LAW ENFORCEMENT TECHNOLOGY

What you don't know can't hurt you

By reading brainwaves, investigators are able to access suspects' minds

By Sam Simon

The classic police interrogation scene starts with two officers marching into a room. They flop a stack of crime scene photos down in front of a suspect and claim he knows the scene and recognizes the images. But there he sits, stone faced and unshaken, denying any knowledge of the crime. The officers hoped the images would evoke a reaction they could go on, but he gave them nothing. Nothing they could recognize — until now.

A new forensic tool is helping officers access a suspect's mind to determine what information is indeed stored in the brain.

This new innovation, Brain Fingerprinting, is able to determine whether a person has certain information stored in his memory — such as a criminal act. By reading a specific brain response — called a P300 MERMER (Memory and Encoding Related Multi-facet Electronic Response), which the creator of Brain Fingerprinting Dr. Lawrence Farwell discovered — this innovation has played an integral role in freeing an innocent man from jail and securing a confession to an unsolved murder (see Page 98). Implemented in hundreds of other cases, Brain Fingerprinting is emerging as a powerful and highly accurate forensic tool.

The "Ah-ha" response

DNA, fingerprints and other forms of forensic evidence are currently at the peak of their practice due in part to popular television shows and their ability to help solve crimes. But what may not be as well known is that most evidence of this type is only applicable

in an estimated 1 percent of cases. The use of Brain Fingerprinting, however, is estimated to be applicable in 50 and upwards of 75 percent of cases.

Instead of collecting physical artifacts as evidence, Farwell uses a computer to record the brain's activity in response to stimuli presented to the subject.

"There's a particular brain response called a P300 MERMER," explains Farwell, a Harvard graduate and neuroscientist. "A person has this response when they take note of something significant."

The Brain Fingerprinting test is able to determine whether a person has knowledge about a crime or other type of information by recording and comparing the brain's response to three types of visual stimuli: targets, probes and irrelevants. The stimuli consists of words or pictures that are flashed on a computer screen in front of the subject for approximately 3/10 of a second at a time.

The target stimuli provide a control for the testers. Targets are the information crime testers are certain the suspect knows. For example, if a suspect has been told details of a crime and investigators are sure he knows them, those facts could be used as targets. "When the target stimuli is presented, we know the suspect will have a brain response indicating he recognizes it," says Farwell. "The brain will essentially say 'Ah-ha, I recognize that.' " This is the P300 brain pattern that indicates the subject recognizes a word or picture. The subject will have a similar response when presented with other stimuli that is stored in his brain, and these responses can be recognized by a computer.

The irrelevants, as the name implies, have nothing to do with the subject, crime scene or crime. "These are details that could have been relevant details about the crime that are equally plausible for an innocent suspect or a suspect that knows nothing about the crime," explains Farwell, "but they happen not to be correct details." These will have a different response pattern than the targets do.

Brain Fingerprinting is able to determine whether a person has certain information stored in his memory — such as a crime.

Mixed in with the targets and irrelevants are probes — items that will be recognizable as salient features of the crime to somebody that was there and knows the details, but not to somebody who is unaware of the specifics of the crime. If the response to a probe stimuli matches the pattern that a target produces, then there is evidence the information of the crime is stored in the testee's brain.

The Brain Fingerprinting test takes the response to target stimuli and uses it as the model for the response a subject's mind will give when presented with stimuli that is stored in the brain. By comparing the response patterns of probes and irrelevants, the test can determine with a high degree of certainty what information is stored in the subject's brain. If the response of the probes are similar to the targets, then the information is present. If it is similar to the irrelevants, the information is not.

"This way we can tell if a person knows the details of the crime that he would have no way of knowing without being there," says Farwell.

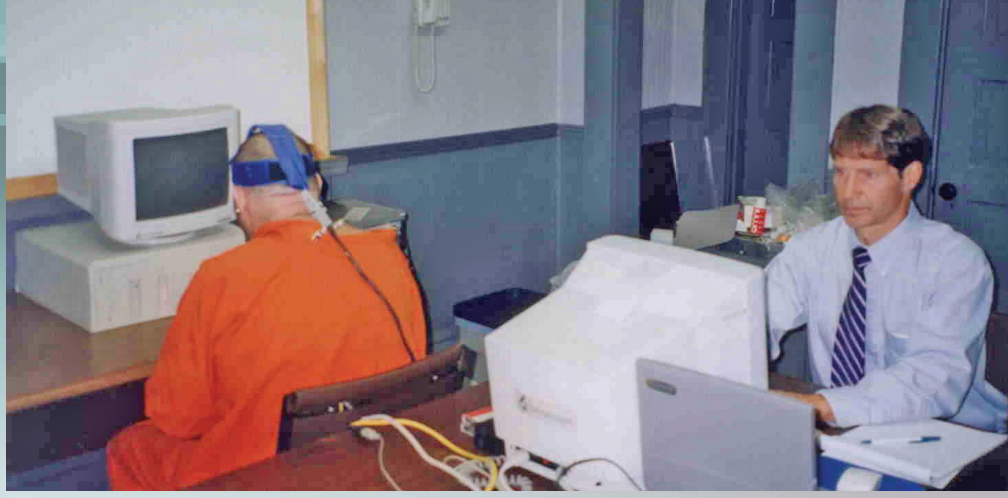
Lifting brain fingerprints

There are two general applications for which Brain Fingerprinting can be applied. The first concerns testing concealed information regarding events that have already occurred. Dr. Drew Richardson, a 25-year veteran, now retired, of the FBI who acted as one of the bureau's top forensic scientists, explains this involves examining suspects of a crime or potential witnesses to see if they have information stored in their brains that would generally not be known by the public, but would be known by somebody who either witnessed or participated in the crime.

The second application is to determine if someone is associated with a group. This capability is what prompted the FBI to aid in funding for the research and development of this technology.

Richardson, who acts as vice president for Forensic Operations with Brain Fingerprinting Labs, and Farwell first worked together in the 1990s at the FBI academy. The Brain Fingerprint testing conducted was centered around determining who in a group of people were FBI graduates and who were new agent trainees.

A list of 25 words, acronyms and phrases relating to the graduates instruction or way of life were collected to act as the probes. One of the items used was FD302. To most people this doesn't mean anything. But to an FBI agent, it's the government designation for the piece of paper that is used to record investiga-



Dr. Lawrence Farwell administers a Brain Fingerprinting test to JB Grinder.

tive information, subsequently record into file and ultimately testify if it comes to trial. FD302 immediately stands out and rings a bell with an FBI agent, and using this as well as numerous other probes, the test was able to determine with complete accuracy who was an FBI agent.

"If we can do this with the FBI, we can do this with organized crime; the KGB, or its successor SVR; and now with terrorist groups, Al Qaeda and so forth," says Richardson.

It's either there or it isn't

This test does not, however, prove a person's innocence or guilt. It determines whether the person has information about the crime stored in his brain. Similar to DNA, the sample is given to a scientist, and following a series of tests, it is determined if the samples match. In this case the information stored in the subject's brain either matches the details of the crime or it doesn't.

Brain Fingerprinting also has nothing to do with lie detection. Unlike lie detection, Brain Fingerprinting has been found to be admissible in court. Further more, lie detection works on the basis of emotional stress response where Brain Fingerprinting simply measures if a subject knows the details of a crime. Therefore, this test would not work as a general screening tool. It could not be used to test job applicants on various habitual behaviors, drug use, falsification of an application, etc.

There also are certain types of cases where Brain Fingerprinting will not be applicable. Since Brain Fingerprinting detects a record of the crime stored in the brain, investigators need to have a clear idea of the specifics of a crime. The case of a person's disappearance could be a murder or simply a runaway. Not being able to know what crime or any specifics to test for, this test could not be used in such a case.

Similarly in a sexual assault case, everyone may agree on exactly what happened, but they disagree on the intent of the party. Brain Fingerprinting doesn't indicate intent; it only tests whether the subject recalls the unique details of the crime.

Another case where it would not be applicable is if a person already knows every conceivable detail the pre-test investigation can find about the crime. "If somebody has already been convicted, they may know everything about the crime that we can find out, so we can't structure a Brain Fingerprint test," states Farwell. "In order to structure a test, we need probes — the items the individual denies knowing that are specific details about the crime."

The earlier in a case a Brain Fingerprinting test can be applied, the better, says Farwell. "One hour after the crime has been committed, the perpetrator knows everything about the crime and an innocent suspect doesn't know anything about the crime." He adds, once the individual has been arrested or brought in for questioning, he'll know a little bit about the crime, even if he's innocent.

Administering the test before trial also requires less resources since investigators won't have to go through mountains of court documents to figure out what the person does and doesn't know.

Using Brain Fingerprinting early on also can help speed up the investigative process. If there is a group of suspects, the innocent parties will likely be willing to take a Brain Fingerprint test and show they do not have critical knowledge the perpetrator of the crime would have. Detectives are then able to focus the resources of the investigation toward those who are reluctant to take the test or have shown to have knowledge of the crime.

"Although admissible in court, Brain Fingerprinting doesn't have to get to that point," says Farwell. "We can use it to point to the right suspects, illuminate people and rule out individuals as suspects."

What you know can hurt you

In many instances a subject may know details of a crime from news accounts or being interrogated. Those details would not be used as probe stimuli during the Brain Fingerprinting test. "Immediately before the test, we interview the individual and make sure what he's telling us is that these are details about the crime he doesn't know," says Farwell.

To determine what to use as stimuli and what details to question the subject on, an investigation is done before the Brain Fingerprinting test is administered. The investigation

determines the salient details about the crime, what to test for (probes) and what the subject knows are the details of the crime (targets).

The investigative team will question the subject and ask if he has knowledge about the crime and the details such as the murder weapon, type of car driven, make-up of the crime scene, etc. If he says he doesn't know what the murder weapon was, he would have no idea if it was a bat, knife, gun, etc. During the test, the subject would be instructed that he is going to see the murder weapon flashed on the screen along with other items. "If at this point he doesn't recognize the weapon as being significant in this context, then we have evidence that he in fact does not know what the murder weapon is," says Farwell.

Even though many murder weapons are items encountered in everyday life, the brain has a unique response depending on the relationship of stored information. Farwell explains that things are significant to us in context and its like a multiple choice test for the brain. A person may use a steak knife every night, he may go hunting with a rifle or shooting with a pistol, but in regards to a crime, only one of these is significant. "If he knows what the murder weapon is, his brain says 'that's it,' " says Farwell. "If the brain doesn't know, it won't respond the same way, and the computer detects which response is received from the individual."

After flashing all stimuli, the computer provides an objective determination of information present or information absent, and a statistical confidence of that determination. "I don't look at a screen and say, 'Oh yeah, I think it looks like he knows it,' " says Farwell. "It doesn't depend on my subjective judgment or someone else's."

Though an information present determination is done objectively, the brainwaves can be produced on a computer screen to show the difference in responses to the target, probe and irrelevant stimuli (see illustration on Page 102).

Altered states of mind

As anyone in law enforcement knows, a majority of crimes are committed while under the influence of a controlled substance. So how does this affect the responses in a Brain Fingerprinting test? Farwell explains people remember very salient activities or events in their lives. Even if someone is a serial killer and only commits a few murders in his life, it's a big event and people tend to remember that.

As a real-life example, JB Grinder was under the influence of drugs and alcohol at the time he murdered Julie Helton. He was also on therapeutic drugs — antipsychotic medication — at the time of the Brain Fingerprint test,

An innocent man's story

The first case where Brain Fingerprinting was admitted in court was the case of Terry Harrington in the state of Iowa. He had been convicted of murder 23 years previous to the test and the entire time claimed he was innocent. Brain Fingerprinting showed that he didn't know salient details about the crime, and in the end he was exonerated and released. There were other legal issues involved in his release; Brain Fingerprinting was not the sole factor, but it did play a major role in showing Harrington did not have a record of that crime stored in his brain.

Dr. Lawrence Farwell also went back to the only alleged witness in the crime that had testified that he saw Harrington commit the murder. When confronted with the Brain Fingerprint results and after some time, he said he didn't see Harrington do it, wasn't there and didn't know anything about it. The man stated that he made the entire story up because he was afraid he was going to get convicted of the crime since he also was a prime suspect.

A murderer's story

In another case that happened prior to the Harrington case, Brain Fingerprinting worked on the side of the prosecution against JB Grinder, who was a prime suspect in the murder of Julie Helton in Macon, Missouri. Grinder had told many stories, some about his participation in the crime and others not. The sheriff wanted Farwell to sort out the facts using Brain Fingerprinting and determine an objective indication as to which story was the truth.

Farwell found the story that matched the one in Grinder's brain was the one in which he committed the crime. One week later, he pled guilty in exchange for life imprisonment. In this case Brain Fingerprinting was instrumental in solving the case without having to go to court because of the man's guilty plea.

and Farwell notes he got very clear responses from him.

It should be kept in mind a Brain Fingerprinting result is an objective, scientific account of the contents of people's memories. Memory is not perfect, and judges and juries have to take that into account. "If the test returns a positive result — an information present result — then, for whatever reason, the person knows the details about the crime," says Farwell. "These are details the subject would have no reason knowing unless he committed the crime — that's solid evidence."

Any time a negative result is returned in any science, it must be interpreted with caution. The same is true when not getting a match on fingerprints or DNA. It doesn't necessarily prove the person is innocent, it just provides evidence that can be helpful.

The spread of Brain Fingerprinting

There are currently two ways for a department to incorporate Brain Fingerprinting in their investigations. The first way is to hire Brain Fingerprinting Laboratories as outside consultants. Farwell and an investigative team will collect the details of the crime and administer the Brain Fingerprint test.

However, those departments that want to implement this on a larger scale would want to use their own people. It is going to be more cost-effective and efficient to have department personnel trained to administer Brain Fingerprint tests.

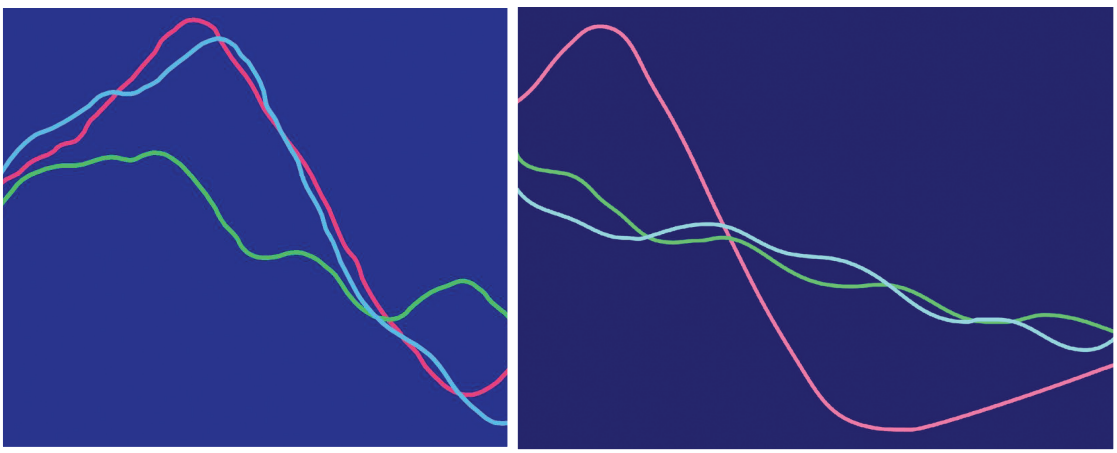
"Initially we would simply be outside consultants," says Farwell. "As we progress we would train people not only how to conduct a test, but also how to collect evidence that could best be used to make a Brain Fingerprint test effective." Training would be furnished to investigators or detectives who would develop the details for a test, as well as a small number of people who would become technically competent in how to conduct the test.

Farwell expects Brain Fingerprinting to become universally applied in the law enforcement field, especially early in the investigative process when there are still a number of suspects and an agency wants to know where to direct resources.

Farwell also believes, as happened with DNA, Brain Fingerprinting will spend years getting fully established in the court system. "We're very confident just as Brain Fingerprinting was ruled admissible in the Harrington case, it will continue to be ruled admissible," says Farwell. In the Harrington case (see Page 98), there was extensive evidence and expert testimony presented from both for a full day, he says. Provided with the test's record, the judge ruled it was admissible. Even the expert on the other side admitted the science was impeccable. "His words for the science were 'totally perfect' and even I don't say that," says Farwell.

Richardson also sees this technology emerging in a similar manner as other forensic sciences have. "I think that, as with any technique, it will rise or fall on its own merits and should be introduced into court and have the particulars looked at," says Richardson. "I fully believe it is a sound technology and when done properly will meet the various tests that it should properly face."

Unlike a fingerprint or DNA sample, a criminal's brain is always at the scene, planning, executing and recording the crime. Because of this, the technology has the potential to be applicable in an overwhelming number of cases. Now when an officer presents a pile of photos to a suspect, he'll get just the response he is looking for. ■



The image on the left is JB Grinder's brainwave responses to crime scene information. The image on the right is Terry Harrington's brainwave response to crime scene information. Target (red), irrelevant (green) and probe (blue) stimuli.