



BRAIN FINGERPRINTING TECHNOLOGY: A UNIQUE TECHNIQUE THAT DETECT THE CULPRIT

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ABSTRACT

Brain Fingerprinting is a brain mapping technique that uses electroencephalography to ascertain the presence or absence of information in a subject's brain based on electrical activities in the brain. As a new forensic psychology interrogative and investigative tool, Brain Fingerprinting technology stands poised to exert a tremendous impact on the presentation and outcome of selected legal cases in the near future. This rise and frequency of heinous crimes and terrorist activities have nations across the globe scrambling for quick deployment of alternative tools to help combat these crimes. When physical evidence, witness and any other forms are unavailable for investigating agencies in a case, to get the lead and right direction this technology is useful, especially blind murder cases. The Brain Fingerprinting technology has undergone through a series of software updates and validation testing to improve on user experience and processing speed.

KEYWORDS : Brain Mapping, Brain Fingerprinting, Electroencephalography.

Introduction

Brain mapping is a set of neuroscience techniques predicated on the mapping of (biological) quantities or properties onto spatial representations of the (human or non-human) brain resulting in maps. All neuroimaging can be considered part of brain mapping. Brain mapping can be conceived as a higher form of neuroimaging, producing brain images supplemented by the result of additional (imaging or non-imaging) data processing or analysis, such as maps projecting (measures of) behaviour onto brain regions. Brain Mapping techniques are constantly evolving, and rely on the development and refinement of image acquisition, representation, analysis, visualization and interpretation techniques. Functional and structural neuroimaging are at the core of the mapping aspect of Brain Mapping (Wikipedia).

Of specific interest is using structural and functional magnetic resonance imaging (fMRI), electroencephalography (EEG), positron emission tomography (PET) and other non-invasive scanning techniques to map anatomy, physiology, perfusion, function and phenotypes of the human brain. Both healthy and diseased brains may be mapped to study memory, learning, aging, and drug effects in various populations such as people with schizophrenia, autism, and clinical depression. This led to the establishment of the Human Brain Project (Huerta et al., 1993).

The neurons in the human brain fire electrically, forming a vast network of electrical potential conduits. Electroencephalography (EEG) involves measurement of these patterns of electrical voltage changes that originate in the brain. When the brain conducts certain tasks, specific patterns of EEG ("brainwave") activity are produced.

Specific patterns of brainwave activity are known as event-related brain potentials, or ERPs. The Brain Fingerprinting technique uses ERPs to determine what information is stored in a person's brain. A specific event is noticing, recognizing, and processing the information contained in a stimulus significant to the person being tested (e.g., a murder weapon), when presented on a computer screen.

How Brain Fingerprinting Works:

Words or pictures relevant to a terrorist act, crime, terrorist training, or specific knowledge or expertise are presented on a computer

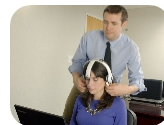
screen, in a series with other, irrelevant words or pictures. The entire Brain Fingerprinting system is under computer control, including the presentation of the stimuli, recording of electrical brain activity, and the algorithmic data analysis which determines whether or not information is present.

Brain responses are measured non-invasively from the scalp, digitized, and analyzed to determine the presence or absence of information stored in the brain.

Three types of stimuli are presented: probes, targets, and irrelevant. Probes contain information that is relevant to the crime or other investigated situation.

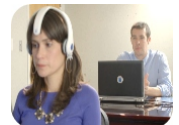
Below are the steps depicting the readiness and user friendliness of the application.

SUBJECT PREPARATION



The first step is to place the wireless headset, which uses sensors (electrodes) to collect brain responses from the scalp and muscle movements.

LAUNCH APPLICATION



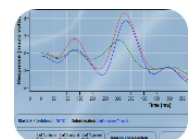
Then a series of crime or event-specific stimuli in the form of words, phrases, or pictures are flashed on a computer screen.

COLLECT BRAINWAVES

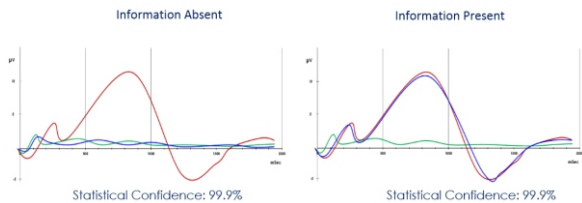


Neurological responses in the form of EEG signals are emitted for each trial.

ANALYZE RESULTS



The proprietary software analyzes EEG signals to determine whether the information under test is present or absent.



Brain Fingerprinting scientifically identifies whether information is stored in the brain by precisely measuring brainwaves.

- i. Brain Fingerprinting scientifically identifies whether information is stored in the brain by precisely measuring brainwaves.
- ii. Unlike a conventional polygraph, which detects an emotional stress response on the theory that people are more stressed when lying, Brain Fingerprinting only detects whether the information exists within the brain or not.
- iii. The system is fully automated using a laptop and specialized wireless headset, and has an accuracy rate of over 99%.

MERMER (Memory and Encoding Related Multifaceted Electroencephalographic Response)

Brain Fingerprinting Technology is based on the discovery that the P300 is only a subcomponent of a more complicated response called a MERMER. The MERMER is elicited when a person recognizes and processes a stimulus that is particularly noteworthy to the subject. When details of a crime are known to the suspect, a MERMER will be detected. A MERMER will not occur in an innocent subject.

India's First Brain Fingerprinting Lab:

India's First Brain Fingerprinting Lab was established at Institute of Research & Development (R&D), Raksha Shakti University (RSU), Ahmedabad on 28th September, 2015. Institute of Research & Development, took the initiation to validate this technology in India. Starting with simulation studies, which included different case scenarios and testing was in progress. Real cases were also being referred from the Central Bureau of Investigation (CBI). CBI is utilizing this technology and reported to have charge-sheeted in the referred few cases at the jurisdictional Courts utilizing Brain Fingerprinting examination report. In some cases, the Brain Fingerprinting expert of Institute of Research & Development, Raksha Shakti University visited the respective branch/unit of CBI concerned for conducting the Brain Fingerprinting Examination. Till date, the validation of this technology is providing satisfactory and positive results in India.

In one case, referred from Special Crime Branch (SCB) Unit, CBI, Mumbai. The SCB team had charge-sheeted and accused was arrested only on the basis of Brain Fingerprinting Examination report. Accused had confessed of committing the crime. Now, waiting for the final verdict from honorable High of Rajasthan.

The Central Bureau of Investigation (CBI), Special Crime Branch (SCB), Mumbai had given an **"Appreciation Certificate"** to the expert for conducting of the Brain Fingerprinting Examination in three cases that led to find the solution as early as possible. This proved that Brain Fingerprinting Technology is valid in India scenario, when other forensic tools proved futile in the examined cases.

Application:

Brain Fingerprinting can be applied successfully to solve different types of crime/dispute situations/investigations such as:

Personal/Violent Crimes: Aggravated assault, Forcible rape, Murder, Robbery.

Property Crimes: Arson, Burglary, Larceny-theft, Motor vehicle theft.

Other Offenses: Curfew violation/loitering, Disorderly conduct, Driving under the influence, Drug law violations, Embezzlement, Forgery and counterfeiting, Fraud Gambling, Liquor-law violations,

Offenses against the family, Prostitution and related offenses, Public drunkenness, Runaways, Sex offenses, Simple assault, Stolen property, Vandalism, Weapons, Vagrancy.

Other Crimes: Corporate/white-collar crimes, Financial crimes, Hate crimes, Identity theft, Organized crime, Cyber Crime, Medical Crime, Terrorism, Spousal Conflicts, Infidelity.

Other areas of Application:

Counter Terrorism: Detects information only a terrorist would know such as names, aliases and roles of individuals involved in financing and terrorist operation, specific IED training, clandestine groups.

Counter Intelligence: Identifies and associate a suspected person with specific knowledge of unauthorized knowledge, tactical plans for past operations, and financial details of illicit transactions.

Human and Drug trafficking: Human trafficking is a crime that exploits women, men, and children; all human beings are at risk and should take insult to trafficking of their fellow man for the purposes of sex or forced labor.

When a trafficker uses secrecy and lies to uphold the crimes, brain fingerprinting technology unlocks that information for law enforcement and investigative agencies.

Immigration and Border Security: There is no national security without border security. Border security plays a key role in both the exclusion of illegal drugs and in defending countries against outside threats. Weak borders allow terrorists and smugglers, as well as millions of illegal aliens, easy entrance to desirable countries.

Brain fingerprinting helps protect countries by aiding in the prevention of criminals, terrorists and terrorist's weapons, including weapons of mass destruction, from entering a foreign nation.

Brain Fingerprinting Credibility and Advantages

This latest technological crime solving tool, which provides an accurate, reliable and systematic process to conduct criminal investigations in a non-invasive manner. It can be used efficiently and affordably to:

- Identify criminals quickly and scientifically.
- Exonerate the innocent and prevent lawsuits from false accusations.
- Gather intelligence information and uncover espionage and terrorists plots.
- Detect accomplices and members of gangs and criminal organizations.
- It is object and system driven. Does not depend on the subjective judgment of the person conducting the test.
- Very useful and effective in counter intelligence and counter terrorism activities cases.
- Suspects cannot beat their own brain. No known counter measures.
- Admissible in US Court.
- Result does not have false positives or false negatives.
- It can be applied in varied situations where evidence can be collected.
- Brain Fingerprinting technology is reliable with 99.9% accuracy achieved.
- Brain Fingerprinting is published and peer reviewed in relevant scientific journals.
- It is tested and proven by FBI, CIA and US Navy with results published in peer review journals.
- Portable.
- User friendly.
- Minimum maintenance.
- Highly customizable.

Conclusion:

The recent terrorist attack in Germany, France, Bangladesh, Pakistan

and the United States shows how vulnerable our population is to terrorism. While the financial implications of terrorist activity when it happens easily amounts to billions of dollars lost, the psychological effect and trauma lives with the individuals and the nation forever. Thousands of rape, murder, criminal offences, human and drug trafficking offenses go unsolved and possibly thousands languish in jail over wrongful convictions.

Law enforcement officers are now faced with ever more growing need for information gathering, therefore access to information for investigative and intelligence gathering purposes is essential. Brain Fingerprinting is an advanced means of getting intelligence by detecting memory records of terror plans, training or crime stored in the brain of suspects. It eliminates number of suspects and its highly accurate tool used to corroborate/ cross verify assumptions and leads.

Thus, the Brain Fingerprinting Technology will pave a path for a new scientific method in the field of Investigative Psychology, which will definitely reduce the time span in Investigation by delivering the accurate result.

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