
BETWEEN COGNITION AND COERCION: LEGAL AND ETHICAL LIMITS OF NEURO-FORENSICS IN INDIA

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ABSTRACT

Neuro-forensics stands at the convergence of neuroscience and criminal law and employs techniques such as narco-analysis, polygraph tests and brain electrical oscillation signature profiling to understand cognition and intent. While these methods offer investigative promise, their scientific validity remains largely contested among researchers. Moreover, these tests raise profound questions of constitutional and ethical concerns. Indian judgments have emphasized that such tests cannot be compelled and that any results obtained involuntarily are inadmissible as they violate the rights to self-incrimination, mental privacy and personal liberty under Articles 20(3) and 21 of the Constitution. Even voluntary tests require stringent safeguards. This paper examines the nature, admissibility, and limitations of neuro-forensic techniques in India, highlighting key ethical dilemmas and judicial view-points. Indians needs to adopt a balanced approach keeping fundamental rights at par with scientific innovation.

Keywords: Naro-analysis, Neuro-forensics, Scientific Tests, Self-incrimination, Privacy

INTRODUCTION

In 2021, an Indian student in her early teens faced a traumatic ordeal. She was raped at knifepoint by a man who later denied the crime. When the accused sought bail, he requested to undergo a series of forensic tests including brain electrical oscillation signature profiling, narco-analysis and lie detection to prove his innocence. During the BEOS test, his brain activity was monitored as he listened to phrases which announced the events of the crime. Neural patterns which might indicate prior knowledge or involvement were searched for. The results largely suggested he had no direct experience of the events and the court released him from custody. That case is one of at least 700 police investigations in India since the early 2000s in which suspects accused of serious crimes such as murder, rape and terrorism have undergone BEOS tests.¹ This case illustrates the tension at the heart of neuro-forensics in India i.e. the promise of cutting-edge technology to aid justice versus its unverified scientific validity. There exists a large potential for misuse. Its implications on constitutional rights cannot be ignored.

Neurologic evidence has been introduced in criminal cases for more than 150 years to determine whether a defendant is competent to stand trial, criminally responsible, or should have a reduced punishment if convicted of a crime.² In the evolving landscape of criminal justice, scientific interrogation techniques such as Narco-analysis, Polygraph Tests, Brain Mapping, and Fingerprint Analysis have emerged as significant tools for law enforcement agencies to investigate and extract information in complex criminal cases. These methods though often perceived as technological breakthroughs, have stirred considerable debate regarding their legality and ethical ramifications.³

NATURE OF NEUROSCIENTIFIC FORENSICS

Neuro-forensics refers to a set of scientific methods and technologies that are used during criminal investigations and judicial processes to further evidence. The underlying intent behind these processes is to uncover hidden cognitive or psychological states of the brain to establish culpability. In fact a lot of these techniques today are present to start identifying criminal behaviour even before its advent. By combining sophisticated imaging technologies with psychological assessments, researchers have effectively compared individuals displaying

¹ Jonathan Moens, *Mind Reader?*, SCIENCE.ORG (May. 15, 2025).

² Shen FX, *The overlooked history of neurolaw*, 85 FORDHAM LAW REV., 667-695, (2016).

³ A. Mehrotra, *Use of Technology in Criminal Investigation and Trial: Ethical and Legal Issues*, 7(1) NALSAR L. Rev. (2012).

heightened levels of violent or aggressive tendencies to those exhibiting less aggressive behaviour.⁴ Neuro-forensic techniques in India, while still developing, include narco-analysis, polygraph tests, brain fingerprinting (BEOS/P300), brain imaging (fMRI/EEG), etc.

Narco-Analysis is commonly known as the Truth Serum Test. The term Narcoanalysis is derived from Greek word NARKCA, which means anesthesia or tarpor. Here a suspect is given intravenous barbiturates which is often sodium pentothal or sodium amytal to induce a hypnotic, semi-conscious state.⁵ It functions on the principle that by suppressing higher reasoning, the drug makes it harder to fabricate lies so that the suspect talks freely and discloses true information. The suspect remains conscious enough to answer questions but is claimed to have reduced inhibitions. In India, the first known narco-test occurred in the Godhra case in 2002, followed by use in the Telgi counterfeit stamp case 2003 and infamously in the 2008 Aarushi murder investigation. The technique is controversial. Studies show that barbiturate-induced revelations can be unreliable: suspects may speak incoherently, fabricate false details, or respond to leading questions.⁶

Polygraph Tests, commonly known as Lie Detector tests measure physiological responses such as heart rate, blood pressure, respiration and skin conductivity while the subject answers a series of questions. It is based on the assumption that deceptive answers produce detectable stress responses. Wires or sensors record these involuntary bodily changes. An examiner later interprets the polygraph chart to assess truthfulness. Polygraphs have long been used globally but are scientifically contentious. Their accuracy depends heavily on the subject's physiology and psychological state. An emotionless liar may not trigger a strong reading while an anxious truth teller may appear deceptive.⁷ The National Academy of Sciences report on the accuracy of the polygraph under various conditions estimates as low as 55% depending on the setting, questioning format, the operator and response classification rules.⁸

Brain Electrical Oscillation Signature Profiling also called brain fingerprinting or mapping uses electroencephalography to measure brainwave responses to stimuli. In a BEOS test, the suspect

⁴ Avantika Samkaria, *Decoding Criminal Behavior: Brain Neurochemical-monitoring Technologies Can Help in Forensic Science*, SPRINGER NATURE (Mar. 31, 2025).

⁵ Sasi Kumar, *Narcoanalysis: The Science Behind Truth Serums*, MEDINDI (Dec. 5, 2024).

⁶ Richa Pandey, *Science and Justice: How Narco Tests, Lie Detectors, and Brain Scans Are Used in India*, ANBY LEGAL (Aug. 26, 2025), <https://www.anbylegal.com/media/uploads/blog/1756262663>.

⁷ R. Khandelwal, *The Legality of Narcoanalysis, Polygraph and Brain Mapping in India*, 2(1) LAW MANTRA J. (2011).

⁸ Daniel D. Langleben & Jane Campbell Moriarty, *Using Brain Imaging for Lie Detection: Where Science, Law and Research Policy Collide*, 19 PSYCHOL. PUB. POL'Y & L. 222 (2013).

listens to words or images related to the crime and neutral items. The EEG detects a characteristic P300 wave if the subject's brain unconsciously recognizes a stimulus indicating familiarity or experiential knowledge of it. The technique's claim is that a suspect who knows crime details will unconsciously show different brain patterns than an innocent person. *State of Maharashtra v. Aditi Sharma*⁹ also referred to as the Pune Brain Mapping case is famous for admitting BEOS evidence. The judge relied on §45¹⁰ of the Evidence Act and treated the EEG results as expert opinion. He found them "conclusive proof of guilt" and the result was a conviction for murder largely based on the alleged brain response to crime details. On appeal however, the Bombay High Court granted her bail noting and raising serious questions about the science. The case highlights the very risks of these scientific tests. Here great weight was given to neuro-evidence not accepted in other jurisdictions.

Each of these neuro-forensic methods is essentially unsubstantiated in nature, drawing inferences from physiological signals. The devices can indeed generate voluminous data. But experts have cautioned that there is no single characteristic in the body or the brain that appears when and only when someone is lying. These techniques are relying largely on complex statistics and assumptions and may produce false positives. From a scientific standpoint, neuro-forensics in India remains deeply speculative and inconclusive.

ADMISSIBILITY AND LEGALITY OF NEUROLOGICAL TESTS

The admissibility of the results of narco-analysis, polygraph and brain mapping remains a contentious issue in both Indian and global legal systems. Indian courts have taken a careful stance acknowledging the deep ethical dilemmas these techniques raise and the potential risks they pose to individual rights and personal autonomy. From a bird's-eye view, these results are largely excluded from being considered as substantive evidence. Even if administered with consent, these results are usually treated only as investigative leads and not conclusive proof of guilt or innocence. There are multiple reasons for this.

Indian statutes like the law The Evidence Act, 1872, now Bharatiya Sakshya Adhiniyam, 2023, do not explicitly mention narcoanalysis or lie-detection tests. Judgements over the years have helped established their admissibility. In *Selvi v state of Karnataka*,¹¹ it was held that the results

⁹ State of Maharashtra v. Aditi Sharma, Sessions Case No. 508 of 2007.

¹⁰ Indian Evidence Act, No. 1 of 1872, §45, India Code (1872).

¹¹ Selvi v. State of Karnataka, AIR 2010 SC 1974.

of the test itself cannot be admitted directly as they are not freely volunteered speech. Rather, any information or facts discovered with the help of the test can be used provided that it meets the usual evidentiary rules. Thus, if a person voluntarily undergoing the test reveals something that leads to new evidence, any physical evidence discovered as a consequence of that disclosure can be admitted under §27¹² of the Evidence Act. The ‘fruit of the poisonous tree’¹³ rule applies here. The results of the test i.e. the recordings or readings are excluded but independently obtained evidence derived from any confession or revelation during the test may be used. Moreover, the results of the narcoanalysis technique, polygraph examination and the BEAP tests are treated as testimonial acts. The court recognised the distinction between testimonial acts and physical evidence. While bodily substances such as blood, semen, sputum, sweat, hair and fingernail clippings can be readily characterised as physical evidence, the same cannot be said for neuro-forensic techniques.¹⁴ The raw outputs of these techniques have no place in evidence by themselves.

The Code of Criminal Procedure, 1973 or the BNSS is also revoked to authorize forensic tests. §53¹⁵ permits medical examination of the accused. The *Selvi*¹⁶ court examined this in depth to answer whether these encompass narcoanalysis or related tests. It noted that none of the typical forensic test powers explicitly mention narcoanalysis, polygraph, EEG or fMRI. The court here read §53¹⁷ narrowly and the scope of ‘such other tests’ was said to be limited. It held that narcoanalysis, polygraph and BEOS are *not* covered by the explanation to §53,¹⁸ because those provisions apply only to physical material evidence like blood samples, fingerprints or bodily fluids. In contrast, these disputed techniques primarily aim to elicit the suspect’s testimony which is non-physical evidence or a cognitive response. For that reason, the Court said these tests cannot be treated as simple medical examinations of the body. Thus while an accused person may be medically examined for injuries or diseases, he cannot be compelled to undergo a brain exam aimed at eliciting speech.

Building on this, the Supreme Court also observed that a lie-detector or narcoanalysis test does

¹² Indian Evidence Act, No. 1 of 1872, §27, India Code (1872).

¹³ Bharat Chugh, *Rethinking the ‘Fruits of the poisonous tree’ doctrine: Should the ‘ends’ justify the ‘means’?*, SCC ONLINE BLOG (June 15, 2020), <https://www.scconline.com/blog/post/2020/06/15/rethinking-the-fruits-of-the-poisonous-tree-doctrine-should-the-ends-justify-the-means/>.

¹⁴ Dharmendra Kumar Singh, *Constitutionality and evidentiary value of narcoanalysis, polygraph & BEAP tests*, 3 INT’L J. L. 84 (2017).

¹⁵ Code of Criminal Procedure, No. 2 of 1974, §53, India Code (1974).

¹⁶ *Selvi v. State of Karnataka*, AIR 2010 SC 1974.

¹⁷ Code of Criminal Procedure, No. 2 of 1974, §53, India Code (1974).

¹⁸ *Ibid.*

not produce an expert opinion. It merely yields statements from the subject, which are his testimonial communications. Thus, results of these tests are not admitted under §45¹⁹ as expert evidence.

ETHICAL AND CONSTITUTIONAL LIMITS

The deployment of neuroscientific tools in criminal investigations raises pressing questions about their compatibility with India's constitutional guarantees. While the state's interest in effective investigation is legitimate, the Constitution lays down firm barriers to any encroachment upon personal liberty and self-incrimination.

At the core of constitutional objections to neuro-forensic evidence lies Article 20(3),²⁰ which declares that no person accused of an offence shall be compelled to be a witness against himself. This Right to Silence is also mentioned under §161(2)²¹ of Cr.P.C. In *Nandini Sathpathy v. P.L.Dani*,²² it was said that nobody can coercively remove proclamations from the accused, who has the right to keep quiet throughout the investigation.

It is argued that techniques like narco-analysis, polygraph and brain electrical oscillation signature profiling amount to testimonial compulsion since they extract information directly from an individual's mental processes. Performance of these tests leads to persuasive interruption into one's psyche accordingly invalidating the legitimacy and authenticity of the Right to Silence.²³ Article 21²⁴ guarantees citizens the right to life and personal liberty which through judicial interpretation like in *K.S. Puttaswamy v. Union of India*,²⁵ has evolved to encompass privacy, bodily integrity and dignity. Neuro-forensic procedures seek to access involuntary cognitive responses and intrude into the innermost realm of human thought. Unlike conventional evidence collection, these methods cross the threshold from physical evidence to psychological. The state's investigative reach now reaches the accused's cognitive sphere. If such processes are performed without free consent and due process, it violates the constitutional sanctity of the human mind thereby turning the accused into a mere object of

¹⁹ Indian Evidence Act, No. 1 of 1872, §45, India Code (1872).

²⁰ INDIA CONST. art. 20(3).

²¹ Code of Criminal Procedure, No. 2 of 1974, §161, India Code (1974).

²² *Nandini Sathpathy v. P.L.Dani*, 1978 AIR 1025.

²³ Avinash Kumar Yadav, *Constitutionality Of Narco-Test & Kumar Kartikeya*, LIVE LAW (Oct. 16. 2020), <https://www.livelaw.in/lawschool/articles/constitutionality-of-narco-test-164554>.

²⁴ INDIA CONST. art. 21.

²⁵ *K.S.Puttaswamy v. Union Of India*, AIR 2017 SC 4161.

investigation rather than a bearer of rights²⁶. In *Ibrahim v. R*²⁷, the judge said that this was a form of violence or intrusion of a moral or mental nature, more subtle than visible violence but not less efficient in the result than an amyntal injection administered by force. In *Amlesh Kumar v. State of Bihar*,²⁸ the Supreme Court addressed a Patna High Court order that had permitted narco-analysis testing for all accused in a kidnapping case pending bail hearings. The order was quashed thereby reaffirming that a narco-analysis test cannot form the sole basis of conviction. The Court further emphasized that involuntary narco-analysis constitutes a violation of Article 21, protecting personal liberty.²⁹

The pillar of constitutional validity for any neuro-forensic technique rests squarely upon the principle of consent. Consent transforms what would otherwise be a coercive intrusion into a permissible investigative act when it is free and informed. If a test is administered involuntarily, the accused is literally being made to tell on himself without choice. *Selvi*³⁰ reasoned that any method used to elicit the accused's knowledge is covered by Article 20(3). Thus in cases of absent consent, such tests trigger the constitutional bar. The Supreme Court's analysis aligns with *Kathi Kalu Oghad*,³¹ which held that such privilege attaches only to testimonial acts. Neuro-forensic tests aim to extract a response in the form of words or knowledge from the accused's mind, making it testimonial. Even if the person does not speak, his neural or physiological responses serve the function of answering questions making it communicative in nature. In sum, Indian constitutional law tilts sharply against coercive neuro-forensic techniques. The right to mental autonomy goes hand in hand with the suspect's right to remain silent.

Even when done voluntarily, the use of neuro-forensic technology raises many ethical questions. The ethical baseline is that any such test must be truly voluntary and informed. But in reality, there is a high risk of coerced consent. An accused person may feel compelled to agree fearing that refusal will make them look guilty or invoke suspicion. Policing pressure may amount to indirect coercion. Fair consent requires the suspect to be fully informed of the procedure's nature, uses, and risks and to have time and counsel to decide. In practice this can

²⁶ Nar Hari Singh, *Brain Data in India: Taking it From Your Head to the Courtroom and Dealing with All the Legal Stuff*, LEXTALK WORLD (July 8, 2025).

²⁷ *Ibrahim v R*, Criminal Appeal No. 346 of 1958.

²⁸ *Amlesh Kumar v. State of Bihar*, 2025 INSC 810.

²⁹ *Ibid*.

³⁰ *Selvi v. State of Karnataka*, AIR 2010 SC 1974.

³¹ *State of Bombay v. Kathi Kalu Oghad*, 1961 AIR 1808.

be very challenging. Suspects often have limited legal aid and may not grasp the complex implications of a brain scan. These scientific tests if applied involuntary have been linked to torture and mental agony in an accused. The experience of being sedated or wired up under police supervision can be psychologically traumatic. Victims have reported feeling helpless, violated or disoriented. In some instances, the very threat of being subjected to narcoanalysis may induce a guilty confession out of fear. The danger is that the mere existence of neuro-forensics could tilt interrogation tactics towards subtle intimidation.³²

An ethical interrogation tool must be reliable or otherwise it risks miscarriages of justice. Neuro-forensic methods are of questionable accuracy. Scientific literature and practitioners warn that no physiological or neurological marker is a definitive indicator of lying.³³ Factors like stress, mental illness, medications or fatigue can skew readings. For example, EEG-based tests rely on the assumption that only someone with actual guilty knowledge will register certain brain waves. But false positives can occur if a suspect inadvertently recognizes a stimulus or is anxious. Likewise countermeasures are also possible and subjects can attempt to manipulate their responses by tensing muscles, thinking neutral thoughts etc. to fool a polygraph or EEG. Courts and investigators must not treat a neuro-test result as foolproof evidence of guilt. This is because physiological or psychological responses can be misleading and are affected by the examiner's subjective interpretation. There are also procedural flaws associated with the handling and recording of such tests. For instance, the way questions are framed during a polygraph test or the environment in which narco-analysis is conducted can influence outcomes. The lack of standardized protocols across forensic laboratories can lead to inconsistent results which further weakens its evidentiary value. Therefore the judiciary has rightly erred on the side of caution by prioritizing constitutional safeguards and human dignity over unverified scientific tools.

WAY FORWARD TO SAFEGUARDING NEUROFORENSIC

Any meaningful integration of neuroscientific techniques into forensic or policy frameworks must be preceded by a rigorous and uncompromising interrogation of their scientific validity. The history of forensic science is replete with examples of methods that entered courtrooms and investigative practice long before their empirical foundations were adequately stress-

³² John H. Langbein, *The historical origins of the privilege against self-incrimination at common law*, 92(5) MICH. L. REV. 1047-1085, (1994).

³³ Alla Katsnelson, *Crime: Does brain scan evidence work?* (Feb. 3, 2022), <https://courier.unesco.org/>.

tested. The consequences of repeating that error with neuro-forensic tools would be far graver. Before neuroscientific techniques can be responsibly deployed in any policy context, they must satisfy established admissibility thresholds developed precisely to guard against the seduction of impressive-sounding science. What is needed is sustained and methodologically rigorous research aimed at developing standardised protocols for each technique followed by independent replication across diverse populations. Reliability in the technical sense that the same test administered under the same conditions produces consistent results must be established before validity can even be meaningfully assessed. Only once a technique demonstrates robust test-retest reliability, low error rates at the individual level and resilience against confounding variables, can the question of legal deployment be seriously entertained.

*Daubert v. Merrell Dow Pharmaceuticals*³⁴ set the standard by requiring courts to assess whether a technique has been tested, subjected to peer review, has a known error rate and enjoys general acceptance within the relevant scientific field. The way forward therefore is not to legislate around uncertainty but to invest in a longitudinal, independently replicated research that could one day produce tools worthy of the weight that law would place on them.

Given these concerns, stringent procedural safeguards surrounding neurological tests are ethically necessary. The Supreme Court in *Selvi*³⁵ laid out a list of protections which it described as procedural safeguards for conducting these tests. These include, no test without consent, explanation of implications, access to counsel, magistrate-recorded consent, independent administration and an understanding that any statement will not count as a confession.³⁶ These mirror earlier National Human Rights Commission guidelines for polygraphs. Such safeguards are designed to preserve the suspect's free will and document the process. These measures aim to prevent the exploitative potential of neuro-tech and protect individuals from psychological coercion or error. In *Tehseen Poonawalla v. Union of India*³⁷ the Supreme Court had already emphasized that police officers cannot engage in clandestine narcoanalysis.

³⁴ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993)

³⁵ *Selvi v. State of Karnataka*, AIR 2010 SC 1974.

³⁶ Srishty Ojha, *Forced narco tests illegal, results not admissible: Supreme Court*, INDIA TODAY, <https://www.indiatoday.in/india/law-news/story/unconstitutional-supreme-court-rules-against-involuntary-narco-analysis-tests-2739223-2025-06-11>.

³⁷ *Tehseen Poonawalla v. Union of India*, AIR 2018 SC 3354.

CONCLUSION

The trajectory of neuro-forensics in Indian criminal justice reveals a fundamental tension that law alone cannot dissolve between the state's legitimate interest in effective investigation on one hand and the constitutional protection of the individual's mind on the other. What makes this tension particularly acute is that unlike most evidentiary controversies, neuro-forensic techniques do not merely risk procedural unfairness, they risk penetrating the last truly private domain left to an accused person i.e. their own cognition.

Indian courts have responded to this complexity with commendable judicial restraint. By firmly anchoring the discourse in Articles 20(3) and 21 of the Constitution, the Court has refused to allow neuro-technology to override the accused's right against self-incrimination and mental autonomy. Beyond legality, ethical considerations play an equally important role. Consent must be genuinely voluntary, informed and free from coercion. The suspect also must be fully aware of the procedure and its potential consequences. The way forward must therefore be calibrated and cautious. Neuro-forensic tools cannot be integrated into investigative or adjudicative practice merely because they are technologically impressive or because investigators find them convenient.

In sum, the Indian legal system has thus far navigated the neuro-forensic frontier with more constitutional fidelity than many other jurisdictions. The task ahead is to consolidate and institutionalise that fidelity, ensuring that the pursuit of truth in criminal investigation never becomes an occasion to reduce the accused from a rights-bearing person to a mere object of neurological inquiry. Justice demands no less.