justice system, highlighting the potential and challenges faced. The journal shows that technologies such as fMRI and EEG can be used to trigger truth, potentially improving accuracy in legal proceedings. However, the study also underscores the ethics of privacy and the possible use of data, which shows serious concern. In addition, the importance of the validity and reliability of neuroimaging results is emphasized, as they cannot be the basis for legal decision-making. With the advancement of technology, neuroimaging may become a more common tool in legal systems, but more research is needed to fully understand the implications and limitations of its users in a legal context. Although there has been significant progress in identifying the link between brain structure and criminal behavior, there are still gaps in the integration of these findings into a coherent legal framework. There is no strong consensus on how Neurolaw evidence should be used in assessing legal errors or assigning proportionate sentences.

This paper aims to bridge this gap by offering a critical mapping of the philosophical and juridical arguments that arise from the use of neuroscience in criminal justice. Through a theoretical approach that brings together moral philosophy, neuroscience, and criminal law principles, this article will seek to evaluate the limits and potential of neurolaw in shaping a fairer and more evidence-based legal system.

Method

This study adopts a normative or doctrinal legal research method, characterised by a qualitative and conceptual analysis of legal norms, philosophical arguments, and interdisciplinary scholarly discourse. The research does not involve empirical fieldwork, interviews, or direct engagement with human subjects.[13] Instead, it is grounded in an interdisciplinary literature-based approach, drawing upon authoritative sources from neuroscience, criminal law, moral philosophy, and Islamic jurisprudence.

Data were collected through a systematic and purposive review of secondary materials, including peer-reviewed journal articles, academic monographs, judicial decisions, international legal instruments, and institutional reports addressing the use of neuroscientific evidence in criminal justice.[14] The

[13] M. E. Saputro, A. Febriansyah, and F. D. Putri, "A Discourse of Capital Punishment in Islamic Law and Human Rights Law," *Contemporary Issues on Interfaith Law and Society* 2, no. 1 (2023): 35–70.

[14] Novendawati Wahyu Sitasari, "Mengenal Analisa Konten Dan Analisa Tematik Dalam Penelitian Kualitatif," *Forum Ilmiah* 19 (2022): 77.

selected literature was analysed to examine how neurocognitive dysfunction is conceptualised within legal theory and ethical discourse, and how such findings may affect assessments of criminal responsibility, culpability, and sentencing. [15]The analysis employed a thematic and argumentative method, identifying recurring normative issues such as free will, moral agency, biological determinism, and proportionality of punishment. Islamic legal sources were examined using a doctrinal interpretative approach, particularly in relation to the concepts of ʿaql, taklīf, rafʿ al-ḥaraj, and maqāṣid al-sharīʿah. By synthesising these perspectives, the study aims to construct a coherent normative framework for understanding the appropriate role of neuroscience in criminal law, while maintaining fidelity to legal certainty, ethical safeguards, and principles of justice.

Result & Discussion

A. Neuroscience and Criminal Responsibility

The findings of this study reveal a robust association between Neurolaw disorders or variations and tendencies toward aggressive and antisocial behavior. Contemporary research highlights how structural and functional impairments in specific brain regions particularly the prefrontal cortex and amygdala are linked to diminished impulse control, moral judgment, and emotional regulation. Neuroimaging studies suggest that such impairments may predispose individuals to heightened aggression and poor decision-making capacities, thus complicating legal notions of culpability and free will [16]. This biological insight alone, however, provides an incomplete explanation for criminal behavior. Human acts of transgression often arise from the intricate interplay between neurobiological vulnerabilities and adverse socio environmental conditions. Chronic deprivation of basic human needs such as security, belonging, and self-esteem, as articulated in Maslow's hierarchy can escalate psychological frustration, contributing to deviant responses that may appear irrational or uncontrolled [17]. In settings

[15] Dede Indraswara, Cahya Wulandari, Muhammad Azil Maskur, and Aisyah Nur Rafidah, "The Legal Politics of Regulating Special Terrorism Crimes under Law No. 1 of 2023 on the Criminal Code," *Indonesian Journal of Criminal Law and Terrorism Studies* 4, no. 1 (2025), https://doi.org/10.15294/ijctns.v4i1.3480.

[16] Nathaniel E. Anderson and Kent A. Kiehl, "Re-Wiring Guilt: How Advancing Neuroscience Encourages Strategic Interventions Over Retributive Justice," *Frontiers in Psychology* (2020), https://doi.org/10.3389/fpsyg.2020.00390; Farah Focquaert, "Neurobiology and Crime: A Neuro-Ethical Perspective," *Journal of Criminal Justice* (2019), https://doi.org/10.1016/j.jcrimjus.2018.01.001.

[17] Francisco Lara, "Neurorehabilitation of Offenders, Consent and Consequentialist Ethics," *Neuroethics* (2023), https://doi.org/10.1007/s12152-022-09510-1.

marked by systemic social failures, including poverty, social exclusion, and loss of personal identity, individuals are more likely to manifest behaviors that transgress legal norms[18].

This dual perspective merging neuroscience and human needs theory offers a multidimensional map of criminal behavior. It underscores that such behavior is rarely reducible to either neurocognitive impairment or socio-economic deprivation alone but emerges at their intersection[19]. Rehabilitation models informed by these insights can tailor interventions to address criminogenic factors at both biological and psychosocial levels [20]. Emerging techniques such as neurofeedback training[21], cognitive behavioral therapy [22], and neuromodulation have demonstrated potential in mitigating violent tendencies and fostering reintegration[23].

In positive criminal law, criminal liability is fundamentally anchored in the concept of mens rea, which presupposes cognitive awareness, intentionality, and volitional control at the time of the offence. Neuroscientific evidence that challenges an offender's impulse control or decision-making capacity therefore raises difficult questions regarding the integrity of culpability without necessarily dismantling the structure of liability itself. Courts operating within this paradigm tend to treat neurobiological impairments as mitigating factors rather than as grounds for the exclusion of responsibility. By contrast, Islamic jurisprudence approaches legal responsibility through the doctrine of ahliyyah (legal capacity), which is subject to impairment by ʻawāriḍ al-ahliyyah conditions that obstruct or diminish a person's capacity to bear legal responsibility, including mental or cognitive dysfunctions. From this perspective, the assessment of liability is not solely concerned with intent but with the presence of sound intellect (ʻaql) as a prerequisite for taklīf. This conceptual divergence highlights a deeper epistemological distinction: whereas positive criminal law

[18] Diego Borbón, "Neurosociology and Penal Neuroabolitionism: Rethinking Justice with Neuroscience," *Frontiers in Sociology* (2022), https://doi.org/10.3389/fsoc.2022.814338.

[19] Olivia Choy, Farah Focquaert, and Adrian Raine, "Benign Biological Interventions to Reduce Offending," *Neuroethics* (2020), https://doi.org/10.1007/s12152-018-9360-0.

[20] Jamie Newsome and Francis T. Cullen, "The Risk-Need-Responsivity Model Revisited," *Criminal Justice and Behavior* (2017), https://doi.org/10.1177/0093854817715289.

[21] Hengameh Marzbani, Hamid Reza Marateb, and Marjan Mansourian, "Neurofeedback: A Comprehensive Review," *Basic and Clinical Neuroscience* (2016), https://doi.org/10.15412/j.bcn.03070208.

[22] Amy Wenzel, "Basic Strategies of Cognitive Behavioral Therapy," *Psychiatric Clinics of North America* (2017), https://doi.org/10.1016/j.psc.2017.07.001.

[23] Anna Anselmo, et al., "Can We Rewire the Criminal Mind?," *Current Psychology* (2023), https://doi.org/10.1007/s12144-022-03210-y.

prioritises behavioural intent, Islamic law emphasises the ontological condition of the legal subject. In dual or plural legal systems such as Indonesia and Malaysia, judges are increasingly confronted with neurobiological defences that straddle these normative frameworks. The absence of clear doctrinal guidance risks inconsistent judicial reasoning, particularly when neuroscientific claims intersect with religiously grounded notions of responsibility and justice. A principled judicial response requires an integrative approach that recognises neuroscientific evidence without collapsing into biological determinism, while remaining attentive to Islamic principles of proportionality, moral accountability, and the preservation of human dignity.

Comparative evidence from jurisdictions like Germany and Norway illustrates that rehabilitation programs integrating neuroscientific findings have contributed to reduced recidivism and improved public safety outcomes [24]. Nonetheless, the integration of neuroscientific evidence into criminal justice proceedings is fraught with ethical and legal complexities. A growing body of empirical work questions the probative value of brain imaging technologies such as fMRI and EEG in courtrooms, citing inconsistencies in their impact on sentencing outcomes [25]. For example, studies in New South Wales found that neuroscientific evidence resulted in more lenient sentences in fewer than half of the cases examined, reflecting judicial ambivalence [26]. This disparity raises concerns about unequal access to neuro-evidence and the risk of exacerbating existing inequalities in legal outcomes. Critics warn of a slippery slope where biological explanations of behavior could be wielded either as mitigation for criminal acts or as justification for preemptive measures against individuals deemed Neurolawly "at-risk".

From a theoretical standpoint, these debates engage with enduring philosophical questions around moral responsibility and free will [27]. While some scholars argue that neurobiological determinism undermines the principle of

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[24] Lea Feuerbach and Anna-Maria Getoš Kalac, "On Measuring Recidivism," *Godišnjak Akademije Pravnih Znanosti Hrvatske* (2023), https://doi.org/10.32984/gapzh.14.1.1.; Hannah Wishart and Colleen M. Berryessa, *Neurolaw in the Courtroom: Comparative Perspectives on Vulnerable Defendants* (London: Routledge, 2023), https://doi.org/10.4324/9781003331056.

[25] Lyn M. Gaudet and Gary E. Marchant, "Under the Radar: Neuroimaging Evidence in the Criminal Courtroom," *Drake Law Review* (2016); Armin Alimardani and Jason Chin, "Neurolaw in Australia," *Neuroethics* (2019), https://doi.org/10.1007/s12152-018-09395-z.

[26] Alimardani, "An Empirical Study of the Use of Neuroscience in Sentencing in New South Wales, Australia."

[27] Bruce N. Waller, *Against Moral Responsibility* (Cambridge, MA: MIT Press, 2011), https://doi.org/10.7551/mitpress/9780262016599.001.0001.

individual accountability, others contend that acknowledging neurocognitive deficits does not absolve offenders but instead informs more proportionate and humane responses [28]. The challenge lies in balancing public protection with respect for human dignity and moral agency [29]. Moreover, the potential for misuse of neuroscientific insights is a pressing concern. Deterministic framings may stigmatize individuals with certain Neurolaw profiles, reinforcing stereotypes and contributing to discriminatory practices within the justice system [30]. To navigate these challenges, scholars advocate for robust ethical and legal frameworks that govern the application of neuroscience in criminal law. Such frameworks must ensure that neuroscientific evidence complements rather than undermines foundational principles of justice [31]. Jurisdictions like the Netherlands and Sweden have begun developing guidelines for the admissibility of neuro-evidence, seeking a balance between innovation and safeguards. These developments reflect a broader movement toward what some have termed "neurojustice," an approach that situates biological findings within social, moral, and legal contexts [32]. Ultimately, the integration of neuroscience into criminal justice demands caution and reflexivity. While biological insights offer promising avenues for rehabilitation and prevention, they must not overshadow the socio-structural determinants of criminality. An adaptive justice system one that recognizes neurocognitive impairments yet upholds ethical imperatives can foster proportionate, humane, and effective interventions [33]. This holistic paradigm acknowledges the dual realities that offenders are simultaneously shaped by brain dysfunctions and socio-environmental deprivations. It reimagines punishment not merely as retribution but as a rehabilitative endeavor aimed at reducing recidivism and promoting social reintegration. When grounded in rigorous science and ethical reflection, such an approach holds the

[28] Focquaert, "Neurobiology and Crime: A Neuro-Ethical Perspective."

[29] Laura Valentini, "Dignity and Human Rights," *Oxford Journal of Legal Studies* (2017), https://doi.org/10.1093/ojls/gqx011.

[30] Colleen M. Berryessa, "Judicial Stereotyping and Genetic Essentialism," *Law and Society Review* (2019), https://doi.org/10.1111/lasr.12382; Evan Auguste, et al., "Psychology's Contributions to Anti-Blackness," *Perspectives on Psychological Science* (2023), https://doi.org/10.1177/17456916221141374.

[31] Frederica Coppola, "Mapping the Brain to Predict Antisocial Behaviour," *UCL Journal of Law and Jurisprudence* (2022), https://doi.org/10.14324/111.444.2052-1871.008.

[32] Borbón, "Neurosociology and Penal Neuroabolitionism: Rethinking Justice With Neuroscience."

[33] Gaye T. Lansdell, Bernadette J. Saunders, and Anna Eriksson, *Neurodisability and the Criminal Justice System* (Cheltenham: Edward Elgar, 2021), https://doi.org/10.4337/9781789907636.

potential to transform criminal justice into a system attuned to the complexities of human behavior.

From the Islamic perspective, justice is an absolute necessity. Allah states in Surah al-Mā'idah, verse 8, which means: *"O you who have attained to faith! Be ever steadfast in your devotion to God, bearing witness to the truth in all equity; and never let hatred of anyone lead you into the sin of deviating from justice. Be just: this is closest to being God-conscious. And remain conscious of God: verily, God is aware of all that you do"* (Qur'an 5:8). Al-Qurtubi, in his commentary on this verse, emphasises that a person's disbelief in Islam does not in any way constitute an obstacle to justice being upheld for him . Hence, the determination of any punishment must be based on certainties that can be explicitly manifested during the process of adjudication.[34] As for matters that remain uncertain, inconsistent, or tainted with doubt, these are to be regarded as hidden, given that their manifestation is imperfect. Such matters, therefore, cannot be used as the basis for imposing any form of punishment.

Imam al-Nawawi, in his commentary on *Sahih Muslim*, sets out an important principle in this regard, relying on the Prophetic tradition, the meaning of which is: *"I was not commanded to delve into people's hearts or to dissect their souls."* This signifies that the Prophet was commanded to judge based only on outward appearances, while God alone possesses knowledge of what lies within the hearts of men[35]. Consequently, aspects of neurolaw are still considered implicit and therefore cannot be relied upon in the determination of punishment, as they are not directly observable or explicitly manifested in judicial proceedings.

In respect of legal capacity, when a person has been determined to be insane, the burden of *taklīf* (legal responsibility) is lifted from him. This is supported by the Hadith narrated from Aishah, found in *Sunan Abi Dawud*: *"The pen is lifted (meaning his deeds are not recorded as sinful) from three categories of people: the one who is asleep until he wakes up, the one who is insane until he recovers, and the child until he reaches maturity."*[36] Furthermore, where a person's intellect is not sound (*safīh*), Islamic guidance is based on Surah al-Nisā', verse 5: *"And do not entrust to those who are weak of judgment the possessions which God has placed in your charge for [their] support; but let them have their sustenance therefrom, and*

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[34] Abu 'Abd Allah Muhammad ibn Ahmad al-Qurtubi, *al-Jāmi' li Aḥkām al-Qur'ān* (Cairo: Dār al-Kutub al-Miṣriyyah), 6:110.

[35] Abu Zakariya Yahya ibn Sharaf al-Nawawi, *al-Minhāj Sharḥ Ṣaḥīḥ Muslim* (Beirut: Dār Iḥyā' al-Turāth al-'Arabī, 1392 AH), 7:163.

[36] Abi Dawud Sulayman ibn al-Ash'ath, *Sunan Abi Dawud* (Cairo: Dar Hijr, 1999), 3:17, hadith no. 1485.

clothe them, and speak unto them in a kindly way" (Qur'an 4:5). Ibn ʻĀshūr explains that the condition of being "weak of judgment" is not limited only to orphans or children, but extends also to adults who experience dysfunction in rational reasoning and decision-making.[37] In Islamic jurisprudence, the discourse concerning *taklīf*, which denotes the burden of legal responsibility, is elaborated extensively, including within legal frameworks, in order to ensure justice for all parties.[38] From a comprehensive perspective, the category of "diseases of the mind", which refers to Neurolaw and psychiatric disorders within the Islamic scholarly tradition, is more closely associated with the aspect of prevention rather than treatment.[39] This is consistent with the nature of Islamic texts, which tend to employ the terminology of "mental health" rather than "mental illness", thus highlighting the importance of safeguarding intellect and rational balance as a preventive foundation for justice and human welfare.[40]

Neurocognitive dysfunction does not necessarily amount to a complete loss of reason (junūn), but often manifests as diminished impulse control, impaired emotional regulation, or partial cognitive dysfunction. Within the framework of fiqh jināyah, such conditions occupy an intermediate legal space that cannot be equated with full insanity, yet equally cannot be treated as ordinary culpability. Classical Islamic jurists distinguished between total incapacity, which removes taklīf, and partial impairment, which affects the quality of moral and legal accountability. In this context, neurocognitive dysfunction may be conceptualised as giving rise to shubha (legal doubt), particularly where the offender's capacity to form deliberate intent (qaṣd) or exercise rational self-control is demonstrably compromised. Under Islamic criminal law, the presence of shubha operates as a critical safeguard, precluding the imposition of ḥudūd punishments, which require certainty (yaqīn) and strict evidentiary thresholds. However, the exclusion of ḥudūd does not imply the absence of legal response. Rather, such cases remain within the discretionary domain of taʻzīr, allowing judges to impose proportionate sanctions or rehabilitative measures tailored to the offender's condition. This structure reflects a moral economy that balances accountability with compassion, deterrence with reform. A deeper engagement with uṣūl al-fiqh, particularly the doctrine of maqāṣid al-sharīʻah, further

[37] Muhammad ibn Tahir Ibn Ashur, *al-Taḥrīr wa al-Tanwīr* (Tunis: al-Dār al-Tūnisiyyah li al-Nashr, 1984), 4:234.

[38] M. al-Syārikh and A. M. Hariz, "Mafhūm al-Iʻāqāt al-ʻAqliyyah wa Atharuhu fī al-Taklīf al-Sharʻī," *Journal of the Islamic University of Sharia and Legal Studies* 27, no. 3 (2019): 165–83.

[39] Wahbah al-Zuhayli, *al-Fiqh al-Islāmī wa Adillatuh*, 2nd ed. (Beirut: Dār al-Fikr, 1985).

[40] A. V. Paladin, "Ethics and Neurology in the Islamic World," *Italian Journal of Neurological Sciences* 19 (1998): 255–58, https://doi.org/10.1007/BF02427614.

illuminates this approach. The preservation of intellect (ḥifẓ al-ʿaql) is a central objective of Islamic law, encompassing not only protection against intoxicants and coercion but also recognition of conditions that undermine rational agency. Contemporary medical findings on neurocognitive impairment thus resonate with Islamic legal principles that prioritise the safeguarding of human intellect, dignity, and moral responsibility.

B. Integrating Neuroscience, Law, and Justice

The findings of this study suggest that criminal behaviour cannot be attributed solely to individual moral failure or wilful intent. Instead, it is often the result of a complex interplay between biological, psychological, and socio-environmental factors. This multidimensional understanding challenges the classical assumptions embedded within traditional criminal law particularly the belief in rational agency and free will as universal foundations for legal responsibility. As neuroscience and psychosocial research continue to evolve, they increasingly call into question the adequacy of retributive legal frameworks that focus exclusively on volition and culpability. Empirical evidence, including interviews conducted with recidivist inmates, reveals that many individuals who engage in criminal acts are driven by prolonged exposure to unmet fundamental needs. Drawing upon Maslow's hierarchy, the study highlights the impact of chronic deprivation of personal security, self-worth, and social inclusion. These deprivations, often exacerbated by systemic poverty, familial breakdown, unemployment, or social rejection, contribute to psychological frustration that manifests in deviant or antisocial conduct. This view aligns with broader criminological theories that attribute criminality to structural inequalities and psychosocial instability, rather than to inherent criminal dispositions.

At the same time, advances in cognitive neuroscience have shed light on how brain structure and function can directly influence human behaviour. Neurolaw impairments particularly those involving the prefrontal cortex, amygdala, or genetic markers such as the MAOA-L gene are associated with diminished impulse control, impaired emotional regulation, and a heightened propensity for aggression. Technologies such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) have made it possible to visualise and assess such impairments in forensic contexts. While their introduction into courtroom settings represents a promising avenue for more accurate assessments of intent and culpability, their application remains limited and inconsistent. Many jurisdictions still lack regulatory standards governing their admissibility, probative value, and ethical implications. This dual reality of

biological predisposition and socio-environmental deprivation demands a reassessment of how legal systems conceptualise responsibility and justice. A legal framework that disregards these factors risks oversimplifying the causes of crime and delivering punitive responses that are neither proportionate nor rehabilitative. It also risks perpetuating cycles of recidivism by failing to address the root causes of criminal conduct. The findings of this study thus call for a paradigm shift from a strictly retributive model to a more integrative and humane approach to justice what some scholars have termed "neurojustice." Such an approach does not entail absolving individuals of accountability, but rather advocates for a deeper understanding of the circumstances that shape criminal behaviour. By acknowledging that certain offenders may lack full volitional control due to neurobiological conditions or chronic socio-economic adversity, legal systems can tailor responses that are both just and constructive. Rehabilitation, rather than retribution, becomes the guiding objective. This orientation is supported by comparative research in jurisdictions such as Germany, Sweden, and the Netherlands, where neuro-informed interventions such as cognitive behavioural therapy (CBT), neurofeedback training, and neuromodulation techniques have shown success in reducing recidivism and fostering reintegration.

The findings of this study underscore a significant relationship between neurobiological impairments and tendencies towards aggressive or antisocial behaviour, particularly when such impairments involve structural and functional abnormalities in the prefrontal cortex and amygdala. These brain regions govern key executive functions, including impulse control, moral decision-making, and emotional regulation. As contemporary neuroscientific research increasingly reveals, deficits in these areas can lead to poor judgement, diminished self-control, and a heightened propensity for violence, thereby challenging conventional legal assumptions about culpability, intent (mens rea), and free will. However, to interpret criminal behaviour solely through a biological lens is reductive. Criminal acts are not merely Neurolaw phenomena but emerge at the intersection of individual vulnerabilities and socio-environmental conditions. In particular, prolonged deprivation of essential human needs such as safety, social belonging, and self-worth has been shown to heighten psychological stress, fostering irrational or deviant responses. Drawing from Maslow's hierarchy of needs, it becomes evident that the erosion of basic security and identity can significantly influence one's behavioural trajectory. This multidimensional lens provides a richer, more nuanced understanding of deviance, positioning it within a framework that is simultaneously biological and structural.

In Indonesia, the applicability of this integrated model remains in its infancy. While the Indonesian legal system recognises diminished responsibility under certain psychological conditions, the deployment of neuroscientific evidence in judicial proceedings is rare and largely unregulated. The Criminal Code (KUHP) traditionally rests upon the principle of individual accountability, wherein intent and volition form the core of culpability.[41] This provision framed criminal irresponsibility in terms of a total inability to understand or control one's actions due to mental disorder, reflecting a binary conception of responsibility: either fully responsible or entirely exempt. While this approach provided legal certainty, it proved increasingly inadequate in addressing contemporary scientific insights into the gradational nature of cognitive impairment.

Law No. 1 of 2023 (the New Criminal Code) represents a significant normative development by reformulating excusing grounds and expanding judicial discretion in assessing culpability. Rather than relying exclusively on a rigid insanity standard, the new framework allows courts to consider diminished capacity, impaired self-control, and other psychological conditions that affect culpability without necessarily eliminating responsibility altogether. From a neurolaw perspective, this shift aligns more closely with neuroscientific findings demonstrating that many offenders do not suffer from complete cognitive collapse but from partial neurocognitive dysfunctions, such as deficits in impulse control, emotional regulation, or executive functioning associated with the prefrontal cortex.

However, despite this conceptual advancement, the New Criminal Code remains underdeveloped in its engagement with neuroscientific evidence. The law does not articulate clear procedural standards for the admissibility, evaluation, or probative weight of neurobiological evidence, leaving judges with broad discretion but limited guidance. This normative ambiguity risks inconsistent judicial reasoning, particularly in cases where neuroimaging data, psychiatric assessments, or neuropsychological evaluations are presented to support claims of diminished responsibility. Without a coherent neurolaw framework, courts may either overestimate the determinative power of neuroscience sliding into biological determinism or disregard it altogether due to evidentiary uncertainty.

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[41] A. Hadiputra, M. A. Maskur, R. Arifin, I. Amrullah, and H. Maajid, "Juvenile Justice in Comparative Perspective: A Study of Indonesian State Law and Islamic Law," *Contemporary Issues on Interfaith Law and Society* 3, no. 2 (2024): 203–228, https://doi.org/10.15294/ciils.v3i2.79011.

Moreover, the excusing grounds under Law No. 1 of 2023 continue to operate within a traditional mens rea paradigm, prioritising intentionality and awareness without fully addressing how neurocognitive impairments complicate these concepts. Neuroscience challenges the assumption that intent is always the product of conscious and rational deliberation, revealing instead that decision-making is often constrained by neurological conditions beyond the individual's volitional control. The absence of explicit doctrinal engagement with this tension limits the transformative potential of the new Code. From a neurolaw standpoint, Indonesian criminal law would benefit from a more explicit integration of neuroscientific insights into its theory of responsibility. This does not require abandoning accountability but rather reconceptualising it in proportionate and humane terms. Clear guidelines on expert evidence, judicial training in neurocognitive assessment, and an emphasis on rehabilitative sentencing would strengthen the coherence and legitimacy of the excusing grounds regime.

The notion of biological determinism suggesting that certain behaviours may be beyond volitional control complicates this paradigm, raising pivotal questions: Can someone be held fully responsible for a criminal act if their brain chemistry undermines their decision-making capacity? And how might such claims be validated within Indonesia's existing evidentiary standards?. These questions resonate with broader philosophical debates on free will and moral agency. Scholars such as Waller [42] argue that neurobiological determinism fundamentally destabilises the moral foundation of punitive justice. Others, including Focquaert [43], contend that recognising neurocognitive impairments does not negate accountability but rather demands more proportionate, rehabilitative responses. Within the Indonesian context where retributive justice still dominates there is limited conceptual space for such a view. Sentencing often prioritises punishment over reform, reflecting a justice culture that views deviance through a moral rather than a clinical or structural lens.

Nonetheless, comparative insights offer valuable lessons. Jurisdictions such as Germany, Sweden, and the Netherlands have pioneered models of "neurojustice" legal systems that incorporate neuroscientific findings into sentencing and rehabilitation. These models are grounded in ethical safeguards and ensure that neuro-evidence informs, rather than replaces, judicial discretion. In particular, neurorehabilitation approaches such as neurofeedback, cognitive behavioural therapy (CBT), and non-invasive neuromodulation techniques have

[42] Waller, *Against Moral Responsib.*

[43] Focquaert, "Neurobiology and Crime: A Neuro-Ethical Perspective."

shown promise in addressing the biological and psychological underpinnings of criminal conduct. These methods seek not only to manage behaviour but to foster reintegration, with the ultimate goal of reducing recidivism. In Indonesia, rehabilitation remains underdeveloped. Correctional facilities are often overcrowded, under-resourced, and lack programmes tailored to individual psychological or neurocognitive needs. Integrating neuroscientific insights into Indonesian criminal justice would thus require systemic reform, including the development of assessment protocols, judicial training, and the establishment of ethical guidelines for the admissibility and interpretation of neuro-evidence. Without such infrastructure, there is a risk that neuroscientific arguments could be misused either to unjustly mitigate punishment for certain offenders or to justify preemptive incarceration for those deemed Neurolawly "at risk." Such risks highlight the ethical tensions at the heart of neurolegal integration. On one hand, the use of neuroscience can humanise the offender, shifting the focus from blame to understanding. On the other, it may reinforce deterministic narratives that strip individuals of agency, reinforce stereotypes, and exacerbate inequalities in legal outcomes. These dangers are particularly pronounced in pluralistic societies like Indonesia, where disparities in legal representation and access to expert witnesses remain stark. If neuro-evidence becomes available only to defendants with greater financial means or institutional support, its use may inadvertently deepen systemic injustice.

In the context of Malaysian law, the term neurolaw refers to the branch of medicine dealing with disorders of the nervous system, rather than a specific legal category[44]. Nevertheless, Neurolaw knowledge remains profoundly relevant within the legal field, particularly in cases involving medical negligence claims, assessments of a defendant's mental capacity, or matters concerning compensation for bodily injuries that affect the nervous system. The incorporation of Neurolaw understanding into legal processes ensures that decisions are not only grounded in legal doctrine but are also responsive to scientific insights regarding human health and cognition. Nurfaizatul Aisyah et al. discuss Neurolaw issues by cross-referencing them with the principles of Maqasid Syariah[45]. This framework requires wisdom and adaptations that remain in harmony with long-held traditions, religion-based ethical values, and

[44] Mohd Hapiz Mahaiyadin, et al., "Islamic Legal Perspective on Hemp Cultivation in Malaysia," *International Journal of Academic Research in Business and Social Sciences* (2022), https://doi.org/10.6007/ijarbss/v12-i12/14810.

[45] Nurfaizatul Aisyah Ab Aziz, Muzaimi Mustapha, and Sabarisah Hashim, "Reflections on Neuroethical Issues in Neuroimaging Research from the Islamic Perspective," *International Journal of Islamic Thought* 25 (2024), https://doi.org/10.24035/ijit.25.2024.291.

broader social stances. The reference to Maqasid Syariah which prioritises the preservation of life (*hifz al-nafs*), intellect (*hifz al-'aql*), and dignity (*hifz al-'ird*) illustrates how Malaysian legal thought seeks to balance contemporary scientific findings with the enduring ethical foundations of Islamic jurisprudence[46]. Such integration highlights that the law cannot operate in isolation but must engage with advances in medical science while ensuring compatibility with ethical and cultural norms.

One area of particular concern relates to neuro-psychological research on individuals with autism[47]. In legal discourse, cases involving such individuals are often framed as 'ordinary and distinct', and they are typically not pursued to the stage of prosecution. This approach acknowledges that Neurolaw and developmental conditions may diminish the capacity to form criminal intent (mens rea), thereby affecting criminal responsibility. It also underscores a humanitarian dimension in legal practice, where compassion and fairness are prioritised over rigid adherence to punitive measures. The discussion has also extended to procedural matters, specifically the arrest of individuals experiencing Neurolaw dysfunctions. Scholars argue that such groups should be afforded special procedures during arrest and detention, recognising their vulnerability and the potential risks of applying ordinary enforcement mechanisms without modification. Tailored procedures not only mitigate the risk of harm but also align with constitutional guarantees of human dignity and fairness under Malaysian law, as well as international obligations, particularly the United Nations Convention on the Rights of Persons with Disabilities (CRPD), to which Malaysia is a State Party[48]. Overall, current debates in Malaysia concerning neurolaw within the legal framework have not yet focused primarily on sentencing. Instead, they are more concerned with how individuals with Neurolaw impairments ought to be managed on humanitarian grounds. This emphasis reflects an evolving recognition that justice in such cases is best served not through retribution but through compassion, protection, and rehabilitation.

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[46] Ahmad Luqmanulhakim Sunawari, et al., "A Patient-Centered Hospital in Malaysia in Accordance with Maqasid Syariah," *International Journal of Islamic Thought* (2023), https://doi.org/10.24035/ijit.24.2023.266.

[47] Zuliza Mohd Kusrin, Wan Nur A'ina Mardhiah Wan Rushdan, and Mohd Al Adib Samuri, "Standard Operating Procedure for Arrest and Detention of Autists by Royal Malaysia Police," *Pertanika Journal of Social Sciences and Humanities* (2021), https://doi.org/10.47836/PJSST.29.1.10.

[48] Ikmal Hisham Md Tah and Khairil Azmin Mokhtar, "Malaysia's Ratification of the UN Convention on the Rights of Persons with Disabilities," *International Journal of Business, Economics and Law* (2016).

Moreover, the deployment of neuro-evidence must not obscure the socio-economic roots of criminality. As Borbón [49] notes, framing criminal acts solely as the product of brain dysfunction overlooks the structural injustices poverty, marginalisation, lack of education that shape behavioural outcomes. Indonesia, with its pronounced urban-rural divide and uneven access to public services, exemplifies a context where crime is often driven by structural deprivation as much as individual pathology. A justice system that truly aims for fairness must address both. From a doctrinal standpoint, Indonesia's dualistic legal system comprising both civil law influences and adat (customary law) presents unique challenges and opportunities for neurolegal reform. The normative flexibility embedded in hukum progresif (progressive law), as advocated by scholars like Satjipto Rahardjo [50], could accommodate neuroscientific insights within a broader rehabilitative ethos. In line with this, the Restorative Justice approach, which has gained traction in certain districts under prosecutorial discretion, may serve as a platform for integrating neuro-informed interventions that prioritise healing, understanding, and reintegration over punishment.

Conclusion

This study demonstrates that criminal behaviour cannot be adequately understood through a singular focus on moral culpability or wilful intent. Contemporary developments in neuroscience reveal that neurocognitive dysfunctions particularly those involving the prefrontal cortex and amygdala may significantly influence impulse control, emotional regulation, and moral judgement, thereby challenging classical assumptions of free will and rational agency that underpin traditional criminal law. However, recognising the relevance of neurobiological factors does not necessitate the abandonment of legal responsibility. Rather, it calls for a more nuanced and proportionate framework of accountability. Through a normative and interdisciplinary analysis, this article shows that the integration of neuroscientific insights into criminal justice systems remains conceptually fragmented and procedurally underdeveloped, particularly in Indonesia and Malaysia. The absence of clear standards governing the admissibility, interpretation, and ethical use of neuroscientific evidence risks both misuse and inconsistency in judicial decision-making. From the perspective of Islamic jurisprudence, criminal responsibility is

[49] Borbón, "Neurosociology and Penal Neuroabolitionism: Rethinking Justice With Neuroscience."

[50] M. Zulfa Aulia, "Hukum Progresif dari Satjipto Rahardjo," *Undang: Jurnal Hukum* (2018), https://doi.org/10.22437/ujh.1.1.159-185.

inseparable from the condition of sound intellect (ʿaql), while the principles of rafʿ al-ḥaraj and maqāṣid al-sharīʿah emphasise justice, proportionality, and the protection of human dignity. Accordingly, this study argues for a normative shift towards an integrative model of criminal justice often described as neurojustice that incorporates neuroscientific knowledge without succumbing to biological determinism. Such an approach supports rehabilitative and preventive orientations, while preserving moral agency and procedural fairness. By grounding legal reform in rigorous doctrinal analysis, ethical reflection, and interdisciplinary scholarship, this study contributes to the development of a more humane, scientifically informed, and normatively coherent system of criminal justice.

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