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## FARWELL BRAIN FINGERPRINTING A NEW PARADIGM IN CRIMINAL INVESTIGATIONS

Mrs. A, HEMA<sup>1</sup> (M.C.A, M. Phil) Assistant Professor  
E.G.S.PILLAY ENGINEERING COLLEGE  
DEPARTMENT OF MCA  
karusnehem@gmail.com

**ABSTRACT:** *Humans in society have had a need to determine the identity of individuals who have committed crimes. In the last century, there has been unprecedented progress in developing accurate, scientific methodologies for connecting a suspect with a crime. This paper reports the discovery of Brain Fingerprinting, a new technology that uses brain waves to connect evidence stored in the brain of a suspect with evidence connected with a crime, and discusses Brain Fingerprinting from the perspective of scientific progress in criminal investigations. The promise of this new technology is to provide an accurate and scientific means through which perpetrators can be identified, and the innocent can be cleared, based on the evidence from the one place where a comprehensive record of every crime is stored: in the brain of the perpetrator. Brain Fingerprinting has been preceded by two major breakthroughs in criminal investigation in the last hundred years. One of the great breakthroughs of modern criminal investigation came when it was discovered that human fingerprints A second breakthrough was the recent. Brain Fingerprinting allows evidence to be analyzed directly from the human brain, in an accurate, objective, non-stressful, non-invasive, and scientific manner. This breakthrough promises to revolutionize criminal investigations.*

**Keywords:** *Brain Fingerprinting, Innocent, Accurate, Objective, Non-stressful, Non-invasive*

### 1. INTRODUCTION

Humans in society have had a need to determine the identity of individuals who have committed crimes. In the last century, there has been unprecedented progress in developing accurate, scientific methodologies for connecting a suspect with a crime. This paper reports the discovery of Brain Fingerprinting, a new technology that uses brain waves to connect evidence stored in the brain of a suspect with evidence connected with a crime, and discusses Brain Fingerprinting from the perspective of scientific progress in criminal investigations.

The promise of this new technology is to provide an accurate and scientific means through which perpetrators can be identified, and the innocent can be cleared, based on the evidence from the one place where a comprehensive record of every crime is stored: in the brain of the perpetrator. Brain Fingerprinting has been preceded by two major breakthroughs in criminal investigation in the last hundred years.

#### 1.1. Fingerprinting

One of the great breakthroughs of modern criminal investigation came when it was discovered that human fingerprints could uniquely connect an individual with a crime. Beginning at around the turn of the century, investigators began to collect and

preserve a new kind of evidence in criminal cases. The traces left behind at crime scenes from the fingers of perpetrators. As is now well known, these traces found at the scene of a crime can be matched with the patterns on the fingers of suspects to place the suspect at the crime scene. Special procedures must be applied to collect and preserve fingerprinting evidence properly.

#### 1.2. DNA Fingerprinting

A second breakthrough was the recent discovery of "DNA fingerprinting[1]." Like fingerprints, DNA can be used to connect or match evidence that is collected at the crime scene -- in this case, biological samples - - with evidence on the person of the criminal -- the DNA. DNA can be used to clear a suspect by showing that evidence from the crime scene does not match evidence on the person of the suspect.

Like conventional fingerprinting, DNA fingerprinting[1] can only be successfully applied when investigators collect and preserve the specific kind of evidence demanded by the technique. DNA fingerprinting is much more complicated and difficult than conventional fingerprinting, because the DNA is much more subtle and complex than the print of a finger. In fact, only a small portion of the DNA is involved in any DNA fingerprinting procedure -- a full DNA "fingerprint", mapping the entire DNA,

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would be virtually unobtainable with current scientific techniques.

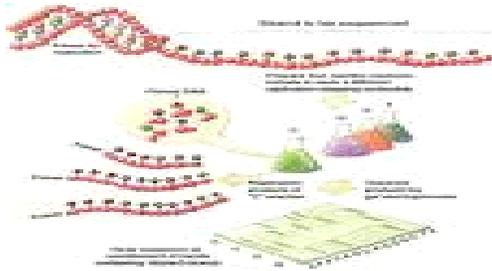


Figure (1)

### 1.3. Highly Successful Techniques

With proper collection and preservation of evidence and proper scientific technique, applied by properly trained individuals, DNA fingerprinting in its present state of development can be a highly accurate means of identifying perpetrators. Both DNA and conventional fingerprinting have also been highly successful in exonerating the falsely accused. DNA fingerprinting has recently resulted in the release of a number of individuals from prison who were falsely convicted of serious crimes.

### 1.4 Drawbacks of Fingerprinting and DNA Fingerprinting.

Although both DNA fingerprinting and conventional fingerprinting are highly accurate, they share two drawbacks.

#### 1.4.1 Additional investigative work and skill required.

Both techniques involve considerable extra work and skill for investigators. Collecting and preserving fingerprints and biological samples involve significant costs in time, resources, and money. From present-day perspective, this difficulty seems trivial compared to the benefits of the techniques, but it was not always considered so. Now that conventional fingerprinting and DNA fingerprinting are established as universally applied procedures, the additional work they require is almost taken for granted. Since both techniques are highly accurate, there is little doubt that the additional work is worth the effort.

#### 1.4.2. Rarity of Fingerprints and DNA Samples

This drawback is more serious. DNA samples and fingerprints are found in only a very small percentage of cases about one in a hundred. This, of course, does not mean that the techniques are not worth pursuing. A technique that provides an accurate identification of the perpetrator even in one percent of cases is

unquestionably of high value.

### 1.4.3 Need for Other Scientific Techniques to Identify Perpetrators.

There is a tremendous need for other accurate, scientific means of matching evidence from the crime scene with evidence on the persons of suspects, particularly in the cases where no fingerprints or DNA samples are left at the scene. This need has inspired some scientists to ask, "What does the criminal take with him from the crime scene that records his involvement in the crime?" The answer to this question, of course, is the brain. The brain of the criminal is always there, recording all of the events like a video camera -- and like his DNA and fingerprints, the brain always stays with the criminal.

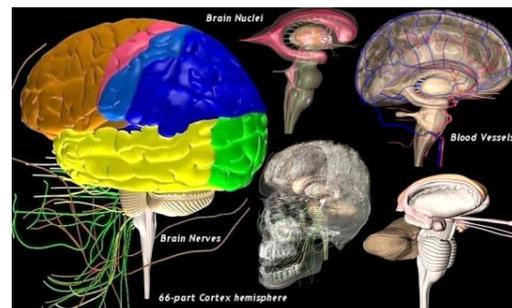
The problem, until recently, has been that there was no way to detect this record of the crime stored in the brain.

## 2. BRAIN FINGERPRINT

Is there a "brain fingerprint" that can reveal a suspect's presence at a crime scene? Although "brain fingerprinting" is a new science, recent advances in neuroscience do indeed make it possible to reveal a "brain fingerprint" that can scientifically, objectively, non-invasively, and accurately match or connect a criminal with a specific crime.

### 2.1. Brain Central to Crime and Criminal Investigations

As the human brain is central to all human acts, the human brain is central to the criminal act. The only reason that the brain has not yet become central to criminal investigations is that, until Dr. Farwell's discovery of Brain Fingerprinting, there was no scientific, objective way to match the evidence stored in the brain with evidence from the crime scene. Now that this new technology is available, it is inevitable that the brain will take its rightful place as a central facet of criminal investigations.



Figure(2)

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## 2.2 A New Era in Law Enforcement and Intelligence.

With the application of Farwell Brain Fingerprinting, a new and significant scientific breakthrough has become a practical applied technology[2]. A new era in law enforcement and intelligence has begun. Now, there is no reason why any individual should ever again be falsely convicted of a crime, nor should any guilty person evade justice for lack of evidence. The foremost reason that the investigation of the brain had not become central to criminal and espionage investigation until now is that, in the past, neuroscience had not yet progressed to the point where the brain could be utilized as a source of evidence regarding crime and espionage. The scientific discoveries of Dr. Lawrence Farwell and others have changed this situation. New research conducted at the Human Brain Research Laboratory and elsewhere has proven that it is possible to match evidence stored in the brain with evidence from a crime, in an accurate and reliable manner and without trauma, invasive procedures, or discomfort to the individual.

## 2.3. Scientific detection of the record of the crime in the perpetrator's brain

Brain Fingerprinting is based on the principle that the brain is central to all human acts. In a criminal act, there may or may not be many kinds of peripheral evidence, but the brain is always there, planning, executing, and recording the crime. The fundamental difference between a perpetrator and a falsely accused, innocent person is that the perpetrator, having committed the crime, has the details of the crime stored in his brain, and the innocent suspect does not. This is what Brain Fingerprinting detects scientifically.

## 2.4. Informational Evidence Detection.

The detection of concealed information stored in the brains of suspects, witnesses, intelligence sources, and others is of central concern to all phases of law enforcement, corporate, and intelligence operations. Farwell Brain Fingerprinting (for multifaceted electroencephalographic response analysis - MERA) presents a new paradigm in forensic science. This new system detects information directly, on the basis of the electrophysiological manifestations of information-processing brain activity, measured non-invasively from the scalp. Since Farwell Brain Fingerprinting depends only on brain information processing, it does not depend on the emotional response of the subject.

## 3. THE BRAIN MERMER

Farwell Brain Fingerprinting utilizes multifaceted electroencephalographic response analysis (MERA)[3] to detect information stored in the human brain. A memory and encoding related multifaceted electroencephalographic response (MERMER) is elicited when an individual recognizes and processes an incoming stimulus that is significant or noteworthy. When an irrelevant stimulus is seen, it is seen as being insignificant and not noteworthy, and the MERMER response is absent. This pattern occurs within about a second after the stimulus presentation, and can be readily detected using EEG amplifiers and a computerized signal-detection algorithm.

### 3.1. Scientific Procedure

Brain Fingerprinting incorporates the following procedure. A sequence of words or pictures is presented on a video monitor under computer control. Each stimulus appears for a fraction of a second. Three types of stimuli are presented: "targets," "irrelevants," and "probes." The targets are made relevant and noteworthy to all subjects: the subject is given a list of the target stimuli and instructed to press a particular button in response to targets and another button in response to all other stimuli. Since the targets are noteworthy for the subject, they elicit a MERMER. Most of the non-target stimuli are irrelevant, having no relation to the situation under investigation. These irrelevant do not elicit a MERMER. Some of the non-target stimuli are relevant to the situation under investigation. These relevant stimuli are referred to as probes. For a subject with knowledge of the investigated situation ("information present" -- stored in the brain), the probes are noteworthy due to that knowledge, and therefore probes elicit a brain MERMER. For a subject lacking this knowledge ("information absent" - not stored in the brain), probes are indistinguishable from the irrelevant, and thus probes do not elicit a MERMER. When the information tested is crime-relevant and known only to the perpetrator and investigators, then "information present" implies guilt and "information absent" implies innocence. Similarly, when the information tested is information known only to members of a particular organization or group (e.g., an intelligence agency or a terrorist group), then "information present" indicates affiliation with the group in question.

### 3.2. Computer Controlled

The entire Farwell Brain Fingerprinting System is under computer control, including presentation of the stimuli and recording of electrical brain activity, as

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well as a mathematical data analysis algorithm that compares the responses to the three types of stimuli and produces a determination of "information present" or "information absent," and a statistical confidence level for this determination. At no time during the analysis do biases and interpretations of a system expert affect the presentation and results of each stimulus presentation.



Figure(3)

### 3.4. Four phases of Farwell Brain Fingerprinting

In fingerprinting and DNA[4] fingerprinting, evidence recognized and collected at the crime scene, and preserved properly until a suspect is apprehended, is scientifically compared with evidence on the person of the suspect to detect a match that would place the suspect at the crime scene. Farwell Brain Fingerprinting works similarly, except that the evidence collected both at the crime scene and on the person of the suspect (i.e., in the brain as revealed by electrical brain responses) is informational evidence rather than physical evidence. There are four stages to Farwell Brain Fingerprinting, which are similar to the steps in fingerprinting and DNA fingerprinting:

1. Brain Fingerprinting Crime Scene Evidence Collection;
2. Brain Fingerprinting Brain Evidence Collection;
3. Brain Fingerprinting Computer Evidence Analysis; and Brain Fingerprinting Scientific Result.

In the Crime Scene Evidence Collection, an expert in Brain Fingerprinting examines the crime scene and other evidence connected with the crime to identify details of the crime that would be known only to the perpetrator. The expert then conducts the Brain Evidence Collection in order to determine whether or not the evidence from the crime scene matches evidence stored in the brain of the suspect. In the Computer Evidence Analysis, the Farwell Brain Fingerprinting system makes a mathematical determination as to whether or not this specific evidence is stored in the brain, and computes a statistical confidence for that determination. This

determination and statistical confidence constitute the Scientific Result of Farwell Brain Fingerprinting: either "information present" – the details of the crime are stored in the brain of the suspect – or "information absent" – the details of the crime are not stored in the brain of the suspect.

### 3.5. Benefits of Farwell Brain Fingerprinting.

Identify crime perpetrators quickly and scientifically;  
Record of 100% accuracy;

Confirm innocence, clear the falsely accused, and the falsely convicted;

Provide immediate Scientific Result: Information Present or Information Absent. Provide the accused and the investigators with an accurate, conclusive Scientific Result: Information Present or Information Absent, i.e., the crime-relevant information is or is not stored in the brain of the suspect, within a few hours (same day).

Identify terrorists and members of gangs, criminal and intelligence organizations;

Discover criminal, espionage, and terrorist plots against individuals, corporations, governments, and society; Contribute to the reduction of potential personal injury and enormous cash and property losses which would have ensued had not the plots been uncovered;

Reduce expenditure of money and other resources in law enforcement. Significantly decrease the high cost in time, money, human and materials resources normally associated with criminal investigations, by quickly and accurately identifying the perpetrator and exonerating innocent suspects.

Reduce evasion of justice. Decrease the number of perpetrators that escape justice because of lack of witnesses or lack of evidence;

Provide scientific proof. Present scientific proof of the suspect's presence or absence from the crime scene.

Reduce costs and complexities. Provide a straightforward, scientific method of distinguishing between perpetrators and innocent suspects.

Access criminal evidence in the brain. Evidence of a crime is virtually always stored in the brain of the perpetrator; fingerprints and DNA, though accurate and highly useful, can only be collected in approximately 1% of all criminal cases.

Provide cost-effective results. By quickly and scientifically identifying perpetrators, Farwell Brain Fingerprinting can potentially save a substantial portion of the money now being spent on investigating and adjudicating crimes.

Save costs associated with pursuing the wrong suspects. Eliminate the need to expend valuable

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resources on pursuing other suspects once a guilty suspect has been identified by Farwell Brain Fingerprinting as the perpetrator, or innocent suspects have been cleared by Farwell Brain Fingerprinting. This, of course, also serves to protect the rights of the innocent.

Provide implementation in the field under varying conditions.

Support the right to a speedy and fair trial.

### **3.6. Types of Questions Answered by Farwell Brain Fingerprinting.**

Does a suspect have evidence stored in his brain connecting him to a specific crime?

Does an intelligence source have knowledge of the internal working of a hostile intelligence agency that would indicate that he was an intelligence officer of that agency and not who he claimed to be?

Has an informant, a debriefed spy, or a suspected member of a criminal organization accurately described the entirety of his actions and knowledge?

Did a convicted serial killer who claims to have killed 40 to 50 individuals, other than the one(s) for whom he was convicted, actually commit these acts, or are these claims merely the bravado of a condemned prisoner?

Did a stock broker leak inside information that allowed a select few illegally to take advantage of an event on Wall Street?

Did a white-collar employee illegally acquire corporate trade secrets, financial data, or intellectual property from his company? Did he pass the information to competitors?

Did a suspected arsonist set ablaze a manufacturing plant?

Did an employee or client of a health insurance company commit fraud, resulting in substantial financial losses for the company and increased costs for policyholders?

## **4. COMPARISON WITH OTHER TECHNOLOGIES**

Conventional fingerprinting and DNA match physical evidence from a crime scene with evidence on the person of the perpetrator. Similarly, Brain Fingerprinting matches informational evidence from the crime scene with evidence stored in the brain. Fingerprints and DNA are available in only 1% of crimes. The brain and the evidence recorded in it are always there.

This has nothing to do with lie detection. Rather, it is a scientific way to determine if someone has committed a specific crime. No questions are asked

and no answers are given during Farwell Brain Fingerprinting. As with DNA and fingerprints, the results are the same whether the person has lied or told the truth at any time.

### **4.1. Accurate, scientific technique saves resources**

By providing an accurate, scientific means of identifying the perpetrator of a crime and clearing innocent suspects, Brain Fingerprinting will provide substantial value immediately for law enforcement organizations, corporations, attorneys, and individuals. Once the authorities know with certainty who has committed a crime, all resources can be devoted to bringing the perpetrator to justice, rather than to seeking additional leads or pursuing innocent suspects.

### **4.2. Effectively solving the central problem in a trillion-dollar market**

Government of India is now spending approximately \$100 billion per year to operate the criminal justice system. In addition, individuals and corporations spend approximately \$65 billion on security operations {including internal investigations}. The total global government budget devoted to crime has been estimated at approximately \$750 billion annually. Including private sector security operations, the figure is over one trillion dollars. This does not include crime-related insurance costs, military and intelligence applications, the costs incurred by defendants in criminal cases, or the cost in life and property to crime victims. Brain Fingerprinting can solve many, perhaps most of these crimes, more quickly, accurately, and scientifically than has been possible before, and thus can save billions of dollars annually.

### **4.3 \$4 Million spent to develop mature technology**

Approximately four million dollars in grants and contracts from the US government has been spent on research and development culminating in a fully developed technology ready for widespread application. No debt has been accumulated in this process.

### **4.4. Unique, patented technology**

Dr. Farwell holds three patents on the technology, and no competing technology is currently known to exist.

### **4.5. Commanding legal position**

Because of its accuracy and scientific nature, we believe that Brain Fingerprinting will be admissible in court once the necessary test cases have been tried. Once this process is completed, the economic and

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practical value of Farwell Brain Fingerprinting will be significantly enhanced.

#### 4.6. Human Rights Oriented.

In the past, innocent suspects have almost universally been subjected to stressful interrogations, and in some cases have been subjected to false conviction and punishment. With Farwell Brain Fingerprinting, an innocent suspect can simply observe a computer monitor on which words, phrases, acronyms, or pictures appear. His brain responses will confirm that information relevant to the crime is not stored in his brain. In this way, Farwell Brain Fingerprinting can establish innocence. This is a great benefit for innocent individuals who are falsely accused. It would be a serious violation of human rights to deny an innocent subject access to this effective, non-invasive, non-stressful, and accurate means of establishing innocence. The rights of a guilty subject are not violated when he voluntarily undergoes such a non-invasive analysis of criminal evidence (unless one considers license to continue to perpetrate crimes, without exposure or punishment, a "right").

#### 4.7. Forensic Science

The goal of forensic science is twofold:

1. To obtain evidence definitively connecting the perpetrator(s) with a crime; and
2. To clear innocent suspects with a minimum of trauma.

Farwell Brain Fingerprinting, as a forensic science investigative method, addresses both of these needs.

#### 4.8 Field tests and criminal investigations

Farwell[4] Brain Fingerprinting was highly effective in the resolution of a case investigation at the Alexandria Police Department. A police officer was accused of a series of felony drug crimes. The officer throughout the entire period of investigation claimed innocence of involvement. His accuser was an individual who had already admitted his own guilt. It was clear from the evidence that a second person had been involved, and the accuser identified the officer as that person. The Alexandria PD requested Brain Fingerprinting which clearly showed that the officer had no knowledge of the crime stored in his brain. The investigation was renewed, and there is now substantial, independent evidence that the officer was indeed innocent, and that his accuser and another individual framed the officer in order to deflect suspicion from another person who had carried out the crimes of which the officer was accused.

#### 4.9. Results of research, field tests, and investigations

Over 120 subjects in the above four experiments were correctly classified as possessing or not possessing the critical information. There were no false positives, no false negatives, and no indeterminate. In one criminal case, Brain Fingerprinting vindicated a police officer falsely accused of a felony. In another actual criminal case, brain responses of two subjects showed that one subject was present at an armed robbery, and the other knew nothing of the crime. Farwell Brain Fingerprinting correctly classified both subjects, with a statistical confidence of greater than 99% in each case. In all of these studies and cases, words, phrases, or pictures flashed on a computer screen containing information relevant to the crimes or other situations elicited a MERMER only in the subjects who possessed the critical information. Previous published research by Dr. Farwell and his colleagues (e.g., Farwell and Don chin, 1986, 1991) has demonstrated similar results

## 5. CONCLUSION

Farwell Brain Fingerprinting is a revolutionary new technology for solving crimes, with a record of 100% accuracy in research with US government agencies and other applications. The technology is proprietary and patented. Farwell Brain Fingerprinting has had extensive media coverage around the world. The technology fulfills an urgent need for governments, law enforcement agencies, corporations, and individuals in a trillion-dollar worldwide market. The technology is fully developed and available for application in the field.

## REFERENCE

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