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Brain Fingerprinting

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I. INTRODUCTION

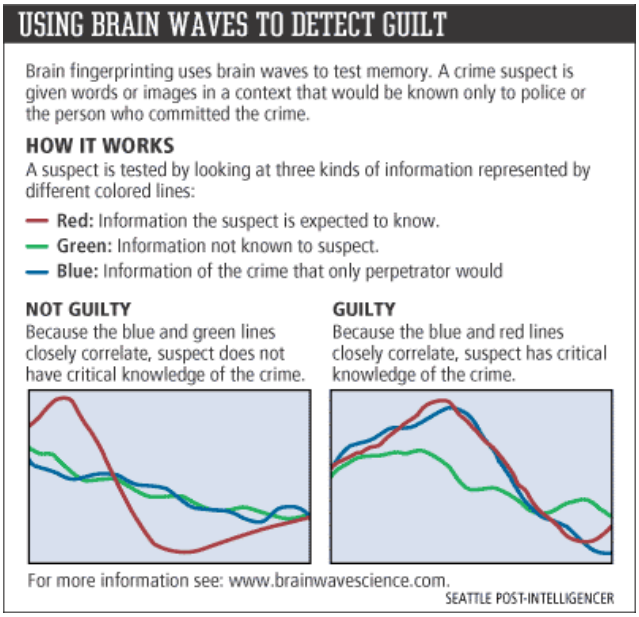
Brain Fingerprinting is a scientific technique to determine whether or not specific information is stored in an individual's brain by measuring a electrical brain wave response to Word, phrases, or picture that are presented on computer screen. Brain Fingerprinting is a controversial forensic science technique that uses electroencephalograph y (EEG) to determine whether specific information is stored in a subject's brain.

Electroencephalography (EEG) is the recording of electrical activity along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within the neurons of the brain. EEG refers to the recording of the brain's spontaneous electrical activity over a short period of time, usually 20–40 minutes, as recorded from multiple electrodes placed on the scalp. Diagnostic applications generally focus on the spectral content of EEG, that is, the type of neural oscillations that can be observed in EEG signals. The brain's electrical charge is maintained by billions of neurons. Neurons are electrically charged (or "polarized") by membrane transport proteins that pump ions across their membranes. Neurons are constantly exchanging ions with the extracellular milieu, for example to maintain resting potential and to propagate action potentials.

Fig. 1 Electroencephalography (EEG)

II. HOW IT WORKS

Brain fingerprinting was invented by Lawrence Farwell. The theory is that the brain processes known and relevant information differently from the way it processes unknown or irrelevant information. The brain's processing of known information, such as the details of a crime stored in the brain, is revealed by a specific pattern in the EEG (electroencephalograph) (Farwell & Smith 2001, Farwell 1994). Farwell's brain fingerprinting originally used the well known P300 brain response to detect the brain's recognition of the known information (Farwell & Donchin 1986, 1991; Farwell 1995a). Later Farwell discovered the MERMER ("Memory and Encoding Related Multifaceted Electroencephalographic Response"), which includes the P300 and additional features and is reported to provide a higher level of accuracy than the P300 alone (Farwell & Smith 2001, Farwell 1994, Farwell 1995b).



The neuron sends out spikes of electrical activity through a long, thin stand known as an axon, which splits into

thousands of branches. The small gap between an end bulb and a dendrite is called synapse across which information is propagated. At the end of each branch, a structure called a synapse converts the activity from the axon into electrical effects that inhibit or excite activity from the axon into electrical effects that inhibit or excite activity in the connected neurons. Learning occurs by changing the effectiveness of the synapses so that the influence of one neuron on another changes.

III. INSTRUMENTAL REQUIREMENTS

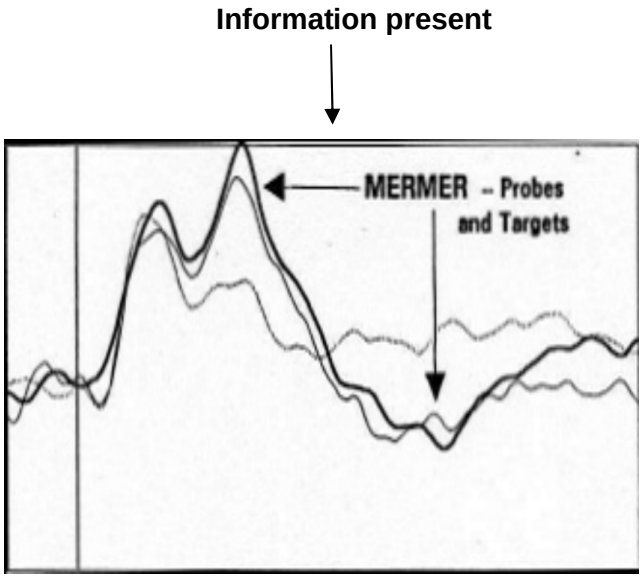
Following are the instruments which is required while making use of brain fingerprinting:

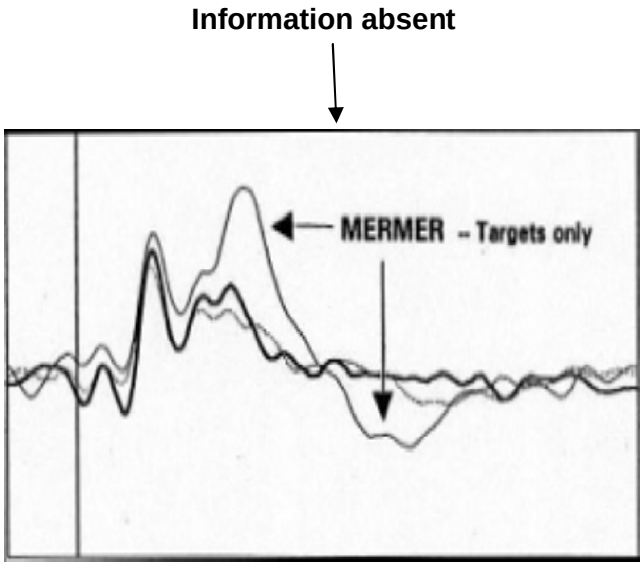
- Personal computer
- A data acquiring board
- A graphics card for driving two monitors from one PC
- Software developed by the Brain Fingerprinting Laboratories for data analysis.

IV. TECHNIQUE

A sequence of words, phrases, or pictures is presented on a video monitor to the subject, wearing a special headband designed for detecting the brain wave responses. There are three types of stimuli presented.

- **Target:** The target stimuli are made relevant to all subjects.
- **Irrelevant**: These have no relation to the situation under investigation.
- **Probes**: Probes are the stimuli that are relevant to the situation under investigation.





V. COMPARISONS WITH OTHER TECHNOLOGIES

- Fingerprints and DNA are available in only 1% of crimes.
- No questions are asked and no answers are given during Farwell Brain Fingerprinting.
- Brain fingerprinting technology depends only on brain information processing; it does not depend on the emotional response of the subject.

VI. CURRENT RESEARCH

Dr. Farwell's recent studies, conducted with former FBI scientist Dr. Drew Richardson, have mostly involved detecting real-life information in field conditions. Farwell and Richardson applied brain fingerprinting in detecting information regarding actual crimes with real-world judicial consequences, including multiple murders (Farwell, Richardson, and Richardson 2011). In one study they tested brain fingerprinting in detecting information unique to bomb makers (experts in improvised explosive devices, IEDs), for application in national security and counterterrorism. 100% of subjects in these studies were correctly detected. (Farwell, Richardson, and Richardson 2011) Dr. Farwell has also offered a $100,000 reward for beating a brain fingerprinting field test. (KOMO News 2008) To date, no one has ever succeeded in doing so.

VII. APPLICATIONS

- Counter Terrorism
- Medical
- Criminal justice

VIII. REMARK

Brain Fingerprinting is a revolutionary new technology for solving crimes, innocent suspects with a record of 100% accuracy and high confidence level of the results, however, provide further support for results from previous research using brain MERMER testing.

IX. REFERENCES

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