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Brain Fingerprinting as a Criminalistics Technique and Method[1]

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Brain fingerprinting has both a past and a present in the United States of America, in other parts of the world, like in Europe, it rather only has a future. The method has been subject to tests at governmental institutions like the US Navy, the FBI or the CIA, and a few studies indicate its significant potentials and the fact that it is worth dealing with brain fingerprinting. This study aims to analyse whether the method is really suitable to play a role in criminal procedures. We also attempt to discover the boundaries of the method and to explore and define the related concerns.

Keywords: *brain fingerprinting, P300, EEG, testimony, stimuli, suspect, witness*

Fundaments of the Operation of Brain Fingerprinting

The first implementation of brain fingerprinting that is suitable for lie detection was devised by Larry Farwell. While the polygraph used for the purpose of lie detection explores the changes in physiological reactions, the graphometer detects the path and movement of the hands in the air, the layered voice analysis (LVA) reflects to the changes of voice, the speciality of brain fingerprinting is that it directly analyses the brain activity. Namely, brain fingerprinting targets to explore, whether a certain information is stored in the brain or not.[4] The examinee is shown visual images on the computer screen, amongst which critical pictures that might be related to the crime committed are also included. If the examinee's brain recons the critical image, in other words, it gives a so-called 'ah' or 'yes' signal,[5] it may lead to the conclusion that the examined person has committed the criminal act.[6] The 'ah' signal is an alleged 'MERMER' brain response, that is one of the components of the larger brain frequency known as P300.[7]

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[4] Moenssens (2002) 891.

[5] Farwell (2012) 117.

[6] Farwell (2018a)

[7] Póczos (2006) 102.

This brain frequency was labelled P300 due to its positive amplitude (referred as P) that appears approximately 300 milliseconds after the presentation of the stimulus (reflected by the number 300 in the denomination), (and typically lasts for a couple of hundred milliseconds more). In order to explore the memory-contents of the P300 brain frequency, Fabiani and his colleagues conducted a series of experiments,[8] during which they have thought a list of words to the participants of the experiment. They analysed whether showing the 'familiar' words previously learned would really indicate a P300 brain frequency in the testee's brain. The participants were shown a long list of words, one-by-one that mostly consisted of 'new' words, not those formerly learned. They randomly inserted some words previously memorised amidst the new expressions, then they analysed the P300 brain potential amplitude recorded during the experiment. They reckoned, that the learnt or familiar words did indicate P300 potential, while no P300 frequency has followed the expressions that were unfamiliar. Rosenfeld and his colleagues[9] have recognised that the P300 potential may be suitable to explore the information related to the criminal act, yet hidden or concealed by the examinee. The leading idea of the authors was that the P300 brain frequency might be suitable to explore familiar information stored in the memory even in cases when the examined person would deny to have known such information (for example, a certain person, object or scene). In this context, the appearance of P300 in itself does not presume a lie, only implies that the examinee's brain does acknowledge the given information, regardless of the fact that the person denies to know such details. His intention is deceptive, since he wants to escape from being exposed. The participants of the experiment have committed a simulated crime, stealing an object out of ten previously placed in a box. Later they were shown the names of the objects one-by-one on a screen. Upon a simple visual analysis of P300 potentials they determined that the objects stolen by the testees – namely, the so-called *probes* – have initiated a P300 in 9 persons out of 10. The other *irrelevant* objects did not generate a P300 potential. On the other hand, they used another special, randomly introduced stimulus during the experiment *(target stimulus)*. The participant had to respond saying the word 'yes' to these stimuli. The authors intended to check, whether the examined persons did really follow watching the screen, in other words, if they paid attention to the test (probes) stimuli. To other stimuli than the target ones, the examinees had to give a negative response ('no'), so they had to lie related to the object they stole during the experiment. The special target stimuli of the experiment have also generated the P300 potential, since the participants have only seen a few of these images; however, they have meant something to them.

Simultaneously with Rosenfeld and his partners' efforts, another group of American researchers[10] has also discovered the possibilities of P300 to explore the 'hidden' memory paths of the brain. Farwell and his workgroup have tested the P300-based method both in laboratory circumstances ('mock crime scenario') and on actual perpetrators. During

[8] Karis et al. (1984) 177–216.
[9] Rosenfeld et al. (1987) 125–129; Rosenfeld et al. (2013) 118–134.
[10] Farwell (1986)

the early stages and also after running further tests, Farwell's workgroup could report on rather satisfactory results using the P300 method to detect concealed information (the figures of specification and sensitivity have generally exceeded over 90%).[11] The denomination of 'Brain Fingerprinting' is also credited to this workgroup. According to further research-summaries and meta-analytical examinations, P300 brain frequencies proved to be more effective in Concealed Information Tests (CIT) compared to psycho-physiological parameters (like skin resistance, respiration, heartbeat).[12] Actually, the concealed information test is the fundament of brain fingerprinting, during which – as mentioned earlier above – alongside the critical pictures imaging certain aspects of the crime (probe), some irrelevant visual images are also shown, that will not generate the P300. If the probe is familiar to the brain, we might suspect that despite of the denial the examined person is actually in possession of the information. This might lead to the presumption, that the information is stored in his brain and he conceals the information because he has committed the criminal act. On the contrary, irrelevant stimulus does not generate any P300 potential.[13]

Brain Fingerprinting: A Criminalistics-technical Measure

Criminalistics techniques incorporate all expedient and professional measures of natural sciences and technological methods that serve criminal investigation. Such measures might be all kinds of results of other sciences or professional areas that could be efficiently used in criminalistics technology (for example, the achievements or instruments of physics, chemistry, measurement procedures, optical instruments, IT devices, etc.).[14] Brain fingerprinting is based on electroencephalogram (EEG) commonly used in health care to examine the electrical activities of the brain placing electrodes on the scalp and connecting it to another area of the head that is electrically (relatively) neutral (for example, the earlobe). The methods also include the use of a screen, on which the subject sees the visual images, when examined how his brain responds to the pictures, one-by-one. These devices are used in health care as well, since originally they were invented for medical purposes, however, they are suitable for use as criminalistics technical measures in criminal procedures. We may also consider the results of other sciences and professional areas as criminalistics techniques, further upgraded during criminalists technological development for the purpose of using them in criminal investigations.[15] Most importantly, we must emphasise the role of criminal photography, that is also an important instrument of brain fingerprinting, since the visual images channel the information to the examinee instead of verbal questions, in other words,

[11] Farwell–Donchin (1991) 531–547; Farwell et al. (2013) 263–299.
[12] Meijer et al. (2014)
[13] Stoller–Wolpe (2007) 362.
[14] Tremmel et al. (2005) 36.
[15] Ibid.

the pictures presenting the circumstances of the criminal act affect his brain as probes during the examination.

Brain fingerprinting is one of the technical measures of criminalistics that is expected to develop and improve rather rapidly. Typically, it is a non-invasive, but safe and painless method.[16]

The Practice of Brain Fingerprinting in the United States of America

At his examinations conducted at the FBI, the CIA and at the US Navy and during further researches done in laboratory or on-site circumstances, Farwell diagnosed 0% failure rate of the brain fingerprinting tests. For only 3% of the tests he could not determine, whether the concealed information is stored in the examinee's brain or not.[17] At the FBI, he tested the method on 17 agents, and he included further participants who were not members of the service. Running the tests, he used critical information available only for the agents. He gained knowledge of such words, expressions, abbreviations during preliminary interviews pursued with the agents. He completed 72 examinations, each consisting of 6 blocks. Each block contained five of six stimuli, and each block included a probe, a target and four irrelevant stimuli.[18] The published researches prove that Farwell is testing the brain fingerprinting method until the present days, still stating that its reliability is close to 100%. Nevertheless, Rosenfeld has expressed a critical opinion on the method in 2005, after the successful experiments Farwell conducted at governmental offices, referring to one of Senator Charles E. Grassley's interviews, who said that neither the United States Department of Defense, nor the FBI or the CIA is expected to use the method. On the one hand, he found the reasons in the limited applicability of the method, on the other hand, he missed Farwell's efforts to prove the validity of the measure and provide detailed information on its scientific reliability.[19] The last 13 years passed since the critics well show, that it is not necessarily convincing if someone states that his method is almost 100% reliable only referring to his own test results.

Besides his permanent publications on the test results, Farwell repetitiously refers to three criminal cases, in which he personally completed the brain fingerprinting examination. All three examinations were completed more than fifteen years ago, which must seem rather far away from today's perspective, however, the relevance of these cases is unquestionable regarding the applicability of the method.

In one of the cases, Terry Harrington who was 17 years old at the time was accused to have murdered John Schweer, in 1977. The victim had been working as security guard

[16] Fox (2008) 34.
[17] Farwell (2012)
[18] Farwell et al. (2013)
[19] Rosenfeld (2005) 34.

at a car dealership in Iowa, where the offence has taken place.[20] During the criminal procedure, the defendant had alleged that he had been at a rock concert with friends in another town at the time of the crime. Several witnesses supported the defendant's testimony, and corroborated Harrington's alibi. Nevertheless, Kevin Hughes who was 16 at the time of the criminal offence, testified in contradiction to the defendant's plea, upon which Harrington was found guilty and sentenced to life without a parole by the court. In 1997, Harrington petitioned the Iowa District Court for post-conviction relief for a new trial, and in 2000, he amended his petition including the results of Farwell's brain fingerprinting test. The applicant alleged that the results of the brain fingerprinting enhance new evidence that was unknown to the first decree procedure, and upon which the defendant should have been acquitted by the court. Upon the results of the brain fingerprinting, Farwell stated that Harrington's brain did not store the information of the crime subject to his conviction, for example, his brain did not recognise the crime scene where he was supposed to commit the crime in accordance with the final and binding order of the court. As for the alibi (he had been at a concert at the time of the crime) Farwell concluded, that such information was stored in Harrington's brain. When confronted with the brain fingerprinting test results, Kevin Hughes, the key prosecution witness recanted his testimony and admitted that he had lied, falsely accusing Harrington. He explained that he had lied, fearing that if he was telling the truth, he might found himself amongst the possible suspects.[21] Recanting the testimony and admitting to false accusation was most significant, since the court has based its final and binding decision on Hughes's testimony he had made as a witness. In November 2000, the Iowa District Court has held a preliminary hearing upon the petition for post-conviction relief for a new trial. Farwell gave an expert opinion on the new method, supported by two acknowledged professors, William Iacono of the University of Minnesota and Emanuel Donchin of the University of Illinois confirmed the efficiency of the Farwell-research and also stated that the scientific method of brain fingerprinting can recall the information stored in the human brain with a 99.9% accuracy. According to their conviction, it may serve as a reliable evidence for authorities proceeding in criminal cases.[22] After the eight hours session, the court admitted that the brain fingerprinting test met the legal standards for admissibility as unquestionable scientific evidence. It constituted a new evidence in the Harrington case that could be the ground of a new trial opened upon the post-conviction petition. However, it denied the petition for a new trial, and ruled that along with other newly discovered evidence(s) in the case, it would probably not have resulted in the jury arriving at a different verdict than at the original trial. In 2001, Harrington has filed an appeal on the Iowa District Court's decision, resulting that the Iowa Supreme Court has finally ordered a new trial in the case.[23] Although the Iowa Supreme Court has acknowledged Farwell's

[20] Hurd (2012) 213.
[21] Farwell (2018b)
[22] Farwell (2018b)
[23] Harrington v. State, 659. N.W. 2nd 509 (Iowa 2003, No. 96-1232).

expert opinion, the favourable closure of the case to Harrington was based on the injury of the Brady rule, thus, the defendant was not confronted with the key prosecution witness, since he recanted his testimony when confronted with the brain fingerprinting test results conducted on Harrington. With regards to the new evidence and to the fact that the key prosecution witness of the original case recanted his testimony which was the basis of the conviction, Harrington was released in 2003 without a retrial of his case.[24] Regarding Harrington's case, Rosenfeld critically stated, that the concealed information could not be found in the convict's brain more than twenty years after the conduct of the crime, and concluded that it would be a naïve approach to presume that Harrington did not commit the criminal action or that he was not at the scene of the crime.[25] This might seem to be a fair presumption, moreover, it also begs the question, when has the image of the concert serving as his alibi been recorded in his brain. Was it on the day of the criminal act or at some other time? Also, it is questionable, what kind of picture Farwell could have had on the concert? When was the shot taken? It is doubtful, whether the P300 brain frequency was detected because Harrington was at the concert on July 22, 1977, or his brain only reacted to a picture that was taken at some other concert.

A man called James B. Grinder was the prime suspect of the other brain fingerprinting case. According to the accusation, he murdered Julie Helton in 1984, whose body was found near a railroad track in outside Macon, Missouri. According to the coroner's examination, the victim's body showed signs of rape and physical abuse and was found with a stabbed wound on the neck. During the fifteen year-long investigation, Grinder came up with several different testimonies. He soon recanted his first confession, and after that he denied the offence. Some of his testimonies referred to other perpetrators of the crime. Nevertheless, all his testimonies were invariably contradictory to the material evidences available to the authorities. The DNA test was without result, since the blood samples taken at the crime scene were old. Later in 1999, Macon County Sheriff, Robert Dawson turned to Farwell, requesting for a brain fingerprinting test in order to decide, whether Grinder had committed the crime or not. Grinder agreed to the test. The Sherriff forwarded all relevant information of the investigation to Farwell, and Farwell completed the later test with the cooperation of an FBI agent. The examination was completed at the correction institute where Grinder was held. The test has shown visual information to Grinder on the murder weapon, specific methods of killing the victim, the wounds, tied hands of the victim, the crime scene and the belongings of the victim found near the location of the offence after discovering the criminal act. Upon the results of the examination, Farwell came to the conclusion, that the information was stored in Grinder's brain.[26] They came to the conclusion, that Grinder did commit the offence, otherwise the P300 brain frequency response detected to the probe could not have been found. Grinder concluded a plea deal. He pled guilty to the rape

[24] Farwell (2018b)
[25] Rosenfeld (2005) 29.
[26] Farwell (2018c)

and murder of the victim, and in exchange, instead of death penalty, he agreed to a life sentence without parole. Interestingly, after being confronted with the results of the brain fingerprinting examination, Grinder did not only confess murdering victim Julie Helton, but he also gave a detailed confession to the murder of three other young girls.[27] Uniquely, brain fingerprinting was not only significant from the aspects of the confession, but also, the method was suitable to detect critical information in Grinder's brain even 15 years after committing the offence. The Grinder case definitely deadens Rosenfeld's critics on the Harrington case, stating that the years passed may delete the concealed information from the brain.

The third convict of the brain fingerprinting cases was Jimmy Ray Slaughter, who was found guilty in 1994, for the murder of his ex-girlfriend, Melody Sue Wuertz, and their child in 1991.[28] The murder has taken place in the victims' Edmond home, and according to the ruling, Slaughter has shot both victims in the head. Moreover, he has also shot his ex-girlfriend in the neck, stabbed her several times, and mutilated her body.[29] Slaughter claimed innocent all along. However, the evidentiary procedure proved that he had an extremely bad relationship with his ex-girlfriend, and they had numerous furious fights over unpaid child support. After sentenced to death by the District Court of Oklahoma County, he has plead for a new trial in 2004, referring the test results of brain fingerprinting in his favour besides other evidences to the Court of Criminal Appeals of Oklahoma.[30] The brain fingerprinting examination proved that Slaughter's brain did not store concealed information related to the crime. The court denied the petition for a new trial, but also referred to brain fingerprinting, stating that it did not recognise the results because it did not receive any comprehensive description on the method, neither on the nature, nor on the application or the results of the technique. The Court of Criminal Appeals of Oklahoma also ruled, that brain fingerprinting 'evidence' would not have changed the balance of the scales before the jury.[31] Finally, Slaughter was executed. The Slaughter case is an example of the fact, that the results of brain fingerprinting in itself is not sufficient to approve a petition for a new trial, for it is not such an evidence that would alter the ruling of the court in the new trial. Although the court's ruling avoided to take the results of brain fingerprinting into consideration due to the lack of information on the method, we are convinced, that even if Farwell would have given appropriate information on brain fingerprinting, most probably the court would have denied the petition for a new trial.

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27 Farwell (2018c)
28 Lumpkin (2018)
29 Clark (2018)
30 Farwell (2012) 134–135.
31 Slaughter (s. a.)

Implementation Possibilities of Brain Fingerprinting in Hungary

The adaption of the brain fingerprinting method might as well be completed in Hungary with the coming into effect of the Be. IV (Act XC of 2017 on criminal procedures) on July 1, 2018, since the new code uniformly refers to instrumental credibility examination of testimonies for all tests and analyses conducted on suspects or witnesses in order to determine, whether the examinee sincerely denies the conduct of the crime or not, or is in possession of crime-related information as he stated during the interview. Thus Be. IV does not only specify polygraph examination, as the only instrumental method referred in Be. III (Act XIX of 1998 on criminal procedures), but it also declares the admissibility of instrumental credibility examination of testimonies, provided that the legally mature witness or suspect agreed to take the test.

Even though the admission of brain fingerprinting would be possible, the introduction and acknowledgement of the method in Hungary should not be expected in the near future, it will surely take more time to become public and be acknowledged, taking note, as it could not gain considerable potential in criminal cases conducted in the US, in its home country either, and the same is true for other countries where the method is rarely used and its importance is still dwarfed by the polygraph. Prior to its introduction, further tests must be run and its admissibility in criminal cases must also be proved.

Subjects of brain fingerprinting

Although the introduction of brain fingerprinting is still not timely yet, it is worth examining the conditions it would require if it was used in the current legal surroundings. One of the first issues is the question of its subjects.

The professional expert counsel

While brain fingerprinting is considered a procedure conducted by an expert, the examination shall be conducted by a professional expert counsel in Hungary. In accordance with Section 212 (2) of Be. IV, the procedure of a professional expert is mandatory, who shall be interviewed on his procedure and conclusions as a witness. As a witness, the professional expert shall have the opportunity to make a verbal presentation on the examination results and answer the questions related to the results and the method if required by the proceeding authority. Section 79 (8) of the Nyer. [Government Decree 100/2018 (VI. 8.) on the detailed regulations on investigation and preliminary procedure] the expert counsel must conclude a memorandum on the procedure of the examination, which should be treated together with the records by the investigating authority. The memorandum includes the results of the instrumental credibility examination as well, thus the interview of the expert as a witness should only be concluded if the proceeding authority should want to ask questions regarding the circumstances or the results of the examination. In case of the introduction of brain fingerprinting

in Hungary, the interview of the expert as a witness will definitely be a general part of brain fingerprinting cases, since the nature and reliability of the method, also, the analysis of the results must be explained and further introduced. Even though polygraph examinations have a more than three decades past in Hungary, in some cases the court still questions its reliability.

While the participation of a professional expert counsel is mandatory at instrumental credibility examination of testimonies, for other procedural actions Be. IV stipulates, that a professional expert might be employed if special knowledge is required to investigate, detect, acquire, gather or record evidentiary measures. [Section 270 (1) of Be. IV.] The expert's special knowledge is needed to complete the instrumental credibility examination of testimonies that otherwise the members of the proceeding authority does not have. Should the legislative goal would have aimed that the result of the instrumental credibility examination of testimonies be considered a priority evidence, it would be completed by an expert and not a professional expert counsel. Despite the fact that a professional expert counsel became the executor of instrumental credibility examination of testimonies, it is still possible that the court will consider the professional expert counsel's testimony or the result of the examination recorded in the memorandum evidence. Nevertheless, such evidence is not sufficient enough to establish the defendant's guiltiness or for an eventual acquittal, it may only confirm the ruling of the court, also, the proceeding court may refer to it amongst the evidences expressly stipulated in the adjudication. Likely to the instrumental credibility examination methods, the prime expectation from brain fingerprinting is to orient the investigation, to assist the perpetrator's identification, furthermore, to clarify if someone is not the perpetrator of the criminal offence. Orienting the investigation as an expectation is more likely one of the characteristics of the professional expert counsel's institution than of the expert, so the statutory regulations of Be. IV implementing the duties of the professional expert counsel to the instrumental credibility examinations is rather reasonable.

Since a medical device, namely the EEG is needed to complete the examination, it raises the question, what qualification or scientific degree is required to complete the brain fingerprinting examination? There are no special educational or qualification requirements for other devices, in principal, anyone can handle the polygraph, the LVA or even the graphometer. Usually, instrumental credibility examination of testimonies is conducted by psychologists, or professional counsels who formerly were in criminal service. On the other hand, all devices require their users to have criminalistics or psychological skills. If only medical doctors could pursue brain fingerprinting examinations, its applicability would truly be narrow. Simplification of the device would be a possible solution, namely, a less complex EEG, which can be handled easier than the one used in medical care. Also, development of a software that would simplify the examination and the analysis of the brain fingerprinting results would further support the process. Actually, the future is here, the researchers of both the Psychiatric and Psychotherapy Clinic of Semmelweis University and the Department of Criminal

Procedure Law of the National University of Public Service, Faculty of Law Enforcement have already initiated the developments related to simplification. The objective is to establish a device that can be handled by anyone, who took part in an EEG assistant's course. This might be one of the key factors to the widespread of the instrument.

The witness

The witness is a rather important subject of instrumental credibility examination of testimonies, since – regardless of the device used – one of its most important goals is the identification of the perpetrator. For example, the polygraph is often used on witnesses, in order to determine whether he is honest, denying the offence, and the same applies to the other instruments, as well. We might state that examining the witness is idyllic, since compared to the suspect, he might have less information on the case that he could learn from the authority or from the investigation documents.

As of the statutory rules on examining the witness, Section 87 (2) of Be. IV stipulates that no witness under eighteen can be subject to instrumental credibility examination of testimonies. Subsequently, only mature witnesses could possibly be examined. The known American cases and practice refer to the brain fingerprinting examination of only defendants in court procedures. The examination of the witness could only be completed upon his own request for brain fingerprinting, provided to avoid being suspected of a crime by the investigating authority. In such case, he would expect the brain fingerprinting to prove and clarify that he is innocent in the criminal act, that he had not been at the crime scene, and he has no crime-related information he could share with the authority. In case the P300 brain frequency cannot be detected, the result of brain fingerprinting examination is a strong argument against being suspected by the authority. On the other hand, if the professional expert counsel conducting the test would come to the conclusion that the witness's brain does store concealed information, it may assume to the investigating authority that the examiner tested the actual perpetrator.

Both the investigating authorities and prosecutors could initiate brain fingerprinting examination of the witness, however, the test could only be concluded upon the witness's approval. Apparently, the approval guarantees that the examination was undertaken voluntarily, in other words, it depends on the witness's decision, whether the test is completed or not. Nevertheless, if the witness does agree to undertake the examination, he also accepts that its results might not be beneficial for him. The witness must be warned that not undertaking the examination shall not be considered a damning evidence. The witness must be aware of this, and should not think that disagreeing to the examination shall be prejudicial for him. Even though not undertaking the test shall not be considered evidence, however, it does occur at the applied devices that the authorities do presume that the disapproval to test is based on the subject's fear of being identified. Evidently, the same problem may occur at brain fingerprinting examinations as well, moreover, the issue is further exaggerated by Farwell's statement, declaring that the method works with a 0-failure rate, and further stating that only

3% of the cases were questionable, where he could not determine, whether the information was stored in the subject's brain or not. If we believe in Farwell's figures, the witness otherwise guilty in the offence may only hope to fall into this 3%, so he would undertake the examination, hoping that the test results will be estimable.

Should we believe that the method is faultless (but supposedly it is not), the authorities could quite easily make the mistake assuming that the person disapproving to the examination might be the perpetrator. First of all, the risk of default lies in the possible injury of the guarantee, namely, not undertaking the examination must not lead to negative consequences, on the other hand, the authorities must consider the true intentions of the witness, why he did not agree to take the test. The witness might as well reject the examination because he has doubts on the effectiveness of the method, and fears to be suspected by mistake. Similarly, another possible reason of not agreeing to the examination, for instance, is that the witness who discovered the body opening the door at a crime scene and discovering what happened to the victim does not inform the authorities, in fear they would not believe that he was innocent in the criminal act. Likewise, the witness discovering the crime will not approve to the examination, if it is inconvenient for him that he misinformed the authorities about the body found due to his fear. If the authorities would take the possible reasons of rejection into their consideration, wrongful assumption of guiltiness could be avoided, also, it would prevent the authorities to pursue the investigation and the entire criminal procedure on a false trail.

Defendant

In accordance with the provisions of Section 212 (1) of Be. IV not only the witness, but also the perpetrator can be subject to an instrumental credibility examination. Taking the brain fingerprinting examination, the defendant may clarify and exempt himself, proving his innocence. Most probably, the defendant shall undertake the test initiated by the authority only if he is not the actual perpetrator. In two of the known US cases, the defendant has initiated the brain fingerprinting examination, to provide evidence to the authorities that he was not the actual perpetrator. If the method truly works with 0-failure rate, the defendant not guilty of the crime will have a prime interest to indicate the completion of the examination. On the other hand, if the defendant did commit the crime, he might initiate the conclusion of brain fingerprinting that does not have faith in the method's reliability, or he might try to pull off some kind of contra-activity, hoping to mock the professional counsel. Consequently, it does worth for the defendant to agree to the examination, hoping that the favourable outcome of the test could lead to the termination of the investigation.

Brain Fingerprinting, a Method of Criminal Tactics

While in the US two cases out of three the brain fingerprinting examination was ordered to the defendant's request, attached to their petitions for a new trial for post-conviction relief, in Hungary instrumental credibility examinations shall be conducted in the course of the legal sequence of investigation, namely, Be. IV does not allow brain fingerprinting neither in the criminal court procedure, nor during any procedures of extraordinary judicial remedies. From the criminal tactics aspect, brain fingerprinting might function as a filter, likely to the polygraph, excluding the witness's criminal liability upon the results of the examination, or just to the contrary, the test results may exaggerate the reasons behind the authority's suspicions. As for witnesses, the method may be completed during both the investigative and the operative sequences of the criminal procedure. In the investigative sequence, it is more appropriate for the identification of the examined witness as the perpetrator, or to prove that the tested witness could not commit the offence, since his brain does not store any concealed information related to the criminal case whatsoever. Conducting the brain fingerprinting examination during the operational sequence may also seem to be reasonable, examining the testimony of the witness detecting whether he had actually seen everything as previously stated in his testimony, since there is a chance that the witness has lied, but the examination method reveals his brain reactions and identifies the false statement of the witness.[32] Brain fingerprinting is a more generally applicable method than the polygraph, since it may not only detect, whether the witness sincerely denies the conduct of the crime, or his familiarity with the perpetrator's identity, but other segments or aspects of the testimony may also be examined. At the operational sequence of the criminal procedure, the authority is already passed the identification of the suspected perpetrator, so at this stage the aim of doing a brain fingerprinting examination is more likely to conduct the instrumental credibility examination of the witness. However, completing the credibility examination during the investigative period may also be reasonable, whereas this stage gives the most extensive range of possibilities to the application of the method.

Since he main subject of the investigative period of the investigation is the interrogation process of the suspect, any and all other evidentiary actions shall take place at the stage of the operation, therefore, the brain fingerprinting examination of the suspect shall be conducted during the operational sequence, examining whether the suspect has committed the criminal act and if the information related to conduct of the crime are stored in his brain. The method could also be suitable to examine a suspect who pleaded guilty, however, the authority assumes that he actually did not commit the offence and has given a false testimony. The advantage of brain fingerprinting compared to polygraph is that this method does not assume the fear of being detected, in other

[32] Farwell (2012)

words, the subject's concern for being revealed after giving a false testimony. Namely, the aforesaid concern is not necessarily present in a defendant in such situation.

Concerns and Boundaries

The most cardinal problem related to the application of brain fingerprinting is the lack of validation of the method. Although some experimental results are already available, further affirmative experiments are required to confirm the endorsement of the method. Simplification of the method may also support more comprehensive testing of brain fingerprinting.

Another issue, whether the method is suitable for mind-reading, as in the professional counsel can or cannot reach to the examinee's thoughts during the brain fingerprinting examination. Actually, the answer to this question is that the method is only and exclusively suitable and used to examine if the visual images shown to the examinee generate P300 brain frequencies or not. The objective of the examination is the detection of the P300, thus brain fingerprinting only focuses on the concealed thoughts of the subject manifested in the photos appearing on the computer screen.

As of the boundaries of brain fingerprinting, case-related photos must be available, otherwise only words can be shown to the examined person. Having photos presumes a previous process of a successful on-site survey or research, whereas, for instance, the knife used to commit the offence or the body, etc. was found. Pictures can be taken of these objects, however, the applicability of the method is significantly narrowed if the picture of the injured party or the knife is available, or the actual crime scene is still unknown. In such cases, successful brain fingerprinting is impossible, nevertheless, a successful polygraph examination might be decisive. Appropriate timing is also crucial regarding the conduct of the method. First of all, it may only be pursued if proper pictures are available, on the other hand, procrastination of taking the pictures must be avoided, for instance, in order to preserve the crime scene (photos taken at a crime scene in the winter or in the summer are not the same, etc.).

Finally, we must comment on the issue, whether P300 brain frequencies can be detected if the examined person did not actually commit the criminal offence. For instance, different types of knifes are shown to the examinee, who responds with P300 potential not because he recognised the knife used to conduct the crime, but because he does possess a knife of a similar kind. For one thing, the analysis of the P300 brain frequency might help to determine the strength of the given brain reaction, to decide, whether it is powerful enough or if it should be when the perpetrator recognises the knife used to commit the act, or if the shown object is only familiar to the examinee. Likewise, if after the brain fingerprinting, the examined person was granted the opportunity to tell which photos he had found familiar and why could also facilitate the proper analysis of the result.

Closing Remarks

In this study, we have outlined the fundaments of brain fingerprinting operation and we have come to the conclusion that the method seems to be well founded from scientific aspects, but needs further testing, in order to be properly used in criminal cases. The fact that only three cases assessed in the US on the practice of the method are referred in scientific literature cannot seem sufficient. Undeniably, it is the benefit of brain fingerprinting that directly examines the brain contrary to other instrumental credibility examinations, and, in addition to the fact that it reveals the perpetrator, it is also suitable to check certain sequences of the testimony, for instance, to determine, whether the examined person had actually seen the things he mentioned in his testimony, or had he seen anything he would conceal from the authorities. Ideally, it may provide the investigating authority with a confession which is a further advantage of the method.

The EEG device used for brain fingerprinting is a criminal technical device originally developed for medical purposes, but it is also suitable for credibility examination of testimonies. The method is also related to criminal tactics, since the authority must take criminal tactical aspects into consideration when deciding on the conduct of brain fingerprinting, when to fit it in the course of the investigation, how to evaluate its results and how to address the results to the examined person. Likewise, the aspects of criminal tactics are enforced when determining which critical images are to be shown to the subject, in what order, etc.

Substantially, we may state that brain fingerprinting does have the potentials that would be beneficial in the Hungarian criminal procedures, however, before its domestic introduction its reliability in examining testimonies must be confirmed.

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