

1. Introduction

Criminal law is arguably among the most important parts of any system of law as its purpose is to counter serious forms of socially undesired behavior such as assault on one's property, physical integrity and life. Therefore in order to fulfill the high expectations society has of it, it should be equipped with the best tools to find out the truth, determine who is guilty and either punish or send them to rehabilitation. To achieve these goals it has the power to gather all kinds of evidence and invade people's liberties and private lives.

These extensive prerogatives are controlled to a large extent, but not only, by the protection from the state's intrusion into private life enshrined in human rights documents such as the right to fair trial and the right to privacy in the European Convention on Human Rights (ECHR). The protection granted to individuals in this way, however, is far from absolute and it is often reduced in the process of solving particularly important cases. Thus the answer to whether human rights are infringed can often be ambiguous, policy-driven and depend on the balancing of interests in the particular case.

On the other hand, in the past twenty years society has seen the rise of a neuroscience, which has made numerous discoveries relating to the structure and functioning of the human brain. On the basis of the results obtained in these studies, claims have been made that neuroscience will be able to drastically change the legal systems and criminal law in particular. However, such a drastic challenge to the criminal justice system seems to hold little promise at present (Greene & Cohen, 2004; Morse, 2008; Morse, 2011).

What seems to be a realistic goal for neuroscience is to redefine some of law's concepts by shedding light on the functioning of the brain and the thought process (Greene & Cohen, 2004; Morse, 2008). For example, being able to 'read' directly the defendant's brain and thought processes is expected to be a powerful tool in the hands of the prosecution that would allow them to gather evidence more efficiently, with less mistakes and therefore will lead to more just verdicts. However, the maxim 'the end justifies the means' is not necessarily valid in criminal law and the means have to be evaluated by themselves.

This paper endeavors to discuss whether the *compulsory* taking and use of neuroscientific evidence in the form of fMRI lie-detection and Guilty Knowledge Tests ('GKT' from now on) as well as Brain Fingerprinting ('BF' from now on) detection of existing knowledge from the defendant in criminal proceedings complies with the right to fair trial and particularly the right to silence which is part of it; and the right to privacy as enshrined in the European Convention on Human Rights. The first part of this paper will discuss the three types of neuroscientific evidence envisaged as they are in their present form and it will provide some further information on the current use of neurosciences in the courtroom. The

second part will deal with the issue of the right of fair trial laid down in Art 6 ECHR. Before providing an answer to the question, a comparison will be made with the federal law of the United States ('US law' from now on) in the context of the Fifth Amendment of the Constitution of the United States ('US Constitution' from now on) in search for possible solutions. At the end a conclusion on the compatibility of neuroscientific evidence with the right to a fair trial and more particularly the right to silence will be drawn. The third part will be a discussion on the right of privacy (Art 8 ECHR) and will follow the same general scheme used in the previous one. The fourth part will provide a conclusion to the paper and an overview of the results reached.

2. Neuroscientific evidence

Neuroscientific evidence in the form of Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET) and Single-photon emission computed tomography (SCEPT) scans has been used for quite a while in US courts to prove brain damage as result of accidents such as lesions (Moriarty, 2008, pp. 3, 12-13, 19; Appelbaum, 2009; Grafton, 2010). Particularly in criminal cases such evidence has been used to try to prove diminished responsibility or insanity defense by arguing that the brain damage indicated that the person had diminished cognitive capabilities. However, this evidence has been admitted primarily in the penalty phase as a mitigating circumstance to reduce sentence, because admissibility standards are not so strict at that stage (Moriarty, 2008, p. 17; Grafton, 2010, p. 62).

Considering the fact that for the greater part these tests collect images of one's tissues and are not aimed at obtaining information about the actual functioning of the person's brain, they can be equated with medical tests to see if someone is wounded (Raichle, 2010 p. 12). However, the problem of interpretation as to what that structural damage means or whether it existed at the time of the commission of the crime is encountered which acts as a major impediment to their wider use in the stage where the verdict is given (Moriarty, 2008, pp. 14-16; Aharoni et al., 2008, pp. 5-6, 9).

2.1. fMRI testing

On the contrary, functional Magnetic Resonance Imaging (fMRI), which is already familiar to the general public thanks to popular media, measures the so-called blood level oxygenation dependent (BOLD) signals. This means that it detects the oxygenation of

the blood and thus where it flows to. Based on that, scientists infer which regions of the brain are activated and work harder (Moriarty, 2008, pp. 4-5; Raichle, 2010, p. 13). The key difference from older MRI method is that it measures brain activity even though indirectly, rather than just structure.

Possibly more importantly for criminal law, scientists claim to be able to tell when someone is lying by measuring which regions are activated (Davatzikos et al., 2005; Ganis et al., 2003; Kozel et al., 2004; Kozel et al., 2004a; Langleben et al., 2002) and even possibly establish experimental knowledge of something (Gamer et al., 2012, pp. 7-9). To add to that, it is in theory possible that fMRI BOLD test will be used to prove that someone is actively suffering from pain (Fields, 2010). However, people would probably undergo this type of tests voluntarily since it would usually be evidence to prove that they have suffered damage and therefore in their favor.

Considering the quickly growing body of academic work on the topic of fMRI lie-detection, this seems to be among the most eagerly expected new developments neurosciences may bring in the foreseeable future. Therefore, it is logical to analyze its compatibility with human rights as well as the use of fMRI for establishing experimental knowledge of something (Bles & Haynes, 2008, pp. 3-4).

While older types of Guilty Knowledge Tests and lie detection, with which crime-related information was sought, relied on reading the physiological responses of the person as a whole, these new technologies promise to allow tester to detect the signs of the actual recognition of the information (MacLaren, 2001, p. 674). Thus the chain between the existence of the incriminating memory and the prosecution becomes much shorter and the chances for drawing mistaken inferences are reduced. Furthermore, this would also allow drawing much more reliable conclusion as all the factors of the environment as well as other stress-related physiological responses are excluded as possible causes for the strong reaction to the actual information (MacLaren, 2001, pp. 675-676). This additional reliability seems to give an edge to neuroscientific methods of gathering evidence which is a valid ground to assume that the prosecution would try to utilize them as soon as they are admissible.

However, the admission of GKT for detecting experimental knowledge by means of an fMRI is very difficult at the very least, because at the time the blood flow starts to alter and can be measured, one is conscious what they are thinking about. Thus, one can change their thoughts and from a purely practical perspective there is no way to detect the fleeting reminiscence of the person who is being subjected to this test (Goebel, 2013). Up to now, the evidence gathered by fMRI scans and the results thereof have not made their way into the courtroom because they do not cover admissibility standards for expert

evidence. Among the main issues is that the connection between the increased blood flow and the corresponding type of the mental activity attributed is not causal. Instead scientists work with correlates (Moriarty, 2008, p. 5) and problems of interpretation may arise especially in the case when two experts conflict (Aggarwal, 2009, p. 3). What is more, the regions which are usually associated with one activity may be responsible for a whole range of similar activities, thus aggravating the problem of interpretation (Bles & Haynes, 2008, p. 6).

Moreover, neither the motivation of the subjects in the tests was similar to what the motivation of a defendant in a criminal case would be, nor the complexity of the situation was comparable (Bles & Haynes, 2008, pp. 5-6). This problem may seriously undermine the results of fMRI tests as it relates to their greatest weakness - BOLD signal in cortical areas is susceptible to deliberate distortion by subjects (Bles & Haynes, 2008, p. 9; Goebel, 2013). However, the real issue with these current weaknesses is that they are not imputable only to technology, but to brain functioning itself. Therefore remedying them may be quite a challenge for neuroscience

2.2. EEG/Brain Fingerprinting

Electroencephalography (EEG) detects the electrical signals that the brain emits as a result of its activity by means of electrodes attached to the scalp. This technology has been used to show the defendant images or ask questions which only someone present at the crime scene could have known – GKT (Bles & Haynes, 2008, p. 7; Rosenfeld, 2001; Farwell et al., 2012, p. 117). The strong signal received from the so-called P300 wave has been interpreted to indicate that the person has knowledge of the thing shown (Farwell et al., 2012, pp. 115, 117-118). The strength of this signal does not depend on the person's active response, but rather on indirect physiological markers whether the interviewee has knowledge of the information (Bles & Haynes, 2008, p. 7). What is more, the electric signals EEG detects are the results of neuronal activity and therefore very quick, fleeting mental processes can be detected.

Again the reliability of the evidence is questioned as the meaning given to the electrical signals from the brain is dependent on interpretation. (Rosenfeld et al., 2004) Furthermore, claims have been made that it is highly resistant to countermeasures, even though they have been contested, but have not been proven to be unfounded (Farwell et al., 2012, p. 141; Rosenfeld, 2005; Rosenfeld & Labkovsky, 2007).

Both the ability to prove that the person tested possesses knowledge which only the perpetrator may have or to detect lies could prove to be a powerful tool in the hands of

the prosecution. That is why it is so vital to see if their use complies with human rights. Despite the current problems of admissibility of neuroscientific evidence due to its low reliability, the discussion on this first line of protection against the threat of irrelevant or unreliable evidence is not central to this work and therefore it will be left aside for the reasons that the standards of admissibility are set by national law and not by the European Court of Human Rights (ECtHR or 'the Court' from now on) (*Jalloh v. Germany*, pars. 94-95). Therefore, the discussion on the main issue will be from a futuristic viewpoint from the premise that such evidence is admissible, trustworthy and scientists can indeed use neuroscientific methods as a reliable tool for lie-detection and administering GKT.

3. Right to fair trial – Art 6 ECHR

The right to fair trial enshrined in Article 6 of the European Convention of Human Rights (ECHR) secures the defendant two main guarantees: equality of arms and *le droit à une procédure contradictoire* which can roughly be translated in English as an 'adversarial proceedings' though it would not convey the precise meaning. Equality of arms entails that both the prosecution and the defense should be entitled to be heard on equal terms while the 'adversarial proceedings' aspect entails that the defense should be notified of the prosecution's materials against them and given a chance to answer it (Marty & Spencer, 2002, p. 45).

Thus a literal reading of Art 6 does not provide what is termed 'right to remain silent and privilege against self-incrimination' (the right to remain silent from now on, if I refer to either aspect of the right specifically, I will note it) which might be threatened when one is subjected to the taking of evidence via fMRI or Brain fingerprinting. However, the ECtHR has read the right to remain silent and the privilege against self-incrimination as one aspect of fair trial relying on a broader interpretation of the article in *Funke v France* (see also Wu, 2011, pp. 38-39, 44-45).

One has to remember that the right to remain silent is not a specific autonomous right, but falls within the general notion of 'fair hearing'. Therefore, if a violation against the right to remain silent alone would have to amount also to a breach of Art 6 ECHR, it would have to deprive the defendant of the essence of their right (*Jalloh v Germany*, pars. 96-97). The first part of the analysis of the applicability of the right to remain silent is that it applies only to people charged with a criminal offence. The notion 'charged with a criminal offence' has been given an autonomous and wide interpretation by the ECtHR (Berger, 2005, pp. 346-349). However, as the starting assumption of this paper is that the person

from whom neuroscientific evidence is taken is a defendant in a criminal case, this is not problematic.

To add to this, the Court has held evidence which was not prima facie incriminating, but was later deployed in a criminal trial is also under the protection of the right to remain silent (*Saunders v United Kingdom*). Therefore, if neuroscientific evidence is taken from a witnesses and the testimony is in no way incriminating for that person, it will most probably be deemed admissible. However, if it was later used against that witness, it would be considered to be a protected kind of evidence.

Second, in judging if the essence of the right is extinguished the Court has held in *Allan v United Kingdom* (par. 44) that it considers first the nature and degree of compulsion used to obtain the evidence, second whether there are safeguards in place against state misuse of its powers and third how the evidence has been utilized (see also Wu, 2011, p. 46). The degree of compulsion has been defined as ‘coercion such as to render his right not to incriminate ineffective’ in *Serves v France* (par. 46; see also Berger, 2005, pp. 355-356). However, as the paradigm that is discussed in this paper – when the defendant is forced to take the fMRI or Brain Fingerprinting test, is in itself a situation of compulsion by the state, this requirement for the applicability of the right to remain silent is fulfilled.

The final requirement for the application to the right to remain silent is that the particular type of evidence is protected or as it was termed by the Court it has to be ‘dependent of the will of the defendant’. In this regard the ECtHR has connected the right to remain silent with the will of the defendant not to disclose evidence (*Saunders v. United Kingdom*, par. 69). What is more, the Court has also granted protection from compulsion by the drawing of adverse references against the defendant when they have made use of the right to remain silent (*John Murray v United Kingdom*; see also Wu, 2011, pp. 45-46).

It seems that the key distinction that the Court makes is that the right to remain silent doesn’t apply to evidence which exists independently of the defendant’s will such as bodily samples including blood, urine, hair, voice samples or documents obtained pursuant to a warrant (*Saunders v United Kingdom*, par. 69; *Jalloh v Germany*, par. 102).

Applying the three-fold analysis of *Alan v United Kingdom*, however, the Court seems to give also particular importance to the compulsive force used to obtain even ‘real’ evidence (*Jalloh v Germany*, pars. 114, 116, 118). If the compulsion used is much more than the required and necessary interference with one’s integrity to obtain the aforementioned ‘real evidence’, then even that may be a violation of the right to remain silent.

The main problem in front of the present analysis is that the Court does not give much guidance as to where the dividing line between evidence that exists dependent on the person’s will and one that exists independently of it lies in regard physiological processes and it is difficult to tell on which side neuroscientific evidence will fall.

3.1. Fifth Amendment and the right not to be witness against oneself

Therefore this paper turns for arguments as to how to deal with the issue at hand to US federal law since it has more experience with this matter because the right not to be witness against oneself has been dealt by federal courts on the basis of the Fifth Amendment of the US Constitution and is clearly comparable to the right to remain silent in Art 6 ECHR. Even though the theoretical and philosophical foundations of the Fifth Amendment are not clear, its practical application has been discussed and defined at length (Allen & Mace, 2004, pp. 243-246).

The US Supreme Court has developed a three-fold test as to whether a particular piece of evidence is protected (*Fisher v United States*), which is very familiar to the ones used by the ECtHR. The first two inquiries are whether there was compulsion and whether the evidence gathered was incriminating (for a more thorough discussion on the two see Allen & Mace, 2004, pp. 250-259). In the present analysis both are not included, because a priori the evidence has been taken compulsory – either by a judicial order or by force; and the assumption is that the evidence is taken from the defendant in the course of criminal proceedings with the object of incriminating them.

The question therefore rest on the third question - whether the three kinds of neuroscientific evidence will be considered ‘testimonial’ evidence. In *Schmerber v. California* the Supreme Court of the United States created the distinction between ‘testimonial and communicative’ and ‘real and physical’ evidence which seems similar to the approach later developed by the ECtHR in *Saunders v United Kingdom* and *Jalloh v Germany*.

However, in the same case Justice Brennan created an exception to the general distinction for polygraph testing. The wording of his argument is based on the fact that determining one’s guilt on the basis of physiological responses would go against the spirit of the Fifth Amendment. This exception, however, has proved difficult to conceptualize for legal scholars (Allen & Mace, 2004, pp. 260-265) and some have argued that it is a non-binding dicta (Holley, 2009, p. 19). As basically both fMRI and EEG GKT measure the physiological responses of the person – be it either blood flow to the brain or electric impulses, one could argue that this exception can be used precisely in this case.

This distinction has been further refined and developed by scholars. On the one hand, some have drawn the dividing line at whether the act of communication itself can be considered testimonial and whether the information itself is of such nature (Stroller & Wolpe, 2007, pp. 367-368). Thus, the degree of control the defendant has over the transmission of the evidence becomes paramount.

On the other hand, some analysts argue that ‘testimony’ should be understood as the results of cognition that allow holding a proposition true or not true. Thus the acquisition, storage, retrieval and use of knowledge which has been caused by the state would be protected ‘testimony’ (Allen & Mace, 2004). Following this reasoning seems to lead to the conclusion that the 3 types of neuroscientific evidence in question are protected ‘testimony’ as they include cognition and in particular the retrieval of knowledge stored in one’s brain.

Further scholarly arguments are based on the connection between the Fifth Amendment and the protection of privacy; however, this discussion will be left for later (Stroller & Wolpe, 2007, pp. 370-372).

3.2. Analysis of compatibility of fMRI lie-detection / fMRI guilty knowledge tests and Brain fingerprinting with the right to fair trial

Considering the case law of the ECtHR the key question in determining whether subjecting a suspect in a criminal trial to forced neuroscientific testing will be in violation of their right to remain silent will depend on whether the evidence produced will be considered to exist independently of the person’s will or not (*Jalloh v Germany*, par. 102).

To begin with, the question of the compatibility of fMRI lie-detection turns out to be quite straightforward. Considering that lie-detection requires the active cooperation of a person and their actual responses, it clearly depends on the person’s will as the actual cooperation of the person is required at least to answer the questions posed in order to determine whether these responses are truthful. And in such cases both Courts have made it explicit that this is a case where the right to remain silent applies in full power. Thus, without much problem one can conclude that administering fMRI lie-detection and forcing one to answer the questions is in violation of the right of fair trial in Article 6 ECHR.

The argument which asserts the compatibility of the neuroscientific evidence gathered by GKTs with the right to remain silent is based on the idea that what is measured during the factual process of taking of the evidence are the defendant’s bodily processes - blood flow and electrical impulses. This argument is supported by the materialistic neuroscientific stance which views consciousness, memory and cognition as a multitude of physiological processes in the brain. Therefore according to this line of reasoning, evidence obtained via fMRI and EEG should indeed be considered to be real evidence.

This argument finds conceptual support in the notion that the right to silence itself is created to assure testimony are reliable and there are no forced false confessions, thus

resulting in verdicts that actually serve justice. It follows that once the defendant becomes a reliable source of evidence, the prosecution should not doubt to use that evidence to serve justice in the most efficient way possible and therefore satisfy the societal desire for risk reduction by removing dangerous persons from society.

The fact that both the blood flow within the brain and the electrical impulses are controlled by processes which are not part of our conscious thought process supports this line of reasoning – we do not generally have the power to direct our blood flow to sub-cortical areas (Goebel, 2013), nor do we control the electrical signals within our brain that occur in such a quick fashion as measured by BF. Therefore in the light of this argument, neuroscientific tests are to be compared to blood content or body temperature tests aimed at determining the state of the person at a particular time (such as the a test to determine whether one has high levels of alcohol in their blood).

Furthermore, this argument is supported in the fMRI and Brain Fingerprinting admissions of GKTs by the non-existent control the person has over the transmission of the evidence. Since the dependence of the evidence on the person's will grants them control over its transmission (as the person can then stop other people's access to it at will), the opposite is therefore also necessarily correct. In view of the fact that the brain's regional increases in blood flow and electric activity in the cases of GKT are mostly independent on our will in the short term, this line of arguments asserts that the defendant will not enjoy the right to silence on the basis of the ECtHR's case law in regard to the three types of neuroscientific evidence which are a discussed.

Contrary to that stands the argument centered on the notion that what is protected by the right to remain silent is actually the result of human cognition and the fact that so much emphasis is put on the defendants' testimony is that this used to be the only way to have access to their mental processes which are the essence of what is to be protected by the right to remain silent

This argument draws strong philosophical support from a retributivist view of the justice system which views the defendant as a subject and not merely as an object and a source of evidence. When elevated to the status of subject, the defendant deserves to be treated as such and their most sacred inner self – cognition, should remain inviolable.

In support of this argument legal scholars and neuroscientists assert that cognitive processes do not exist independent of people's will and memory as one among them should be viewed as part of person's will (Farell, 2010, p. 94). In essence, the fact that in the long run people can will what they want to think about and remember, even if they are given conflicting outside stimuli (Goebel, 2013), adds credibility to the assertion that memory is indeed part of their will (and therefore dependent on it). This ability to exert

some measure of conscious control over some of their mental states is why techniques for brain enhancement such as neurofeedback have been reported to have great success in the context of treatment of psychological issues such as depression (Goebel, 2013; Hammond, 2005; Won Choi et al., 2011). Moreover, considering that the use of fMRI for GKT requires the compliance of the subject in holding the thought for several seconds while blood flow alters accordingly (Goebel, 2013) provides a further proof that people's thoughts in that instance are their own conscious cognition and gives an indication that the 'control argument' is not fully applicable to either kind of fMRI testing.

On the other contrary, if it would be possible to make the defendant think for a longer period of time about a particular event, fact or place by means of specific outside stimuli and to measure the results of this process, thus giving insight into the content of that person's thoughts, one would have a result very similar to forcing one to talk about these things.

Furthermore, the language used by the Court in its case law seems to place the stress on the defendant's will to communicate the evidence which seems to support an argument centered on the protection of the defendant's cognitive processes rather than control as naturally one's will to communicate refers mainly to the results of their cognitive processes.

To add to this, the ECtHR has not made any exception to the distinction of evidence similar to the US Supreme Court's with polygraph. However, the underlying logic employed by Justice Brennan that seems to be the protection of privacy may prove in the future persuasive if privacy is also threatened and thus leading the ECtHR to embrace it. This exception provides further support to the view that neuroscientific evidence would violate the right to fair trial.

Another quite different peril to the right of fair trial in general poses the danger of assigning too much importance to the neurological evidence. As neither judges, nor juries are unerring in their assessment of evidence, the colorful results of fMRI scans which are backed by a relatively new and revolutionary science may induce such mistakes. This problem is aggravated by the relatively low knowledge of judges and juries in the area of neurosciences at present. However, this situation of lack of experience in dealing with such matters may (and most surely will if courts are often confronted with neuroscientific evidence) change considerably in the future and therefore this argument is not really persuasive ground for considering neuroscientific evidence a threat to the right to fair trial. A situation which is an interesting exception from the two argument outlined above is the situation whereby even neuroscientific evidence which is considered to exist independently of the person's will, may fall within the exception provided for in *Jalloh v Germany*: the Court there allowed for the protection of real evidence when the intrusion

into one's personal integrity to obtain the evidence was too great. In this instance, the defendant has to then rely on the violation of other rights such as the right to privacy and even more importantly - the right to be free of inhuman and degrading treatment to invoke this defense as the Court has held that violation of other rights could lead to a violation of the right to fair trial as well.

At present, it would be wishful thinking on my part to believe that the Court will embrace any of the two arguments that have been constructed by this paper when faced with such a case. This is so especially considering that a lot of time may pass and many factual and legal circumstances may change until the judges are faced with a case dealing with this issue.

However, considering the practical necessity for active response by the person tested in the case of fMRI lie-detection it is almost certain that this will be an instance when the defendant enjoys the right to remain silent irrespective of the viewpoint taken.

In the case of fMRI GKT the decision is not as clear-cut. However, due to the necessity that the person has to think about the relevant information for a couple of seconds before blood flow alterations occur, one can infer that the person has a significant amount of control over the results of the test. Having that in mind, it seems that in this instance both arguments would support a ruling that the defendant's right to remain silent will be endangered in this case.

The third type of neuroscientific evidence – Brain Fingerprinting, seems to be the one that will raise the most controversy. On the one hand side, the person tested has no effective control over the information transmitted as the P300 wave appears only 300 ms after the stimulus is given and is physically impossible to suppress. Furthermore, as the assertion that it is resistant to manipulation has not been refuted convincingly, the conclusion that one is not in control of the result of the tests cannot be challenged effectively thus lending further credibility to this line of reasoning. These two give a strong indication that a control-based reasoning may actually find the subjects of Brain Fingerprinting tests not to enjoy the right to silence.

On the other hand, memory and the retrieval of information from it is indeed a cognitive process and therefore should deserve the status of protected evidence from the viewpoint of the cognition argument. Opponents of the cognition line of argument may, however, claim that what BF tests (and not only) is not cognition itself, but physical changes which are interpreted to have a specific meaning. Thus the results from BF are equated with the tests for other 'similar' physical changes such as facial expression or body movements which are also used for drawing inferences about one's state of mind and therefore BF is just a way to get more accurate measurements (Holley, 2009, pp. 20-21). However, there is a strong intuitive feeling stemming from Cartesian philosophy that draws a distinction

between physical changes in the brain that affect our mental processes and in the rest of the body, which leads us to think that the processes that occur within our brain and are therefore linked to our cognition deserve a higher level of protection, thus making this counterargument less persuasive. What is more, if one takes the US Supreme Court's exception for polygraph GKT further, it is not difficult to see how it can be extended by analogy to cover brain fingerprinting as well.

Overall, if I am to make an educated guess as to the line of reasoning that the Court might follow should such a case arise, my prediction would be that the 'cognition' argument or a variation thereof would form the basis of the ECtHR's reasoning. This should not come as a surprise considering that the Court, in fulfilling its task as an enforcer of the Convention, has more often than not taken strong stances on the protection of human rights and has had little tolerance to their limitation by states. Hence this judicial activism could play an important role as it is not difficult to envisage how the use of neuroscientific evidence may intrude into areas the protection of which is among the core values of a democratic society such freedom of thought (Brems, 2005, pp. 303-305). Furthermore, curtailing the prosecution's right to use neuroscientific evidence obtained from the defendant does not prevent them from uncovering the truth, but makes that task more difficult. While on the contrary, the use of neuroscientific evidence from the viewpoint of the 'cognition' argument threatens to extinguish the essence of both the right to remain silent and the right to privacy. Applying this analysis by analogy from cases of conflicts of human rights, it seems important to provide protection for the defendant, rather than take it away and give less freedom to the prosecution by reasoning in the line of the 'control' argument (Brems, 2005, pp. 303-304).

4. Right to privacy

In the case law of the European Court of Human Rights the analysis as to whether there has been a violation of Art 8 ECHR is usually divided into five parts. The first question that the Court asks is whether the relevant information obtained or stored is covered in the concept of 'privacy'. The second inquiry is whether there has been an actual interference with the right.

Thirdly the Courts looks at whether it has been done in accordance with the law. If a particular state activity is to fulfill this criterion, there will have to be thorough regulation on the issue in order to prevent the arbitrary interference with people's lives. Therefore, the old Acts on criminal procedure will have to be amended to accommodate the new

developments, or probably the old rules will be applied to neuroscientific evidence with the help of some interpretation of the concepts laid down therein. The question of legality, however, is not really the focus of the discussion, so it will be assumed that there is relevant domestic law which regulates the matter.

The fourth requirement that has to be met to avoid infringing the right of privacy is that the acts must have been undertaken in pursuit of one of the interests laid down in art 8(2) ECHR. This is also not really a problem as the evidence from the defendant in this paper is taken for the public safety and the prevention of crime.

The fifth question the Court asks is whether the gathering of the information is necessary in a democratic society. This is a proportionality requirement aimed at restricting governmental interference to the minimum level necessary (Trechsel, 2005, pp. 535-540).

The present discussion on whether the information obtained by fMRI and EEG scans is protected by the right to privacy will be focused on the first two issues that are dealt by the ECtHR, because they appear to be most problematic in the case discussed.

The Court has used the notion 'legitimate expectation' a person has for the respect of their private life to determine which information and what use of that information fall within the scope of the right (*Von Hannover v Germany*, pars. 51, 69). It is, however, difficult to set down concrete formula the Court uses for establishing whether one harbors such 'legitimate expectations', because States parties to the Convention enjoy a margin of appreciation due to cultural differences. Therefore, each state can engage in a relatively independent evaluation of the right to privacy and the person's legitimate expectations (Bignami, 2008, pp. 212-214, 239, *Von Hannover v Germany*, par. 57). However, one should not forget that the Court itself can (and will) often engage in an evaluation of its own and in such cases it has attached importance to the question whether the information gathered related to private or public matters (*Peck v United Kingdom*, par. 61). To add to this, considering the fact the defendant is protected from having to provide the prosecution with incriminating evidence by the right to remain silent, it can be argued that such 'legitimate expectations' indeed exist in regards to this information.

Therefore, in view of these indications that the person may have 'legitimate expectation', what the Court and States can do is essentially evaluate whether the public interest in obtaining a particular piece of information outweighs the person's interest in keeping it secret. The question is not an easy one to solve and factors such as the nature of the information and the degree of its intrusiveness are very important.

To begin with, the question whether there has been interference with the right hinges to a great extent on the duration and seriousness of the interference as well as the duration for keeping the information. In *Jalloh v Germany* (pars. 70-71, 79) the Court clearly

demonstrated that that the mode of taking evidence is also to be considered – the more intrusive the scientific method of taking of evidence, the more serious justifications should be given even for physical evidence. Taking this rationale to its logical end it was held that evidence taken in violation of Art 3 ECHR and thus obtained by means of inhuman and degrading treatment can never be used to prove the defendant's guilt, because this would render the trial unfair and also in violation of Art 6 per se (*Jalloh v Germany*, pars. 105-106). On the other hand, the present discussion will not turn to the problem of storing of the data obtained with the neuroscientific evidence and its later use, because this is another aspect of the right and questions raised are quite different.

It seems that the Court would evaluate the conflicting interests in each case with view of the particular facts of the case rather than some general principles. Therefore, in search for further arguments and guidance this paper turns once more to US law.

4.1. Fourth Amendment and the right not to be subject to unreasonable searches and seizures

First and foremost, the US Constitution does not contain a general right of privacy as in the ECHR. Instead the interpretation of the Fourth Amendment used by the Supreme Court in the case *Katz v United States* where the two-fold formula for assessing whether the guarantee against warrantless unreasonable searches and seizures was breached will be used. The test consisted of the questions whether the person has specific expectation for privacy and whether those were reasonable (*Katz v United States*, 361). Yet, this is not equal to a general right to privacy as the Supreme Court stated itself. The protection granted to individual privacy by the Fourth Amendment applies only in some instances of government intrusion into private life (*Katz v United States*, 350; Wimberly, 2007, pp. 295-296). As the present analysis focuses an intrusion into the functioning of one's brain by the government with the purpose of using the results as evidence at a criminal trial, the conclusion is that the Fourth Amendment serves the same purpose as the right to privacy in the ECHR and a meaningful comparison can be made.

However, if the US police have a valid search warrant issued by a judge, this protection is not applicable (Halliburton, 2007, 340-341; Wimberly, 2007, p. 294). Therefore the analysis turns to unwarranted searches and the permissibility of the evidence gathered thereof.

To begin with, in the cases of unwarranted searches courts would balance legitimate expectations for privacy with the governmental interest in the information very much like the ECtHR (Wimberly, 2007, pp. 294-295). In determining whether one has reasonable expectations of privacy worthy of protection in unwarranted searches the US courts

consider several factors. The main one is that a person retains no 'legitimate expectations' in regard behavior that is exposed to the public or even to a limited circle of people. This is also extended to cover information which can be gathered only thanks of the capabilities of technologically sophisticated methods of observation. This principle is qualified in cases of novel technologies - if the technology used is not of general public use, then the person will be considered to have retained such interest even when it relates to evidence-gathering procedure which is less intrusive than a classical search (*Kyllo v United States*, 34-35; see also Kerr, 2004, pp. 831-837). Thus the more commonplace brain scanning of all types becomes, the more peoples' legitimate expectations for privacy will diminish (Halliburton, 2007, pp. 348).

What is important in this line of reasoning is that there is no determination whether it is morally appropriate to use such technologies (Halliburton, 2007, p. 346). The lack of specific boundaries means that there is a real possibility that at some point there are no boundaries and no inviolable private sphere is left and in my opinion this is a highly undesirable situation.

Last, but not least, some scholars have been argued that even today the analysis of the Fourth Amendment revolves around concepts, notions and expectations from property law (Kerr, 2004, pp. 827-831). However, such line of reasoning has little utility when applied to the right of privacy, because the ECtHR has never relied on such arguments. This way of thinking becomes even more inappropriate when one considers the fact that human bodies and the working of their brains are not property, as the opposite would violate human dignity.

4.2. Analysis of compatibility of neuroscientific evidence with the right to privacy

The starting point of the analysis is whether the information at stake is protected. As the taking of neuroscientific evidence includes a scan of human brains, the information retrieved arguably forms part of one's private life and thus one has 'legitimate expectation' of privacy in that regard. Furthermore, inferring certain mental states and feelings by measuring brain activity allows scientists access to thoughts and feelings one has consciously chosen to keep for oneself and to exclude the outside world from. Such a decision to exclude others from the information has been held to be an indication for the strong expectations one has for it remaining private and therefore the possible existence of 'legitimate expectations' (*Niemietz v. Germany*, par. 29).

Moreover, Cartesian philosophy and Lockean natural-law, which have shaped the perception of what constitutes the modern person, have deeply embedded into society the notion that the essence of humanity is the freedom of thought and conscience. Since even simple observation of our behavior often limits it to a great degree and behavior is result of human will it is possible to conclude that observation will also limit cognitive processes (Halliburton, 2007, pp. 331-340). This intuitive notion is used to support the claim that people should retain legitimate expectations of privacy in regard to all their cognitive processes even if they are defendants at criminal trial.

Contrary to that, as fMRI testing requires the complete stillness of a person, complying with this may be interpreted as a functional consent to the taking of the test even in the face of the fact that the person does their best to frustrate the test results. Such consent can then be used to argue that one has exposed the information and should therefore not retain their legitimate expectations. However, one can argue that there has been no real consent, because the defendant has been forced to take the tests and their will has been overborne and therefore this line of reasoning does not appear very persuasive.

Therefore the conclusion is that both fMRI and BF tests have the potential to violate the right to privacy, because the defendant would have retained their 'legitimate expectations' of privacy in regard the information that has been gathered.

Hence the second part of the analysis, which seeks to answer whether there will be an actual violation of the right when neuroscientific evidence is used, becomes paramount.

The first aspect of this analysis is a balancing exercise between the prosecution's interest in determining whether the defendant is lying in the testimony given or has knowledge of some details of the crime and the person's interest in privacy.

This balancing naturally hinges on the type of information that may be gathered, but the threshold is different from the one used to determine the existence of 'legitimate interests' (*Peck v United Kingdom*). Considering that most recent developments in the area of fMRI scans allow determining one's most general thoughts, but not their specific content (Goebel, 2013), it seems that the threat to any information of personal character is quite limited. This gives preference to the prosecution's interests and therefore to the conclusion that there is no violation. What is more, as the person has great degree of control over their persistent thoughts, it can be argued that they retain control over the collateral information that the prosecution may uncover. Therefore the argument that fMRI scans can discover irrelevant information which is very personal (McMonagle, 2007) is not very persuasive at the moment.

It is imperative, however, that this balancing be undertaken each time neurosciences advance and the more precise information can be inferred, because then greater the

protection has to be afforded to the defendant and their non-crime related knowledge. Even though the spectrum of what fMRI lie-detection and GKT can uncover in the person's cognitive processes at the moment is not very broad, it will increase in the future. Therefore it seems that the balancing exercise with regard fMRI methods of obtaining evidence will have to be undertaken with increasing care and intensity each time.

In the case of BF this balancing does not seem to raise many issues considering that the capabilities of EEG at detecting thought processes are quite limited and the information that can be gathered is relates only to whether one is familiar with some information (Farwell, 2012, pp. 115-116). Therefore, on application of the reasoning from *Peck v United Kingdom* the person's interest in privacy may be held to be diminished compared to those of the government. Hence, it seems that the interests of the prosecution outweigh the interests of the defendant relatively easily in the case of BF and therefore the defendant's right to privacy would probably have to be curtailed to allow the taking and use of BF evidence.

The next step in the present analysis is to determine whether there is actual interference with the right to privacy in view of the degree of intrusiveness of the measures taken.

In the case of scanning one's brain to see if the person is in possession of particular information it can be argued that there is indeed interference on the basis of the fact that this allows to extract information which the person has decided not to share.

On the one hand, the nature of the interference in the case of fMRI scans whereby one has to remain still in a huge magnet, be subjected to strong noise and magnetic fields does not seem to be very problematic considering the ECtHR's adjudication based on the ways evidence is taken. Possibly in the case when the test subject suffers from aggravating conditions such as claustrophobia the test would be so stressful for the person tested that it will amount to inhuman and degrading treatment and thus a violation Art 3 ECHR, therefore rendering the evidence unusable. However, in normal circumstances this method does not seem invasive enough because there is no intrusion into one's physical integrity, nor is there any interference into the psychological functioning of the person.

On the other hand, EEG testing with electrodes on the scalp does not seem to raise any issues in that regard because of the relatively low level of discomfort for the person who is being tested (Farwell et al., 2012, p. 122).

The last point that should be raised in the present analysis focuses on the last requirement – whether the invasion into privacy is necessary in a democratic society. This condition is a safeguard that could have either a very negligible role or a very prominent one, depending on how the evidence is used. This clause provides protection against the misuse of previously gathered evidence by the state as well as against the ever more invasive types of surveillance that are used.

Therefore if neuroscientific evidence's existence is limited to the case only and is destroyed immediately afterwards, then an assessment of the first two criteria will probably be sufficient and this will not be a ground for asserting unlawful violation of privacy. On the contrary - cases of creation of large databases with the results of neuroscientific testing seem bound to be indefensible in the light of modern social philosophy.

In my opinion, this part of Art 8(2) ECHR will play an important role in future as its task is to prevent the executive power from taking the road to becoming the all-knowing and all-powerful totalitarian government depicted in George Orwell's *1984*. In the foreseeable future such a scenario seems highly unlikely and only the fMRI technology seems to pose serious foreseeable threat to the defendant's right to privacy at a criminal trial, but it is nevertheless important that this safeguard is in place.

5. Conclusion

This paper has taken three state-of-the-art types of neuroscientific evidence and analyzed their compatibility with human rights as enshrined in the European Convention of Human Rights. The approach used was futuristic – the reliability of the evidence and the results of its analysis are considered to be unerring so that the discussion can be focused on the compatibility between their forceful taking and use and the right to silence and the right to privacy.

Having looked into the case law of both the European Court of Human Rights and the United States Supreme Court on broadly similar matters, general arguments supporting both the thesis that neuroscientific evidence is in accordance with human rights and the claim that it violates them have been put forward and discussed.

In the case of the right to silence two opposing lines of reasoning were developed. According to the first one, only the testimony over which the defendant has conscious control is protected with the goal to ensure proper administration of justice and to exclude forced false confessions. The opposite argument is that the results of one's cognitive processes lay at the heart of the right to remain silent and they should be protected.

When applying the case-law of the ECtHR it is almost certain that fMRI lie-detection will be deemed to be a case when the defendant enjoys the right to remain silent, because their actual cooperation and answers to the questions posed are required. However, its use on witnesses is restricted to a much lesser degree which makes the distinction between defendant and witness of paramount importance.

The compatibility of fMRI based Guilty Knowledge Tests with human rights is not so clear, because there may be problems of interpreting what is 'evidence existing independent of the defendant's will'. However, considering both arguments, there is a strong indication that it will also prove to be a kind of protected evidence whereby the defendant enjoys the right to remain silent.

On the other side of the clarity scale is the case of Brain Fingerprinting. As it is the least intrusive test which measures something that people have no conscious control of and none of the two arguments seems to be prevailing and applicable to a greater degree, the decision may hinge on the facts of the case or the sentiment of the court.

During the analysis of the protection afforded by the right of privacy it became clear that in both jurisdictions the 'legitimate expectations' one has are balanced against the interests of the prosecution in uncovering the particular type of information.

On the one hand, in view of the fact that fMRI is capable of unveiling more than only crime-related information, the conclusion is that if not at present, then in the future serious issues with the right of privacy may arise.

On the other hand, as the results of BF only indicate whether one is familiar with a piece of information, it seems that the relative importance of this information is not so high as to overcome the interests of investigation.

In conclusion, it appears that the current possibilities of neuroscience to delve into human brains are much more limited than one might think based on popular media publications. In fact, at present there is actually little that threatens cognitive liberty and the right to privacy in normal circumstances. But this also seems to be the moment to think exactly how much does society value these rights and how they should be balanced against the interests that exist in crime prevention and swift administration of justice. For if society would start thinking on those questions when it is already faced with the issue and difficult decisions have to be made under pressure, there is a great chance that grave mistakes will be made.

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Meetings:

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