

Brain Mapping: A Critical Overview of its Applicability, Reliability and Validity in the Indian Criminal Justice System

Shivam Bhattacharya*

Abstract

This paper examines the use of brain-mapping tests in the legal framework. The paper aims to draw a parallel between how criminal justice system and the psychology of a criminal works. This paper explains how the entire process of brain mapping test works and attempts to explain the procedure and the objectives achieved by this test. The paper also looks into the reliability of such tests in the real-world scenario, by providing a list of landmark judgments pronounced by Indian judicial system in this regard. The paper will also cover the aspect of 'recidivism' of criminals and how conducting brain-mapping tests might provide a solution. The paper will also explain the tussle between the need for an efficient judicial system and the protection of an individual's fundamental rights.

Keywords: Brain-mapping, criminals, judicial system, fundamental rights, forensics, investigations

INTRODUCTION

Forensic psychology has carved out a unique place for itself in the modern world. This unique combination of medical psychology in conjugation with criminal justice has opened new avenues and techniques for solving and preventing crimes. The term 'forensic' in common parlance can be defined as 'the scientific method for investigation of a crime' [1]. Another term which is closely related to the criminal justice system is *forensic assessment*. It is a unique combination of medical psychology and criminal justice. Forensic psychology often plays a role in providing justice and preventing crimes. It is often described as the merger of law and psychology.

Even though no clear definition of forensic assessment is provided, it can be inferred that this form of assessment is required whenever there is a complex legal question to answer, which can only be done by a forensic expert [2]. The concept of 'Forensic assessment' has led to the creation of a whole new set of techniques for investigating and solving crimes. In light of such changes in the criminal justice system, the requirement of **DDTs or deception detection tests** is being felt by both the legal fraternity and the forensic community alike [3].

*Author for Correspondence

Shivam Bhattacharya
E-mail: shivambhatta16@gmail.com

Student, Gujarat National Law University (GNLU), Koba,
Gandhinagar, Gujarat, India

Received Date: March 31, 2022
Accepted Date: April 23, 2022
Published Date: June 30, 2022

Citation: Shivam Bhattacharya. Brain Mapping: A Critical Overview of its Applicability, Reliability and Validity in the Indian Criminal Justice System. National Journal of Criminal Law. 2022; 5(1): 6–13p.

At the centre of such tests lies arguably the most accurate and the most effective one – *Brain mapping*. Its simplicity and ability to provide vital leads in the investigation of the most complex of crimes has made it a popular option among the investigative agencies. It allows for smooth and rapid results in forensic investigation. In India, the concept of 'brain-mapping' has been used, albeit on a small scale, since the year 2003. And with the duration of such a test ranging from fifteen to twenty minutes on an average, the use of brain-mapping tests to aid investigation has grown

exponentially in many developed countries around the world. The idea which lies behind conducting such tests is that the information, which is known to an accused and not to the investigating officers, is crucial for investigating crimes [4].

Therefore, in order to make scientific tests like brain-mapping admissible in criminal investigations, forensic experts and legal personalities have pointed out that there needs to be a paradigm shift from the admissibility of only non-scientific evidences to evidences involving both scientific and psychological materials in the Courts.

DESCRIPTION OF THE PROCEDURE AND THE OBJECTIVES OF BRAIN-MAPPING TESTS

Brain-mapping involves a set of techniques *encompassing image representation, visualization and interpretation techniques* [5]. At the centre of this process of brain mapping lays the concept of structural and functional neuro-imaging. Before the presentation of a set of words to the accused, the accused is first interviewed and interrogated to find out whether he or she is concealing any evidence related to the investigation. Then the suspect is shown a set of words. The activation of brain for the associated memory is carried out by presenting these set of words to the accused.

The type of words presented depends on the nature of the crime being investigated. Broadly, the list of words can be divided into a total of three parts:

1. Neutral words: This part consists of those words which have no relation with the nature or the type of the case. These are presented to the subjects at the beginning of the test.
2. Probe words: The probe words are considered to be the most important among all the three sets of words. These set of words are directly related to the events which took place during the course of the crime. These words in general help the forensics experts to determine crucial information related to the crime.
3. Target words: These words in simple terms can be said to be those words which are based on confidential findings of an investigating authority. These set of words mainly includes those words which the accused does not know.

The main objective of this test is to find out whether the persons' brain recognizes things, sounds or movements from the crime scene which an innocent suspect would have no knowledge of [6]. The subjects in this process are required to wear a special band consisting of electronic sensors and they are made to sit in front of a computer screen.

The electrodes which are used for brain-mapping are carefully placed on the surface of the skin of the head and the face. The neuronal activity taking place in the brain produces potentials based on specific cognitive events, more commonly known as event-related potentials [7]. The stimuli of the brain in response to the auditory and the visual stimuli related to the crime helps the forensics experts to examine the potentials which may or may not be crime-related in the form of brain-mapping.

The sensors attached to the brain monitor all the activity which is taking place in the neural network of the brain. The computer screen then registers waves called *P300 waves*, based on the electrical activity of the brain. Equipment called the 'neuroscan' is used to obtain the '*Event Related Potential*' and to obtain an *Electro Encephalogram (EEG)* [8].

The specialty of conducting a brain-mapping test in determining a crime scene is that the entire process only works on the cognitive responses of the accused. It is also important to remember that the brain is involved in every action done by an individual and is able to record everything which an individual does or sees [9]. More importantly the entire procedure does not involve the accused to speak anything since it is based on the EEG signals. In addition to that, the high degree of accuracy has made it a great tool in aiding the investigating agencies for solving crimes. Brain-mapping tests have provided crucial leads in solving some of the most complicated crimes.

CONSTITUTIONAL VALIDITY OF BRAIN MAPPING UNDER ARTICLE 20(3)

Judicial Stand Taken by the Supreme Court of India

The Supreme Court of India has through its various judgments mentioned that a great deal of caution and care has to be exercised while receiving scientific evidences for investigation purposes.

Article 20(3) of the Indian Constitution provides that, “*No person accused of an offence shall be compelled to be a witness against himself [10].*” This Article invokes protection against self-incrimination and it provides the accused person the right to remain silent over any matter which is self-incriminating to him. Thus, the constitutional embodiment invigorating the ban on self-incrimination has been enshrined in the said article. The legal principle of ‘*Nemo Tenetur Seipsum Accusare*’ is an essential component of Article 20(3), as it signifies that ‘no man is bound to accuse himself’ [11].

However, at the same time it is also essential to keep in mind two things before testing the validity of brain-mapping tests under the provisions of Article 20(3). Firstly, it is important to note that an accused can avail the protection of this article only if; he is compelled to be a witness against himself [12]. And secondly, the said article speaks of self-incriminating evidence only by way of compulsion.

One of the foremost arguments of making such tests legal is that since criminals are increasingly using technology as a shield to protect themselves, it is necessary for the investigating officers to deal with them in a technology-oriented manner [13]. Moreover, several legal experts and clinical psychologists also feel that performing of tests like brain-mapping on the accused persons is a part of the investigation process and thus the consent of the accused is not required. They have pointed out that the Criminal Procedure Code or CrPC does not provide for any provisions whereby the consent of an accused is required during the investigation process [14]. Conducting of or performing of the Brain Mapping Test on the accused would not take away the protection guaranteed under Article 20(3) of the Constitution of India, they believe.

The Supreme Court of India had taken a broad view of the constitutionality of conducting such tests in light of the provisions contained in Article 20(3) of the Constitution. They have mentioned that self-incriminating evidences given by an accused person without any threat would not attract the provisions of the said Article. Since brain-mapping does not require the accused to make any statement, and thereby signifying that no compulsion is required, Article 20(3) of the Constitution is thereby not violated [15].

Though the right has been defined broadly its scope has been confided by judicial interpretation to evidence that is testimonial in nature. If a strict interpretation of the said article is done, it can be inferred that the said article only provides for compulsion which is testimonial in nature. As has been observed by the SC in the landmark case of *M.P. Sharma v. Satish Chandra* that the guarantee provided to the accused is only against ‘testimonial compulsion’ [16]. It is of utmost important to understand that admission made by a person in such a test would not be considered conclusive but only *would be decisive of the matter* [17].

Landmark Judgments Passed Regarding the Admissibility of Scientific Tests

The Indian judicial system has given out a series of judgments pertaining to matters involving the admissibility of scientific test. However, some of these judgments given have far-reaching consequences. The timeline of some of the major decisions given by the Indian Courts is given below:

MP Sharma and Others v. Satish Chandra

In this landmark case, the Supreme Court held that the scientific tests like brain-mapping, narco analysis and lie-detector tests was violative of the provisions enshrined in Article 20(3) of the Indian Constitution. The rationale behind the judgment given was based on two considerations. The first consideration is the requirement of ensuring reliability of the evidence given by an accused person.

Secondly, and more importantly it is imperative that the evidence or the statements given should be of a voluntary nature. The Court held that such tests involve threat or coercion to the accused person [18].

Ramchandra Reddy and Ors. v. State of Maharashtra

The Bombay High Court in this case upheld the legality of the scientific tests. They held that conducting tests like Brain-mapping tests or P300 tests, lie-detector tests etc. are legally admissible as evidence. The Court held that conducting tests like brain-mapping at no stage involved any statement to be made by the accused and such tests involved no harm to the body. They allowed the investigating agencies to conduct scientific tests on the accused people in that case [19].

Dinesh Dalmia v State

In this case of 2006, the High Court of Madras, ruled that narco-analysis testimony was not ‘testimony by compulsion’ because the accused “may be taken to the laboratory for such tests against his will, but the revelation during such tests is quite voluntary.” The Court noted that the breaking on one’s silence is always technically ‘voluntary’. The Court also held that the element of coercion is only present whenever there is an act or a threat of violence [20].

Rojo George v. Deputy Superintendent of Police

The Kerala High Court in this much-publicised case held that permission of courts is not required to do such scientific tests. The magistrate in this case stated that filing a plea in the court would delay the process of investigation. The magistrate held that conducting such tests can be considered as effective tools for investigation [21].

Selvi v. State of Karnataka

However, in its most recent judgement a 3-judge bench of the Supreme Court stated that Article 20(3) provides protection to an individual’s choice between the two domains of remaining silent and speaking. The Court held that the results of such tests cannot be admitted in evidence, irrespective of whether the testimony proves to be either exculpatory or inculpatory. The test results cannot be admitted as conclusive or material evidence [22].

Thus, from the above judgments it can be inferred that the stand of the Indian courts in such cases has differed from time to time, even though, the most recent judgments of the Supreme Court have recognized this right against self-incrimination. It is therefore, important to understand that the scope of Article 20(3) is not self-interpreting. The extent to which this Article can check the power of the state as an investigator, depends on the philosophy it is underpinned by [23]. Further discussion and deliberations on this topic by taking into consideration an individual’s fundamental rights and the need to provide justice is the need of the hour.

THE ROAD AHEAD: APPLICATIONS AND DRAWBACKS OF BRAIN-MAPPING IN THE CRIMINAL JUSTICE SYSTEM

One of the major applications of brain-mapping tests is that conducting them allows the forensics professionals who are investigating a criminal case come out with important and sometimes clinching evidence. Several legal luminaries and investigative agencies who support such tests have mentioned that even though an accused may be taken to the testing laboratory against his will, but the revelation the accused makes will be quite voluntary [24]. It can thus, be inferred that the process does not involve a witness to give evidence against him.

Moreover, with the legal system increasingly playing an important role in investigation processes and providing justice, the use of brain-mapping tests has become of utmost importance. The applications of brain-mapping have become a common term around the world [25]. Also, with criminals becoming highly-trained professionals, the use of modern techniques like brain-mapping could act as a perfect tool for getting vital information, even in the most complex of cases [26].

As has been rightly pointed out that for combating crimes which are organized, the methods of prevention, detection and investigation have to be used synchronously [27]. The ever-growing arena of science and technology has thrown multiple challenges to both the forensics professionals as well as the legal professionals, with highly-advanced techniques being increasingly used [28].

Various legal professionals and forensic experts have pointed out that in several cases the evidences are wiped off and no clue of the criminal acts can be ascertained from a crime scene. In such scenarios, utilizing techniques like brain-mapping has proved to be of huge significance. Investigating agencies resorting to such techniques to gain valuable inputs related to a crime is increasingly being seen. The evidence which can be extracted by conducting such tests has been found to be crucial in investigative processes [29]. The Supreme Court has also mentioned that using forensic techniques cannot be held violative of any fundamental rights of citizens if it is done in the presence of an expert [30].

However, a lot still needs to be done in this for such tests to become a common feature of investigation. One of the foremost criticisms is the reliability of such tests for investigating crimes. Such tests have in several cases been inadmissible on the grounds of lack of developed techniques, lack of research and development of such techniques, difficulty in assessing how far such tests can be made admissible and lack of theoretical basis for conducting such tests. And in some cases, the Court has to analyze such evidence by analyzing them under the ambit of Fundamental rights provided to the citizens.

USE OF BRAIN MAPPING TESTS IN DETERMINING RISK ASSESSMENT

The American Psychological Association has defined risk assessment as '*the process of determining the danger which an individual would be likely to pose if he or she is released from confinement* [31].' It provides a broad overview of the chances of an individual re-offending.

The ancient method of predicting risks by the forensics professionals by using their own judgment has been made away with a modern and more refined system of risk assessment. Some experts working in this field have worked and pondered about how exactly the inclusion of neural variables could ameliorate risk assessments in the evaluation of future criminal conduct.

Several researches and studies have been conducted in this field. A recent study conducted has pointed out that a small region of the brain called the **Anterior Cingulate Cortex (ACC)** provides key inputs and provides key details regarding the probability of a person re-offending. The study has pointed that people having a lower ACC activity in the brain were shown to be more likely to commit an offence again [32]. The study involved scanning the brains of the prisoners using functional magnetic resonance imaging. The subjects were given tasks which required quick decision-making skills. The studies conducted in this field have shown that brain-mapping of the criminals 'provide a new and promising way' to find patterns of brain activity [33]. ACC is considered to be one of the most active regions of the brain. However, experts have cautioned against the social implications of such tests on the individuals.

Even though the concept of **Neuro-prediction** using brain-mapping techniques holds promise of adding crucial predictive value of understanding the chances of recidivism, but it is also important to keep in mind that it does not provide absolute guarantee in this regard. It merely provides a rough probability of recidivism of an individual [34].

Experts have pointed out to a potential '*neuro-cognitive biomarker*' for criminal or anti-social behavior [35]. A statistical model of risk assessment called the *actuarial risk assessment* has proved to be an important tool to determine the chances of an individual to re-offend if he or she is released from confinement. However, some critics of this model have questioned the reliability of using such

methods for the prediction of future crimes [36]. They have argued that the results of such tests could have significant repercussions of the rights of the individuals and in general the safety of the society. Thus, the development of more powerful predictive tools would be crucial in the coming times [37].

It is the need of the hour that the investigating authorities should update their procedure of investigating a crime according to the nature and the pattern of the crime. For achieving this, they need to seriously think about applying techniques like brain-mapping as part of their investigation whenever the need arises. Different courts around the world including the Supreme Court of USA has approved of such methods for investigation. On a broad scale, it can be inferred that the Indian judiciary has allowed use of these tests on a conditional basis, for achieving the ends of justice [38]. Some experts have however, cautioned against the use of such techniques, wondering whether any differences revealed by such tests would increase the accuracy of prediction if it is used in conjunction with other behavioral measures [39].

CONCLUSION

It can thus be concluded that the legal system in India should start imbibing advancements that take place in science and technology as long as these changes are good for the society and is essential in providing justice. Contemporary DDTs particularly, brain-mapping tests, needs to undergo rigorous research in normative and pathological populations [40]. Law is a living process, which changes according to the changes in society, science, and ethics and so on [41]. It is important for the Indian judicial system to imbibe the developments and the advancements take place in the field of psychology and science as long as they don't violate any legal principles and are for the good of the society at large.

The objective of science and justice is to bring out the truth. When the matter is in consideration with the objective of doing Justice, the means to achieve Justice may change from time to time [42]. The need to ensuring a balance between protecting an individual's rights provided under the Constitution and the requirement of providing justice at the same time, would be a key issue for further deliberation and research. There needs to be a careful consideration of all the factors affecting a case and how an investigating agency or the Courts in general should deal with the matter. As has been rightly pointed out by the Supreme Court of United States that, *"a society's need for interrogation outweighs the privilege associated with it"*.

The phrase that, "Law is pulsating and not static and therefore, as society evolves, law has to keep in consonance with the changing social order" has gained renewed significance in today's times [43]. Several research and advancement have taken place in conducting scientific tests for aiding the investigation process, with experts pointing out the important ethical, legal and scientific implications of such test [44].

Regardless of where one stands on the admissibility of evidence collected by brain-mapping and its associated tests, the main objective of protecting an individual's freedom while creating a clean and speedy justice system should not be forgotten. Brain-mapping tests have been upheld as a necessity in various developed countries as a key tool for solving even the most complicated of issues [45]. At the end of the day, the main aim of conducting such tests is to aid the investigation process in order to have a crime-free society. The conclusiveness, however, of these tests is a matter of further discussion and research [46].

REFERENCES

1. Ian Evett, The logical foundations of forensic science: towards reliable knowledge, NCBI Resources (last accessed September 16, 2020), <https://www.ncbi.nlm.nih.gov>.
2. Itiel E. Dror, Cognitive neuroscience in forensic science: understanding and utilizing the human element, Royal Society Publishing (last accessed September 16, 2020), <http://royalsocietypublishing.org>.

3. Yawer Qazalbash, Law Of Lie Detectors: Narcoanalysis, Polygraphy, Brainmapping & Brain Fingerprinting 69 (Universal Law Publishing 2016).
4. Mart Bles and John-Dylan Haynes, Detecting concealed information using brain-imaging technology, 14 The Neural Basis of Cognition (NEUROCASE) 78, 82-92 (2008).
5. Arthur W. Toga and John C. Mazziota, Brain Mapping: The Systems 639-654 (Elsevier Science 2000).
6. Ibid.
7. Rosenfeld, J. P., Soskins, M., Bosh, G., & Ryan, A. (2004), Simple effective countermeasures to P300-based tests of detection of concealed information, 41 Psychophysiology Journal, 205-219 (2014).
8. Kriti Das, Brain-Mapping: A Breakthrough in Indian Investigation, The viewspaper (last visited September 16, 2020), <http://www.theviewspaper.net>.
9. A.K. Gupta, S. Back & U.B. Roychowdhury, "Probing in the depth of criminal mind", Forensic Med (last visited September 16, 2020), <http://www.indianjournals.com>.
10. India Const. art. 20, cl. 3.
11. IPLEADERS Blog, <http://www.blog.ipleaders.in> (last visited September 16, 2020).
12. Legal Service India, <http://www.legalserviceindia.com> (last visited September 16, 2020).
13. Indian Kanoon, <https://indiankanoon.org> (last visited September 16, 2020).
14. The Code of Criminal Procedure, 1974, No. 2, Acts of Parliament, 1974 (India).
15. Abhinav Sekhri, between a Rock and a Hard Place, Indian Constitutional Law and Philosophy (last visited September 16, 2020), <http://indconlawphil.wordpress.com>.
16. M.P. Sharma and Ors. v. Satish Chandra and Ors., AIR 1954 SC 300.
17. Supra note at 6.
18. Supra note at 11.
19. Ramchandra Ram Reddy v. The State of Maharashtra Ramchandra, Crl. WP No. 1924 of 2003.
20. Dinesh Dalmia v. State, 2006 CriLJ 2401.
21. Rojo George v. Deputy Superintendent of Police, 2006(2) KLT 197.
22. Selvi and Ors. v. State of Karnataka and Ors., AIR 2010 SC 1974.
23. Arthur W. Toga, Brain Mapping: An Encyclopedic Reference 2458-2463 (Elsevier Science 2015).
24. Rajni Nanda, Evidentiary Value of Forensic Science with Special Reference to Narco Analysis Test, 7 Indian Journal of Law And Justice 558, 558-566 (March 2016).
25. Ibid.
26. Norbert Ebisike, The Use of Offender Profiling Evidence in Criminal Cases, GGU Law Digital Commons (last visited September 16, 2020), <https://www.digitalcommons.law.ggu.edu>.
27. Manpreet Singh, Constitutional Validity of Brain-mapping and Narco Analysis Test, 301 International Journal of Law (2011).
28. National Textile Workers Union v. P.R. Ramakrishna and Ors., AIR 1983 SC 750.
29. Supra note at 7.
30. Kalawati and Anr. v. The State of Himachal Pradesh, AIR 1953 SC 131.
31. American Psychological Association, <https://www.apa.org> (last visited September 16, 2020).
32. Steve W.C. Chang and Matthew A.J. Apps, The Anterior Cingulate Gyrus and Social Cognition: Tracking the Motivation of Others, NCBI Resources (last visited September 16, 2020), <https://ncbi.nlm.nih.gov>.
33. LIVESCIENCE, Criminal Minds are Different from Yours, Brain Scans Reveal 2011 (last visited September 16, 2020), <https://www.livescience.com>.
34. B. R. Sharma, Forensic Science in Criminal Investigation 33-34 (ed. 4, Universal Law Publishing 2003).
35. Jean R. Seguin, Neurocognitive elements of antisocial behavior: Relevance of an orbitofrontal cortex account, NCBI Resources (last visited September 16, 2020), <https://www.ncbi.nlm.nih.gov>.
36. N. Zoe Hilton and Janet L. Simmons, The Influence of Actuarial Risk Assessment in Clinical Judgments and Tribunal Decisions about Mentally Disordered Offenders in Maximum Security, SPRINGERLINK (last visited September 16, 2020), <https://www.link.springer.com>.

-
37. Ibid.
 38. LIVELAW News Network, Results of Even Voluntary Narco-Analysis and Brain Mapping Tests Admissible Only for Purposes of Sec 27 of Evidence Act, LIVELAW.IN (last visited September 16, 2020), www.livelaw.in.
 39. Brain Waves Module 4: Neuroscience and Law, the Royal Society 16 (1st ed. 2011).
 40. Sudha Mahi, Telling Voice: Brain Mapping, The Hindu 2016 (last visited September 16, 2020), <https://www.thehindu.com>.
 41. The Economic Times, Law must evolve with the times if societies are to progress (last visited September 16, 2020), www.economictimes.indiatimes.com.
 42. John I. Thornton, "Uses and Abuses of Forensic Science", Vol. 69 No. 3, ABA J., 288-292 (March, 1983).
 43. Bar and Bench, <https://www.barandbench.com> (last visited September 16, 2020).
 44. Wolpe PR, Foster KR and Langleben DD, Emerging Neuro-technologies for lie-detection: promises and perils, PubMed.gov 2017 (last visited September 16, 2020), <https://pubmed.ncbi.nlm.nih.gov>.
 45. LEGALLYINDIA, Brain-Mapping Tests: Need of the hour (last visited September 16, 2020), www.legallyindia.com.
 46. Supra note at 27.