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LAW AND NEUROSCIENCE: ADMISSIBILITY AND ETHICS OF BRAIN-BASED EVIDENCE

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ABSTRACT

Neuroscientific evidence started playing a prominent role in the legal system, reshaping how we think about evidence, responsibility and justice. Thanks to the advancements in brain imaging and related technologies which led us to get a clearer picture of how brain functions, paving new ways to understanding behavioral patterns and decision making. This raises important questions for the law: should brain based evidences be admitted in court? Can it really reveal intent and reliability and where should limits be set to not misuse it.

This paper explores these pressing issues with a critical focus on the law of evidence. It examines the relevance of it in the Indian courts and provides insights about other jurisdictions across the globe and also how it affects the system of law. This paper also addresses both the potential benefits and ethical challenges including concerns over privacy, the risk of determinism and the limits of current scientific understanding. Bringing neuroscience into the legal field, the justice system is required to reconsider fundamental principles related to culpability, intent and fairness and also, we are challenged to rethink how justice is defined and delivered in modern world.

I. INTRODUCTION

Evidence is considered the bridge between alleged facts and judicial decisions.[2] The quality, admissibility, and reliability of evidence can't be underscored enough, as it plays a key role in

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[2] Manupatra Academic, Law of Evidence—Chapter 1, http://student.manupatra.com/Academic/Abk/Law-of-Evidence/chapter1.htm (last visited Sept. 1, 2025).

pronouncing a person or a party guilty or innocent. One piece of wrong evidence and a decision given in furtherance questions the legitimacy of the judicial system itself. Whether it's in criminal cases where questions of guilt and culpability arise or in civil cases where rights and liabilities are decided, evidence plays a pivotal role. The principle that no one is to be convicted without proof beyond a reasonable doubt underscores the heightened role evidence plays in safeguarding individual liberty in criminal law and the balance of probabilities in civil law.[3]

The question of "What's to be admitted as evidence?" is one that has undergone various changes, and courts are no strangers to this question, as in the course of time, we can see them adopting newer forms. One such form of evidence that calls for our immediate attention is "Neuroscientific Evidence". Studies in neuroscience shows that when a person attempts deception there are heightened loads of cognitive processes when compared to telling the truth. Deception typically activates the prefrontal cortex, anterior cingulate cortex and parietal regions which are responsible for conflict monitoring, decision making and suppressing truthful responses. This results in distinct brain patterns which methods such as functional MRI (fMRI) and EEG-based methods seek to capture by measuring changes in blood flow, oxygen consumption or electrical activity in the brain.

As said by David M. Eagleman, a neuroscientist and professor in Stanford University, ***"Neural understanding of behaviours will lead to better prediction of recidivism, a rational basis of sentencing and customized rehabilitation."***[4]This evidence, if made admissible, has the potential to facilitate rational sentencing and better rehabilitation mechanisms. But the admissibility and reliability of these evidences in court room proceedings and their persuasive role in giving judgements raises profound legal, ethical and evidentiary challenges. Potential infringement of constitutional rights such as right against self-incrimination and right to privacy remain at the forefront of this debate. Weighing the scientific promises against the risk of misuse, prejudice and over-reliance of technology is the need of the hour.

[3]Use of Evidence, Rule of Law Educ. Ctr. (Aust.), https://www.ruleoflaw.org.au/crime/criminal-trial-processes/use-of-evidence (last visited Sept. 1, 2025).
[4]DAVID EAGLEMAN, THE BRAIN: THE STORY OF YOU (Pantheon Books 2015).

Thus, the discussion doesn't limit itself to scientific promises and accuracy but extends to compatibility with fundamental rights, legal principles and due safeguards in place. At the core, this compels us to consider the dynamic relationship between law and technology and as to how far the courts can go on to integrate them and the price, we might have to pay for the steps taken.[5] This journal seeks to evaluate these very questions by analysing neuroscientific evidence, their reliability, the scientific backing they hold, safeguards to be kept in place to ensure fair usage and the broader implications it holds for evidence law in civil and criminal jurisdictions.

II. DOCTRINAL ANALYSIS

A. EMERGING ROLE AND LEGAL FRAMEWORK OF NEUROSCIENTIFIC EVIDENCE IN INDIA:

In recent times there has been an increase in the surge of admissibility of Neuroscientific evidences in the diverse legal systems, concerning various jurisdictions across the globe. In comparison to the other jurisdictions, the use of Neuroscientific evidence in Indian legal system is in its nascent stage and also restricted.Neuroscientific evidence, relating to the brain science in legal contexts, holds increasing relevance in Indian judicial system.[6] With advancements in Neuroimaging and cognitive assessment, neuroscience can significantly impact legal proceedings. As the field progresses, a comprehensive discussion is very required regardingits admissibility and challenges of using it in the Indian court rooms.

In Indian legal system, the admissibility of evidence is basically governed by the Indian Evidence Act of 1872. This act emphasizes the legal principles governing the relevance, admissibility and evaluation of evidence.According to the act, all the evidence must be pertinent, trustworthy,founded and recognized on scientific standards.[7] These requirements must be met by the Neuroscientific evidence to be considered admissible.

[5]6 Major Challenges of Legal Technology Adoption, DoxFlowy, https://doxflowy.com/challenges-legal-technology/ (last visited Sept. 1, 2025).
[6]Ritika Srivastava, Neuroscientific Evidence in the Criminal Trials: Mapping the Other Side of Courtroom Proceedings, 2 J. Legal Rsch. & Juridical Sci. 1 (2023).
[7]Indian Evidence Act, 1872, § 45 (India).

The Indian Evidence act doesn't address Neuroscientific evidence, leaving it to the discretion of presiding judges. But factors like evidence's relevance, scientific credibility and qualification by expertcomes into play while considering these evidences.However, Neuro evidence's acceptance may vary from case to case based on circumstances and judge's familiarity with the topic.

B. CONSTITUTIONAL, ETHICAL CHALLENGES AND JUDICIAL DISCRETION:

While considering the approval rate of these evidencesthere are three main factors that should be looked for:[8]

1.Relevancy: Neuroscientific evidence is considered relevant in courtrooms when it'sable to prove or disprove facts on issues likedefendant's mental state, conduct, responsibility or when it is able to logically connect with the facts of the case.

2.Reliabilty: It's reliability basically hinges on the examination of the scientific soundness, accuracy and the methods that are in the use.

3.Probative value: Probative value is assessed by how much it increases the likelihood of a fact being true compared to without the evidence.

Judicial precedents further illustrate the evolving stance towards neuroscientific evidence. In **Ram Singh and others v. State (NCT of Delhi)**, the Delhi High Court ruled against the admissibility of narco analysis, citing violations of the constitutional right against self-incrimination and concerns about technical reliability.[9]On the other hand, in **Ritesh Sinha v. State of UP**, the Allahabad High court permitted the inclusion of brain mapping test results as supporting evidence. The court evaluated the dependability of the technique, while ensuring adherence to strict procedural safeguards.[10]

These precedents illustrate the dualist approach to neuroscientific evidence in India where admissibility is dependent not only on case-specific circumstances but also on judicial comfort

[8]Arjun Nair, Neuroscience in the Courtroom: Unveiling the Mind's Secrets for Just Verdicts, Jus Corpus L.J. (June 26, 2023), https://www.juscorpus.com/neuroscience-in-the-courtroom-unveiling-the-minds-secrets-for-just-verdicts/.
[9]Ram Singh v. State (NCT of Delhi), AIR 2011 SC 2495 (India).
[10]Ritesh Sinha v. State of Uttar Pradesh, (2019) 8 SCC 1; AIR 2019 SC 3592 (India).

with emerging scientific methodologies. The need for safeguards and strict adherence to constitutional rights is much emphasized.

III. COMPARATIVE ANALYSIS

A. INDIA: CAUTIOUS ADOPTION AND JUDICIAL DISCRETION:

India's stance on neuro-based evidence is one that is cautious and rooted in precedents given by the highest court of the land. This can be observed in the way courts handle things when confronted with techniques such as polygraph, narco-analysis, EEG and neuroimaging. One such landmark case that gave us an insight into this aspect of neuro-based evidence is **Selvi v State of Karnataka.**[11]The Supreme court in this case dealt with the intricate issue of admissibility and legitimacy of neuro investigative techniques. It has been held that results of such tests obtained through compulsion as in the case of Selvi v State of Karnataka are non-admissible and are treated as **"testimonial compulsion"**. The court briefly identified that such compulsive tests violate the basic principles of constitution i.e., right against self-incrimination Article 20(3)[12] and right to life and personal liberty Article 21[13]. Though voluntary admission is not per se unconstitutional, safe and strict regulations are kept in place to prevent misuse of these testimonials under the disguise of free consent. Measures such as free and informed consent (preferably before a magistrate), access to legal counsel, medical supervision and ethical protocols and judicial supervision to prevent coercion are suggested. This emphasises that right against self-incrimination extends beyond physical confessions to cognitive autonomy.

B. PROVISIONS IN PLACE: INDIAN EVIDENCE ACT AND INFORMATION TECHNOLOGY ACT:

While there have been no outright legislations that legitimizes the use of neuro evidence in the court of law provisions in the Indian Evidence Act (IEA) corroborates to the same. Specific sections are needed to be dealt with in this regard namely Section 45,46 and 51 of IEA. Section 45 of IEA deals with **"expert opinion"** which states that opinions of experts are to be taken in

[11]Selvi v. State of Karnataka, AIR 2010 SC 1974 (India).
[12] Constitution of India art. 20, cl. 3.
[13]India Const. art. 21.

cases where the court must form an opinion in science, under whose ambit neuro-based evidence falls in a broader aspect.[14] This provision however renders the expert's opinion only as relevant but not conclusive, ultimately laying the weight upon the judge's discretion. In practice this meant competence of the expert, violation of provisions of the constitution if any all condition the admissibility of the evidence.

Section 46 of the Indian Evidence Act, says that facts that are otherwise irrelevant are made relevant if they are consistent or inconsistent with the opinion of the experts.[15] This means that behavioural analysis, medical records and brain patterns can strengthen or undermine the opinion of the expert. It ensures that expert's opinions are not considered in isolation but are to be taken in relevance with other facts of the case. Section 51states that if an expert's opinion is considered as relevant the grounds on which such opinion is made is also to be considered relevant.[16] This means that courts can't accept an fMRI or EEG on their face value but have to delve deep into the scientific principles beneath the technique, reliability (error rates etc), has the expert explained how he came to such conclusion from raw data? and whether proper procedures were followed during the test?

These provisions emphasize the view in which the Indian judicial system views neuro-based evidence marked by safeguards which shows both potential and the limitations of neuroscientific evidence in courts. Yet, India is not alone in this crossroads, several other jurisdictions of both common law and civil law like USA, UK, Germany are partners in this. A comparative analysis of these jurisdictions offers valuable insights into how they handled these issues and how India's stance differs or aligns with other countries from which lessons can be drawn.

C. EVOLVING STANDARDS AND LIBERAL ADMISSION IN USA:

Over the past 3 decades the integration of neuroscientific evidence has seen major turns. Prior, US has relied on the much restrictive Frye framework, which was established in the year 1923in the

[14] Indian Evidence Act, 1872, § 45 (India).
[15] Indian Evidence Act, 1872, § 46 (India).
[16] Indian Evidence Act, 1872, § 51 (India).

case of **Frye v. United States**[17]. Under Frye framework the trail judge examined the underlying methodology and only allowed it had it gained widespread consensus among experts and only then a testimony made underis allowed to be submitted before the jurors. This standard was kept in place to make sure only credible methodologies were provided to the jurors in the early stages of neuroscientific evidences ultimately limiting the admissibility of emerging forensic sciences. This was the case until a new standard came into play.

The Daubert framework replaced the Fyre framework in the year 1993 through the case of **Daubert v. Merrell Dow Pharmaceuticals**.[18] This standard is comparatively liberal and changed the role of trail judges from giving "general acceptance" to acting as "gate keepers". Trail judges were to examine 4 non-exclusive factors under this framework namely,

(1) whether the method or theory can be and has been tested

(2) whether it has been subjected to peer review and publication

(3) the known or potential error rate and standards controlling its operation

(4) whether it enjoys general acceptance within the relevant scientific community

This has opened US court rooms to innovative scientific techniques including neuroimaging prior to its universal acceptance.

D. NOTABLE CASES AND USAGE STATISTICS IN USA:

The case of **United States v. Hinckley (1981)** is one that has been decided under the Frye framework. The counsel for John Hickley Jr. brought up the defense of schizophrenia thereby not making him liable for his attempted assassination ofPresident Ronald Reagan. To support their plea the counsel introduced computed tomography (CT) scans of Hickley's brain arguing that the results corroborated findings of severe mental illness. The District Court ultimately found Hickley to be not guilty by reason of insanity.[19]**People v. Weinstein (1992)** is one such other case where Michael Weinstein was charged under second degree murder of his wife. His attorneys commissioned positron emission tomography (PET) which revealed an arachnoid cyst compressing regions of his brain involved in impulse control and emotions. Despite initial

[17]Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).
[18]Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993).
[19]United States v. Hinckley, 525 F. Supp. 1342 (D.D.C. 1981).

prosecution objections the court admitted the evidence and Weinstein ultimately pleaded guilty to lessen the charges.[20]Both these cases represent high-profile admissions of neuro evidences in severe cases and portrays growing willingness of courts to consider neuro evidences to decide intent and culpability.

Even in contemporary times neuro-based evidencehas shown dramatically increase in its usage. Between 2005 and 2010 US courts experienced a sharp increase in admission of neuro-based evidence serving as a tool to understand criminal behavior and assisting to determine culpability.[21] By, 2012 neuroscientific imaging has been introduced in approximately 5 percent of all murder trails and 25 percent of all death-penalty proceedings. Moreover 1,585 judicial opinions issued between 2015 and 2012 have discussed regarding genetic evidence and neuro scientific evidence.[22]

E. THE EFFECT OF "SEDUCTIVE ALLURE":

While Daubert and Frye frameworks lay standards for neuro evidences to be admissible in a case, the main weight of disposing the judgement is laid on the shoulders of the judges. Regardless of how relevant or admissible the evidences might seem it's the work of the judges to interpret the evidences and apply them to the facts in question to draw a conclusion and decide culpability. Here in comes an important effect known as **"seductive allure"**. Also called as"seductive allure of neuroscience explanations" (SANE) this effect concerns the misleading of judges when neuro-based evidences are used for prosecution.Discovered by Weisberg and colleagues in 2008, it demonstrates that when lay people encounter explanations of psychological phenomena accompanied by irrelevant explanations of neuroscience such as brain activity description or mentioning of neural structures, they are more likely to be convinced that it is credible than when the same argument was presented isolating it from any kind of scientific explanation.In their landmark experiment, researchers presented participants with both good and bad explanations of psychological phenomena, with half containing irrelevant brain-related details (e.g., "Brain scans

[20]People v. Weinstein, 156 Misc. 2d 34, 591 N.Y.S.2d 715 (N.Y. Sup. Ct. 1992).
[21]Cognitive Research: Principles and Implications, SpringerOpen, https://cognitiveresearchjournal.springeropen.com/ (last visited Aug. 30, 2025).
[22]Jillian R. C. Kemp & David J. H. Denno, Neuroscientific Evidence in the Courtroom: A Review, 14 Neurosci. & L. 113 (2019), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6805839/ (last visited Aug. 30, 2025).

indicate this reasoning occurs in the frontal lobe"). The results showed that while people could generally distinguish good from bad explanations, the addition of meaningless neuroscience information significantly boosted ratings of bad explanations from clearly unsatisfactory (-0.73) to seemingly acceptable (+0.16), whereas good explanations saw minimal improvement.[23]Though there is no added value provided by the mentioning of brain structures and psychological phenomena. This bias occurs because non-experts tend to tie together credibility with scientific explanation.

Though all judges might not be a victim of this effect, some who are laymen in this fieldor those who didn't seek assistance from experts in the same might fall in this trap leading to biased judgements or irrational assumption of credibility to non-relevant information.This happens because neuroscientific evidence is not treated as one of judgmentalvalue but as one of persuasive value leaving its application to the judges.Another recurring pattern is observed among cases where neuroscientific evidence is deemed more effective in death penalty cases but not as par in guilty/not guilty verdicts. Effectiveness of this kind of evidences also vary by the mental health condition of the victim, where evidences are far more effective in cases of schizophrenia than for psychopathy and also the perceived dangerousness of the defendant.Other mechanisms of influence are also in play wherein counsels try to reduce the perception of the judge regarding the control of the defendant onfactors of his actions such as self-control, moral responsibility and free will rather than proving them scientifically.[24]These factors are in play and shouldn't be given a blind.

The movement from a much stricter standard to a more liberal one implies the increase in emphasis the courts have given to neuro evidences in trail procedures whilst being cautious regarding its application by laying the ultimate test of applicability on judges. Though effects like seductive allure have the potential to mislead judges, increased effectiveness of neuro evidences in certain cases advocates for its usage in certain cases.

[23]Diego A. Weisberg et al., The Seductive Allure of Neuroscience Explanations, 23 J. Cognition & Culture 1 (2008), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2778755/ (last visited Aug. 30, 2025).
[24]Nicole A. Vincent, Emily A. Wassermann, Andrew D. Irving & Marc A. Sellbom, Neuroscientific Evidence in the Courtroom: A Review, 10 Neuron 27 (2019), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6805839/ (last visited Aug. 28, 2025).

F. UNITED KINGDOM: CONSERVATIVE STANDARDS AND ETHICAL EMPHASIS:

The principles of reliability, relevance, necessity govern the admissibility of neuro-based evidence in the United Kingdom. Judges are the ultimate authorities that decides on the admissibility of the evidence based on these factors of the case. Other guidelines such as the Law Commission report of 2011 recommends a multi-factor reliability test in which the courts may exclude evidence deemed unreliable or not directly pertinent to cases issues ensuring that only credible scientific evidences influence legal decisions.[25] The absence of specific legislations furthers widens the gap and set standards for evaluation of evidence as concise is variable.

Unlike in USA, UK doesn't rely on any specific set tests or standards like Frye or Daubert frameworks but completely relies upon the discretion of the judges. Between 2005 and 2012, neuroscientific evidence appeared in approximately 204 reported criminal cases in England and Wales, equating to roughly 1 percent of appeals heard by Court of Appeal (Criminal Division). Theres been a huge spike notably after 2008, with the number of reported cases from an average of 17 (2005 to 2008) to over 34 cases per year (2009 to 2012).[26] The majority of these cases were appellate decisions reflecting the increased role of neuroscientific evidence in deciding cases that include but not limited to convictions, mitigating sentences, resist extradition, challenge bails and bail conditions, rebut prosecution's causation claims etc. There are instances where courts have expected counsels to provide brain scans for their plead of mental conditions.

G. ETHICAL CONCERNS AND ADMISSIBILITY STATISTICS IN THE UK:

Alongside the increased presence and openness of courts in accepting neuroscientific evidences there are also concerns raised in regard to coercive neuroimaging. Compelling humans to undergo brain scans without their consent raises serious human right concerns under the European law under the Human Rights Act of 1998 which incorporates the rights set out in the European Convention on Human Rights (ECHR) into domestic law.[27]This practice violates bodily and

[25]Philipp A. Vetter et al., Replicating the 'Seductive Allure of Neuroscience Explanations' Effect in a Classroom Experiment and an Online Study, 11 R. Soc. Open Sci. 241120 (2024), https://royalsocietypublishing.org/doi/10.1098/rsos.241120 (last visited Aug. 28, 2025).

[26]Paul Catley & Lisa Claydon, The Use of Neuroscientific Evidence in the Courtroom by Those Accused of Criminal Offenses in England and Wales, 2 J. L. & Biosciences 510 (2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5034405/ (last visited Aug. 28, 2025).

[27]Sjors Ligthart, Coercive Brain-Reading and the Right to Respect for Private Life, in Coercive Brain-Reading in Criminal Justice: An Analysis of European Human Rights Law 68 (Cambridge Univ. Press 2022),

cognitive right to privacy, personal autonomy and ethical concerns under the law. As laid down, neuroimaging must be consensual and authorities are required to safeguard sensitive brain data again misuse and minimizing disclosure of such information. These situations raise concerns regarding proper usage of scientific techniques against ethical and legal protections.

Regardless of the openness of the court we can observe the number of cases constitute far less numbers when compared to those in USA. Percentage of cases that use neuroscientific evidence in UK goes as low as 1% and limited to appeal cases when compared to 5% of murder and 25% of death penalty trails in US.[28]These lower rates of prevalence can be attributed to structural and systematic differences in between the two systems. The abandoning of death punishment in the year 1965 meant that the behemoth of cases that use neuroscientific evidences in the USA i.e., death penalty trails are nonexistent in UK. If read between lines, we can observe that the US's Daubert framework is far liberal allowing judges to act as gate keepers explicitly embracing "liberal thrust" favoring admission of evidence that meets basic reliability criteria. In contrast UK's law commission's recommendations imply far strict reliability standards. Historically, UK has adopted "laissez-faire" approach where in courts perform less scrutiny of evidences unless clear flaws are identified, but developments in legal system has led to abandoning of this system and moving towards far strict system of reliability and relevance before admission. This can explain the presence of far less cases when compared to that of USA.

In conclusion, UK is taking a cautious approach towards neuroscientific evidence. While allowing judges to evaluate reliability and standards for evidences, stricter frameworks were kept in place which explains lesser presence of neuro-based evidence in trails. While number of cases are less when compared to USA the double fold increase in cases from 2009 to 2012 beams a glimmer of acceptance of judiciary in accepting neuro scientific evidences in trails.

https://www.cambridge.org/core/books/coercive-brainreading-in-criminal-justice/coercive-brainreading-and-the-right-to-respect-for-private-life/BE39E962479C38FE602DEA24CD75D252 (last visited Aug. 28, 2025).

[28]Paul Catley & Lisa Claydon, The Use of Neuroscientific Evidence in the Courtroom by Those Accused of Criminal Offenses in England and Wales, 2 J.L. &Biosci. 510 (2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5034405/ (last visited Aug. 28, 2025).

H. INQUISITORIAL LEGAL FRAMEWORK AND EXPERT PROCEDURES IN GERMANY:

In contrast to USA and UK, Germany has a much-sophisticatedlegal system with multi-level checks for ensuring credibility of the evidences. Inquisitorial system of evidence is followed in Germany which is fundamentally different from the adversarial system followed by UK and USA. Under Section 244(2) of the German Criminal Procedure Code (StPO) judges are required to actively investigate into the evidences and facts of the case *exofficio* and not to depend upon presentations by parties.[29]This system embodies the truth-finding principle "*Wahrheitsfindung"* which compels the courts to consider all forms of evidences and facts of the cases and ensure cases are elucidated on all aspects.Unlike in common law jurisdictions where parties to the case bring their own experts, Germany requires experts to be formally appointed by the court through chambers of commerce that maintain lists of over 8,500 accredited judicial experts called as "*öffentlich bestellter und vereidigter Sachverständiger".*[30]These court appointed experts assist the courts, taking oaths to perform their duty impartially and reporting exclusively to the court rather than to adversarial parties ensuring objectivity in scientific evidence evaluation.

Germany's legal framework for scientific evidence operates under codified provisions within the Criminal Procedure Code of Germany (StPO) which governs admissibility. Section 244(3) StPO empowers courts to reject evidence applications on grounds of "unsuitability" (*Ungeeignetheit)* specially when its nature is non-relevant to pursue truth.[31] This means that regardless of its scientific validity evidence is regarded as irrelevant if it's not useful for the case in question. Section 79 of StPOestablishes structural framework for appointment of experts, court appointed experts are to take an oath (Eid) to provide objective and impartial decisions thereby ensuring independence from adversarial parties.[32]Section 244(2) of StPO, courts have the duty to "extend reception of evidence to all facts and all means useful in pronouncing a verdict" creating a mandate that ensures how and where neuroscientific evidence is evaluated and applied in German criminal proceedings.

[29]Strafprozeßordnung [StPO] [Code of Criminal Procedure], § 244(2) (Ger. 1975).
[30]Criminal Procedure Law in Germany, Schlun&ElsevenRechtsanwälte, https://se-legal.de/criminal-defense-lawyer/criminal-procedure-law-in-germany/?lang=en (last visited Aug. 30, 2025).
[31]Strafprozeßordnung [StPO] [Code of Criminal Procedure] § 244(3) (Ger. 1975).
[32]Strafprozeßordnung [StPO] [Code of Criminal Procedure] § 79 (Ger. 1975).

I. ROLE AND IMPACT OF NEUROSCIENTIFIC EVIDENCE IN GERMANY AND SIMILAR CIVIL LAW SYSTEMS:

Since there are no explicit statistics that are widelyavailable regarding Germany's judicial system on the topic of neuroscientific evidence this article is going to use the statistics and legal systems of Slovenia which has systems similar to Germany to provide the reader a clear context of its impacts.In the civil law system of Slovenia (a country having similar judicial system and rules regarding neuroscientific evidence to that of Germany) usage patterns of neuroscientific evidence demonstrate notably different trends when compared to common law systems. High prevalence in serious crimes is evidenced by Slovenia where comprehensive studies show that nearly 20% of homicide trails (85 out of 495 cases) between 1991-2015 involved neuroscientific evidence. The introduced evidence ended up effecting 85% of judicial decisions in those cases. The thoroughness of the inquisitorial system is visible by the appointment of experts, which is at 95% of the total cases with claims of neurological evidence.[33]More importantly unlike in the US and UK, Slovenia maintained relatively stable annual cases number unlike the sharp increase observed in 20005-2010. This stability reflects the consistent truth finding system where courts systematically investigate evidences rather than responding to changing judicial needs.

Neuropsychological evidence emerges as the primary form of neuroscientific evidence in Germany. Structural Neuroimaging, including MRI and CT scans appear less frequently but provides crucial information about anomalies that affect behavior.EEG technology is occasionally employed for brain activity analysis in cases involving seizure disorders or other neurological conditions. Notably fMRI is surprisingly absent with studies finding no actual employment in court cases. Their effectiveness in these jurisdictions were high nearing 85% success rate in establishing insanity defenses or diminished criminal responsibility under provisions like section 20 of German Penal Code.

[33]Miha Hafner, Judging Homicide Defendants by Their Brains: An Empirical Study on the Use of Neuroscience in Homicide Trials in Slovenia, 6 J.L. &Biosci. 226 (2019), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6813933/ (last visited Aug. 28, 2025).

In civil law systems neuroscientific evidences play a comparatively different role as when compared to in common law countries exhibiting what can be called as indirect sentence influencing. Unlike the direct mitigation system found in countries like UK and US where evidence is provided during penalty phase to reduce punishment from death penalty to life imprisonment or long sentences to short sentences, in civil law countries like Germany and Slovenia they channel neuroscientific evidences through binary capacity determination framework. Then this is used to determine liability under section 20 which states that "if a person is found completely free of criminal intent,then he receives no punishment and is sent for psychiatric treatment"[34] or section 21 which states that "if a person is found with partial or diminished criminal intent then sentence may be mitigated in pursuance of section 49(1)" which is solely in respect of law and not under judicial discretion.[35]This creates an indirect pathway where evidence effects legal categorization first and sentencing next.

One major trend observed by researchers is called as the "Doble Edged Sword Effect" of neuroscientific evidence in criminal justice which demonstrates how such evidences can both mitigate and aggravate defendant outcomes. Unlike in USA where evidences as such typically reduces sentences by supporting diminished responsibility claims, German studies show that such evidences often lead to involuntary psychiatric commitments rather than sentence diminishment. One of the reasons for this divergence can be attributed to increased priority given to public safety than for psychologically disabled people. For example, a person pleading psychological disability and submitting neuroscientific evidence in furtherance to prove it is more likely to face involuntary psychiatric treatment along with diminished responsibility which greatly differentiates from way these evidences impact proceedings in USA or UK where sentence diminishment is the extent up to which neuroscientific evidences affect proceedings.

J. SUMMARY OF COMPARATIVE INSIGHTS AND FUNDAMENTAL TAKEAWAYS:

The comparative analysis of the three judicial systems i.e., USA, UK, Germanyreveals three distinct paradigms. The adversarial common law systems of UK and USA reveal that neuro

[34]Strafgesetzbuch [StGB] [German Criminal Code] § 20 (Ger. 1998).
[35] Strafgesetzbuch [StGB] [German Criminal Code] § 21 (Ger. 1998).

evidence can't be left as the sole rider for the chariot of justice and the need for a moderating body such as the judges and the judiciary in evaluating evidences and proving their reliability not only regarding their relativity to the case in question but also the scientific backing behind each method. Frye and Daubert frameworks show the evolutionary and modern approach USA took towards neuroscientific evidence and the statistics shows the prevalence and the pivotal role neuroscientific evidence plays. Since USA and UK are of common law system the reliability and concurrence between the effects in both countries are relatable and can be trusted upon to be replicated if taken inspiration from. The system followed in Germany and other civil law countries though are a bit experimental in India the process of court appointed expert witnesses can be sought inspiration from as they are effective and can prevent false witnessesarising from adversarial sides.

IV. CONCLUSION

The growing intersection of neuroscience and law demands India to beyond its cautious and precedent-driven approach and develop statutory frameworks that govern and clear the ambiguity surrounding neuroscientific evidence. The experiences of the United States, United Kingdom and Germany offer valuable insights: frameworks like Dubert and Frye that brought forward a massive change in how neuroscientific evidence is used, strict and cautious scrutiny model followed by UK which promoted both innovation and gatekeeping, Germany's well-structured laws that deal with scientific evidences and court appointed expert witnesses which ensure objectivity and scientific rigor. However, inspiration from such models must be done with a keen eye with due consideration for India's legal structures, demographic concerns and judicial capacities.

The phenomena of "Seductive allure" which can unduly affect judicial reasoning must be avoided at all costs and judges must be fool proofed regarding the same by means of training for judicial practitioners and judges. Any new regulations or standards should be carefully scrutinized for ensuring optimal compatibility and practicality with India Judicial system ensuring that reforms enhance the administration of justice rather than deteriorating it leading to unintended consequences.

A tailored framework for Indian should be drawn from global practices but remain sensitive to local contexts which highlights the needs for the constitution of a competent regulatory body and well-structured and emphasized evidence-based guidelines. It is only through balanced and context-driven approach that India can unlock the full potential of neuroscientific evidence in courts. Procedural safeguards such as informed consent, access to legal counsel and medical council when conducting medical examinations as laid in Selvi v. Karnataka. Periodic reviews and updates to neuroscientific standards with stakeholder consultation will ensure that reform is both effective and ethically sound navigating the complexities and challenges outlined throughout the journal.