RESEARCH ARTICLE OPEN ACCESS

Brain Fingerprinting Technology

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ABSTRACT
Brain Fingerprinting is a new computer-based technology to identify the perpetrator of a crime accurately and scientifically by measuring brain-wave responses to crime-relevant words or pictures presented on a computer screen. Brain Fingerprinting has proven 100% accurate in over 120 tests, including tests on FBI agents, tests for a US intelligence agency and for the US Navy, and tests on real-life situations including felony crimes.
Brain fingerprinting is based on finding that the brain generates a unique brain wave pattern when a person encounters a familiar stimulus Use of functional magnetic resonance imaging in lie detection derives from studies suggesting that persons asked to lie show different patterns of brain activity than they do when being truthful. Issues related to the use of such evidence in courts are discussed. The author concludes that neither approach is currently supported by enough data regarding its accuracy in detecting deception to warrant use in court.
In the field of criminology, a new lie detector has been developed in the United States of America. This is called "brain fingerprinting". This invention is supposed to be the best lie detector available as on date and is said to detect even smooth criminals who pass the polygraph test (the conventional lie detector test) with ease. The new method employs brain waves, which are useful in detecting whether the person subjected to the test, remembers finer details of the crime. Even if the person willingly suppresses the necessary information, the brain wave is sure to trap him, according to the experts, who are very excited about the new kid on the block.
Keywords: Brain fingerprinting, Unique brain wave pattern, magnetic resonance

I. Introduction

In the field of criminology, a new lie detector has been developed in the United States of America. This is called "brain fingerprinting". This invention is supposed to be the best lie detector available as on date and is said to detect even smooth criminals who pass the polygraph test (the conventional lie detector test) with ease. The new method employs brain waves, which are useful in detecting whether the person subjected to the test, remembers finer details of the crime. Even if the person willingly suppresses the necessary information, the brain wave is sure to trap him, according to the experts, who are very excitedabout the new kid ontheblock.

Brain Fingerprinting is a controversial proposed investigative technique that measures recognition of familiar stimuli by measuring electrical brain wave responses to words, phrases, or pictures that are presented on computer screen. Brain fingerprinting was invented by Lawrence Farwell. In the field of criminology, a new lie detector has been developed in the United States of America. This is called "brain fingerprinting". This invention is supposed to be the best lie detector available as on date and is said to detect even smooth criminals who pass the polygraph test (the conventional lie detector test) with ease.

II. Brain Fingerprinting

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.

Brain fingerprinting is a controversial technique that is advocated as a way to identify a terrorist or other dangerous person by measuring the "brainprint" of that person when shown a particular body of writing or an image that was previously familiar (such as of a training camp or manual). The brainprint is based on the P300 complex, a series of well-known brainwave components that can be measured. The technique is said to be more effective than a lie detector test.

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III. Technique

When a crime is committed, a record is stored in the brain of the perpetrator. Brain Fingerprinting provides a means to objectively and scientifically connect evidence from the crime scene with evidence stored in the brain. (This is similar to the process of connecting DNA samples from the perpetrator with biological evidence found at the scene of the crime; only the evidence evaluated by Brain Fingerprinting is evidence stored in the brain.) Brain Fingerprinting measures electrical brain activity in response to crime-relevant words or pictures presented on a computer screen, and reveals a brain MERMER (memory and encoding related multifaceted electroencephalographic response) when, and only when, the evidence stored in the brain matches the evidence from the crime scene. Thus, the guilty can be identified and the innocent can be cleared in an accurate, scientific, objective, non-invasive, non-stressful, and non-testimonial manner.

IV. MERMER Methodology

The procedure used is similar to the Guilty Knowledge Test; a series of words, sounds, or pictures are presented via computer to the subject for a fraction of a second each. Each of these stimuli are organized by the test-giver to be a "Target," "Irrelevant," or a "Probe." The Target stimuli are chosen to be relevant information to the tested subject, and are used to establish a baseline brain response for information that is significant to the subject being tested. The subject is instructed to press on button for Targets, and another button for all other stimuli. Most of the non-Target stimuli are Irrelevant, and are totally unrelated to the situation that the subject is being tested for. The Irrelevant stimuli do not elicit a MERMER, and so establish a baseline brain response for information that is insignificant to the subject in this context. Some of the non-Target are relevant to the situation that the subject is being tested for. These stimuli, Probes, are relevant to the test, and are significant to the subject, and will elicit a MERMER, signifying that the subject has understood that stimuli to be significant. A subject lacking this information in their brain, the response to the Probe stimulus will be indistinguishable from the irrelevant stimulus. This response does not elicit a MERMER, indicating that the information is absent from their mind. Note that there does not have to be an emotional response of any kind to the stimuli- this test is entirely reliant upon recognition response to the stimuli, and relies upon a difference in recognition- hence the association with the Oddball effect.

V. Procedure

The person to be tested wears a special headband with electronic sensors that measure the electroencephalography from several locations on the scalp. In order to calibrate the brain fingerprinting system, the test is presented with a series of irrelevant stimuli, words, and pictures, and a series of relevant stimuli, words, and pictures. The test subject's brain response to these two different types of stimuli allow the tester to determine if the measured brain responses to test stimuli, called probes, are more similar to the relevant orirrelevant responses.

Fig.4.1: Testing of brain finger printing device

The technique uses the well known fact that an electrical signal known as P300 is emitted from an individual's brain approximately 300 milliseconds after it is confronted with a stimulus of special significance, e.g. a rare vs. a common stimulus or a stimulus the proband is asked to count. The novel interpretation in brain fingerprinting is to look for P300 as response to stimuli related to the crime in question e.g., a murder weapon or a victim's face. Because it is based on EEG signals, the system does not require the taste to issue verbal responses to questions or stimuli.Brain fingerprinting uses cognitive brain responses, brain fingerprinting does not depend on the emotions of the subject, nor is it affected by emotional responses. Brain fingerprinting is fundamentally different from the polygraph (lie-detector), which measures emotion-based physiological signals such as heart rate, sweating, and blood pressure. Also, unlike polygraph testing, it does not attempt to determine whether or not the subject is lying or telling the truth.

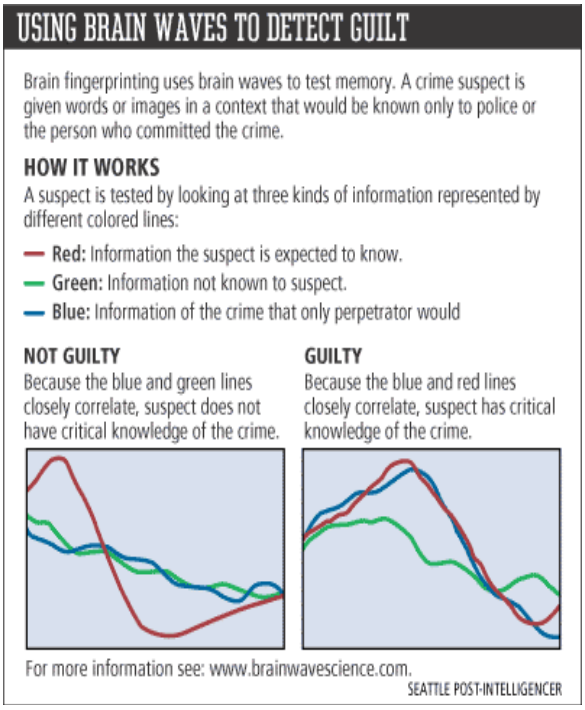


Fig.5.1: verifying the result

THE FANTASTIC FOUR

The four phases of Brain Fingerprinting

In fingerprinting and DNA 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. 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 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
4. 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 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 Brain Fingerprinting: either "information present" ("guilty") – the details of the crime are stored in the brain of the suspect – or "information absent" ("innocent") – the details of the crime is not stored in the brain of the suspect.

Scientific Procedure, Research, and Applications

1. 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, government and private investigations, and intelligence operations. Brain Fingerprinting 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 Brain Fingerprinting depends only on brain information processing, it does not depend on the emotional response of the subject.

2. The Brain MERMER

Brain Fingerprinting utilizes multifaceted electroencephalographic response analysis (MERA) 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 insignificant and not noteworthy, and the MERMER response is absent. The MERMER occurs within about a second after the stimulus presentation, and can be readily detected using EEG amplifiers and a computerized signal-detection algorithm.

3. 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," "irrelevant," 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 to press 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 crime. These irrelevants do not elicit a MERMER.Some of the non-target stimuli are relevant to the crime or situation under investigation.

For an innocent subject lacking this detailed knowledge of the crime, the probes are indistinguishable from the irrelevant stimuli. For such a subject, the probes are not noteworthy, and thus probes do not elicit a MERMER.

4. Computer Controlled

The entire Brain Fingerprinting System is under computer control, including presentation of the stimuli and recording of electrical brain activity, as well as a mathematical data analysis algorithm that compares the responses to the three types of stimuli and produces a determination of "information present" ("guilty") or "information absent" ("innocent"), and a statistical confidence level for this determination. At no time during the testing and data analysis do any biases and interpretations of a system expert affect the stimulus presentation or brain responses.

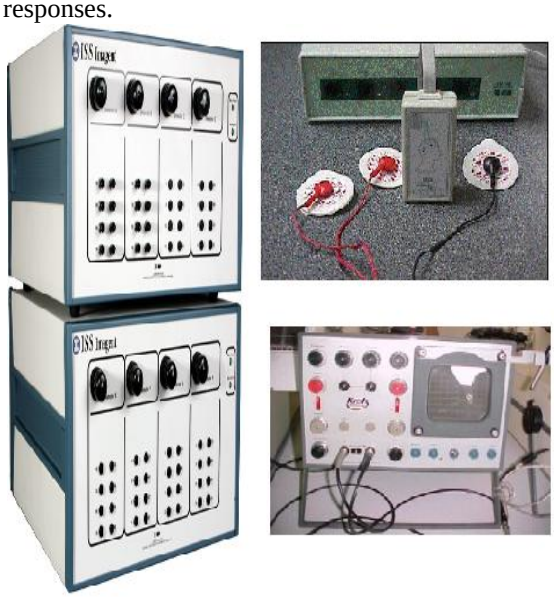


Fig.5.2: Brain Fingerprinting Device

The devices used in brain fingerprinting
Equipment required

1. Personal computer
2. A data acquisition board
3. A graphics card for driving two monitors from one PC
4. A four-channel EEG amplifier system
5. Software developed by the Brain Fingerprinting Laboratories for data acquisition and analysis.

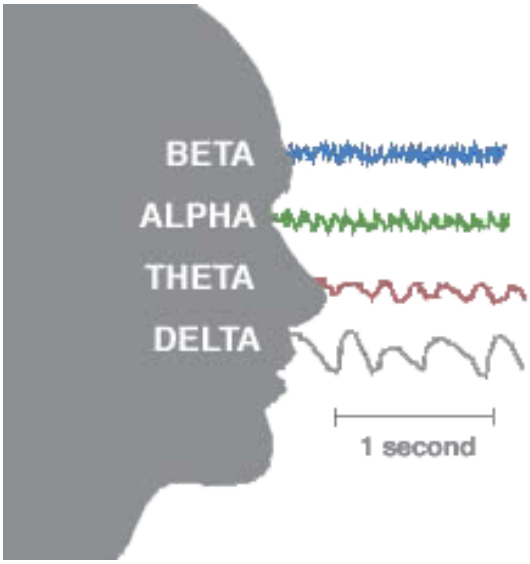


Fig.5.3: Brain waves

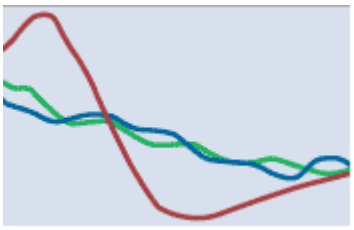
Using brain waves to detect guiltyWorking

A Suspect is tested by looking at three kinds of information represented by Different colored lines:

------Red: information the suspect is expected to know.

-----Green: information not known to suspect

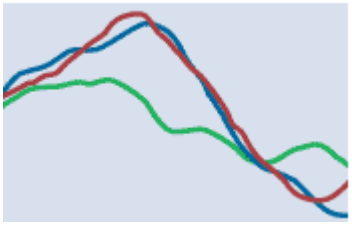
-----Blue: information of the crime that only perpetrator would know



Graph.5.1: Information is absent

Information Absent

Because the blue and green.Lines closely correlate, suspect doesNot have critical knowledge of the crime.



Graph.5.2: Information is Present

Information Present

Because the blue and red.
Lines closely correlate, and suspect has critical knowledge of the crime.

Scientific Experiments, Field Tests, and Criminal Cases

Scientific studies, field tests, and actual criminal cases involving over 120 individuals described in various scientific publications and technical reports verify the extremely high level of accuracy and overall effectiveness of Brain Fingerprinting. The system had 100% accurate scientific results in all studies, field tests.

Terry Harrington's Brain-Wave Responses

Y-axis: voltage in micro volts.

X-axis: time in milliseconds (msec). Stimulus was presented at 0 msec.

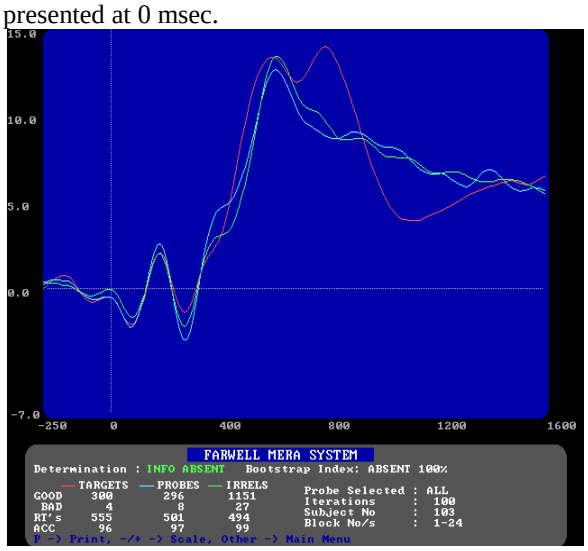


Fig.5.4: Determination:information absent.

Determination:information absent.

Statistical Confidence: 99.9%

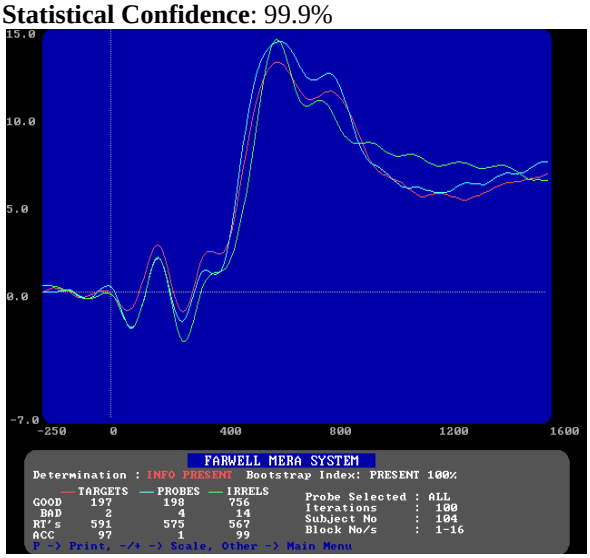


Fig.5.5: Determination:information present.

Determination: information present.
Statistical Confidence:99.9%

Results of the Brain Fingerprinting test on Terry Harrington

For the test on Schweer's murder at U.S, the determination of Brain Fingerprinting was "information absent," with a statistical confidence of 99.9%. The information stored in Harrington's brain did not match the scenario in which Harrington went to the crime scene and committed the murder. The determination of the Brain Fingerprinting test for alibi-relevant information was "information present," with a confidence of 99.9%. The information stored in Harrington's brain did match the scenario in which Harrington was elsewhere (at a concert and with friends) at the time of the crime.

Record of 100% Accuracy

At the time of this first field application, Dr. Farwell's successes in the scientific laboratory with his invention were already well known. In collaboration with FBI scientist Dr. Drew Richardson, Dr. Farwell achieved 100% accuracy in using Farwell Brain Fingerprinting to identify FBI agents based on their brain responses to words and phrases only an FBI agent would recognize. Tests conducted by Dr. Farwell for the US Navy in collaboration with Navy LCDR Rene S. Hernandez, Ph.D., also resulted in 100% accurate results. In research on contract with a US government intelligence agency, Farwell Brain Fingerprinting achieved 100% accuracy in proving the presence or absence of a wide variety of evidence stored in the brains of individuals involved in over 120 cases. Dr. Farwell has published extensively in the scientific literature and presented his research to many scientific and technical audiences throughout the world. Farwell Brain Fingerprinting has been subjected to rigorous peer review under US government sponsorship, and has been found scientifically viable as well as revolutionary in its implications.

VI. Applications

1. Counter terrorism

Brain fingerprinting can help address the following critical elements in the fight against terrorism:-

A: Aid in determining who has participated in terrorist acts, directly or indirectly.

B: Aid in identifying trained terrorists with the potential to commit future terrorist acts, even if they are in a “sleeper” cell and have not been active for years.

C: Help to identify people who have knowledge or training in banking, finance or communications and who are associated with terrorist teams and acts.

D: Help to determine if an individual is in a leadership role within a terrorist organization

2. Criminal justice

A critical task of the criminal justice system is to determine who has committed a crime. The key difference between a guilty party and an innocent suspect is that the perpetrator of the crime has a record of the crime stored in their brain, and the innocent suspect does not. Until the invention of Brain Fingerprinting testing, there was no scientifically valid way to detect this fundamental difference. Brain Fingerprinting testing does not prove guilt or innocence. That is the role of a judge and jury. This exciting technology gives the judge and jury new, scientifically valid evidence to help them arrive at their decision.

3. Medical

'Brain Fingerprinting' is the patented technology that can measure objectively, for the first time, how memory and cognitive functioning of Alzheimer sufferers are affected by medications. First generation tests have proven to be more accurate than other routinely used tests, and could be commercially available in 18-24 months. The 30 minute test involves wearing a headband with built-in electrodes; technicians then present words, phrases and images that are both known and unknown to the patient to determine whether information that should be in the brain is still there. When presented with familiar information, the brain responds by producing MERMERs, specific increases in neuron activity. The technician can use this response to measure how quickly information is disappearing from the brain and whether the drugs they are taking are slowing down the process.

VIII. Conclusion

Brain Fingerprinting is a revolutionary new scientific technology for solving crimes, identifying perpetrators, and exonerating innocent suspects, with a record of 100% accuracy in research with US government agencies, actual criminal cases, and other applications. The technology fulfills an urgent need for governments, law enforcement agencies, corporations, investigators, crime victims, and falsely accused innocent suspects.

- It would be inappropriate to generalize the results of the present research because of the small sample of subjects.
- But the 100% accuracy and high confidence level of the results, however, provide further support for results from previous research using brain MERMER testing.

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