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Coercive neuroimaging, criminal law, and privacy: a European perspective

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ABSTRACT

Different studies have shown that neuroimaging technologies can contribute to answering crucial legal questions of criminal law, generally regarding guilt, legal insanity and the risk of recidivism. However, the use of neuroimaging in criminal law also raises important legal questions. One of those questions is whether neuroimaging should be applied *coercively* to defendants and prisoners in light of privacy considerations. This paper examines this question regarding the European legal context. I argue that most neuroimaging applications yield data, which is, in terms of privacy sensitivity, no more sensitive than data acquired through current methods of criminal investigation, such as compulsory DNA testing. Therefore, I argue that some types of coercive neuroimaging will, in general and under certain specific conditions and safeguards, not contravene the right to privacy as set out in Article 8 of the European Convention on Human Rights. I suggest that while on the one hand one could advocate the need for a novel, specific European human right to mental privacy, on the other hand, it is possible to argue that such a right may be superfluous in respect of the use of existing neuroimaging technologies.

KEYWORDS: Neurolaw, Privacy, Forensic neuroimaging

INTRODUCTION

In 2015, four studies were published in this journal, which examined the way in which neurobiological information is being used in the criminal justice systems of the USA, Canada, England and Wales, and the Netherlands.[1] Recently, similar studies have also

1 Nita A. Farahany, *Neuroscience and Behavioral Genetics in US Criminal Law: An Empirical Analysis*, 2 J. Law Biosci. 485 (2015); Jennifer A. Chandler, *The Use of Neuroscientific Evidence in Canadian Criminal Proceedings*, 2 J. Law Biosci. 550 (2015); Paul Catley & Lisa Claydon, *The Use of Neuroscientific Evidence in the Courtroom by Those Accused of Criminal Offenses in England and Wales*, 2 J. Law Biosci. 510 (2015); C. H. de Kogel & E.

been published covering both the Slovenian and Australian legal approaches.[2] These studies show that neuroimaging technologies can contribute to addressing crucial criminal law issues, such as guilt, legal insanity, fitness to stand trial, and the risk of recidivism. However, the use of neuroimaging for criminal law purposes also *raises* important legal issues.[3] One of these is whether neuroimaging technologies should be applied *coercively* to defendants and prisoners in light of privacy considerations. In the USA, this question has been considered quite extensively: for example by Nita Farahany, Francis Shen, Michael Pardo, and Dennis Patterson.[4]

Although a similar question arises in the European legal context,[5] this question has received little attention.[6] Therefore, this paper poses the following question: how does coercive neuroimaging in criminal law relate to the right to respect for private life as laid down in Article 8 of the European Convention for the Protection of Human Rights and Fundamental Freedoms (ECHR)? In my view, most neuroimaging applications yield data, which is, in terms of privacy sensitivity, no more sensitive than data acquired through current methods of criminal investigation, such as compulsory DNA testing. Therefore, I argue that some types of coercive neuroimaging will, in general and under certain specific conditions and safeguards, not contravene the right to privacy as set out in Article 8 of the ECHR. Furthermore, I suggest that while on the one hand one could advocate the need for a novel, specific European human right to mental privacy,[7] on the other hand, it is possible to argue that such a right may be superfluous in respect of the use of existing neuroimaging technologies. Although the neuroscientific, philosophical, and ethical underpinnings of neuroimaging applications are an important topic in the neurolaw debate,[8] this paper only focusses on the *legal* implications of coercive use of such applications in light of the right to privacy.

The outline of this paper is as follows. Section 2 briefly mentions four neuroimaging applications and the way in which they could contribute to answering crucial questions

J. M. C. Westgeest, *Neuroscientific and Behavioral Genetic Information in Criminal Cases in the Netherlands,* 2 J. Law Biosci. 580 (2015).

2 Miha Hafner, *Judging Homicide Defendants by Their Brains: An Empirical Study on the Use of Neuroscience in Homicide Trials in Slovenia,* J. Law Biosci. (2019), DOI:\ignorespaces10.1093/jlb/lsz006; Armin Alimardani & Jason Chin, *Neurolaw in Australia: The Use of Neuroscience in Australian Criminal Proceedings,* Neuroethics (2019), DOI:\ignorespaces10.1007/s12152-018-09395-z.

3 Henry T. Greely, *Mind Reading, Neuroscience, and the Law*, in A Primer on Criminal Law and Neuroscience (S. J. Morse & A. L. Roskies eds., 2012); Sjors Ligthart, Thomas Douglas, Christoph Bublitz & Gerben Meynen, *The Future of Neuroethics and the Relevance of the Law*, 10 AJOB Neurosci. 120 (2019).

4 Nita A. Farahany, *Searching Secrets*, 16 U. Pa. L. Rev. 1239 (2012); Francis X. Shen, *Neuroscience, Mental Privacy, and the Law*, 36 H. L. Rev. 653 (2013); Michael S. Pardo & Dennis Patterson, Minds, Brains, and the Law: The Conceptual Foundations of Law and Neuroscience (2015).

5 R. Encinas de Muñagorri & C. Saas, *France. Is the Evidence Too Cerebral to Be Cartesian?*, 104 in Legal Insanity and the Brain: Science, Law and European Courts (Sofia Moratti & Dennis Patterson eds., 2016); Paul Catley, *The Future of Neurolaw*, 22 Eur. J. Curr. Leg. Iss., 1 (2016); Elena Rusconi & Timothy Mitchener-Nissen, *Prospects of Functional Magnetic Resonance Imaging as Lie Detector*, 7 Front. Hum. Neurosci. 1, 8 (2013).

6 D. van Toor, Het Schuldige Geheugen? Een Onderzoek Naar Het Gebruik Van Hersenonderzoek Als Opsporingsmethode in Het Licht Van de Eisen Van Instrumentaliteit en Rechtsbescherming (2017).

7 See on this topic Marcello Ienca & Roberto Andorno, *Towards New Human Rights in the Age of Neuroscience and Neurotechnology,* 13 LSSP (2017); Jan Cristoph Bublitz, *My Mind is Mine!? Cognitive Liberty as a Legal Concept*, in Cognitive Enhancement (E. Hildt & A. Francke eds, 2013).

8 For this, see *i.a.* Pardo & Patterson, *Supra* note 4.

of criminal law. Section 2 also describes two types of coercion, which can be used in order to apply different neuroimaging applications. Section 3 describes the general meaning and scope of the right to privacy contained within Article 8 ECHR. Thereafter, Section 4 compares coercive neuroimaging in criminal law to current methods of criminal investigation, within the context of the right to privacy. Subsequently, Section 5 examines the legal implications of the right to privacy for coercive neuroimaging in criminal law (which I also call 'coercive forensic neuroimaging'). The results of this analysis are discussed in Section 6.

COERCIVE FORENSIC NEUROIMAGING

Neuroimaging technologies enable us to examine our brains and their activity. In general, two types can be distinguished: structural and functional neuroimaging.[9] While structural neuroimaging technologies, like MRI and CT, show the biological structures of someone's brain (brain anatomy), functional neuroimaging, like fMRI and EEG, measures brain activity (indirectly), which can yield information about how someone's brain functions. Much research has been done regarding possible forensic applications of these neuroimaging technologies. Here, I focus on four categories of neuroimaging applications that can yield specific brain-related information and could therefore contribute to answering central questions of criminal law:[10]

I. Brain-based lie detection,[11]
II. Brain-based memory detection,[12]
III. Diagnostic neuroimaging, and[13]
IV. Neuroimaging to predict future dangerousness ('neuroprediction').[14]

Through acquiring information from the brain of 'the subject', these four neuroimaging applications, each in their own way, may be very helpful to answering crucial questions of criminal law. Neuroimaging may assist in determining guilt, legal responsibility, fitness to stand trial, and the risk of recidivism.[15] As well as these four methods, more

9 Sarah Richmond, *Introduction,* in 3 I Know What You're Thinking: Brain Imaging and Mental Privacy (Sarah Richmond, Geraint Rees & Sarah J. L. Edwards eds., 2012).

10 For a brief discussion of these categories, see Sjors L. T. J. Ligthart, *Coercive Neuroimaging Technologies in Criminal Law in Europe. Exploring the Legal Implications for the Prohibition of Ill-Treatment (Article 3 ECHR)*, 87–89 in Regulating New Technologies in Uncertain Times (Leonie S. Reins ed., 2019).

11 Martha J. Farah et al., *Functional MRI-Based Lie Detection: Scientific and Societal Challenges*, 15 Nat. Rev. Neurosci. 123 (2014).

12 J. Peter Rosenfeld (ed.), Detecting Concealed Information and Deception: Recent Developments (2018).

13 Joseph R. Simpson (ed.), Neuroimaging in Forensic Psychiatry: From the Clinic to the Courtroom (2012).

14 Andrea L. Glenn & Adrian Raine, *Neurocriminology: Implications for the Punishment, Prediction and Prevention of Criminal Behaviour*, 15 Nat. Rev. Neurosci. 54 (2014); Eyal Aharoni et al., *Neuroprediction of Future Rearrest*, 110 PNAS 6223 (2013).

15 Farahany, *supra* note 1; De Kogel & Westgeest, *supra* note 1. See also Gerben Meynen, *Forensic Psychiatry and Neurolaw: Description, Developments, and Debates*, Int'l J.L. & Psychiatry, DOI: 10.1016/j.ijlp.2018.04.005 (2018); Henry T. Greely & Anthony D. Wagner, Reference Guide on Neuroscience, 798–99 (2011).

potential forensic applications of neuroimaging, are conceivable. A very interesting (relatively new) application is the use of neuroimaging together with machine-learning algorithms, which enables researchers to identify 'real-time thoughts' of an individual. Using this technology in a laboratory setting, researchers have been able to detect actual thoughts in real time about abstract physics concepts, and also identified suicidal thoughts with 91% accuracy.[16] Although this form of 'real-time neurotechnological mind reading' is still in its infancy, it may become a very valuable tool for future criminal investigators in determining whether a defendant has relevant knowledge about a specific crime.

Note that most of the neuroimaging applications discussed in this paper—especially real-time mind reading —are still in their experimental stages and therefore not ready for practical forensic use yet (although the results of some of these tests, like lie detection, have already been introduced, though rejected, as evidence, and memory detection has even already been used in a legal proceeding[17]). An important current limitation of lie and memory detection is, for example, that the subject can manipulate the scan results, using mental or physical countermeasures, such as moving his tongue or recalling emotional memories.[18] To some extent, this limitation applies to any neuroimaging application, since neuroimaging data are useless if the subject moves his head a few millimeters.[19] However, horizon scanning is an important task of neurolaw scholars in order to anticipate coming developments and consider potential legal implications of (coercive) neuroimaging in criminal law. It is important to do this before new technology actually arrives in court.[20]

When thinking about *coercive* neuroimaging, it is important to think about how different neuroimaging applications could be used effectively in a situation where coercion is applied to the suspect. Basically, there are two types of 'coercion' that may be used: physical and legal coercion.[21] In the context of *physical coercion*, a noncooperative or even resistant subject could be physically overpowered in order to enable a successful brain scan. For instance, a resistant subject might be physically secured in a way that makes movement impossible. In some cases, this could enable the examiner to accomplish a specific neuroimaging assessment.[22] Another possibility is the use of drugs that prevent movements for the purpose of carrying out the neuroexamination.

16 Robert A. Mason & Marcel A. Just, *Neural Representation of Physics Concepts*, 27 Psychol. Sci. 904 (2016); Marel A. Just et al., *Machine Learning of Representations of Suicide and Emotion Concepts Identifies Suicidal Youth*, 1 Nat. Hum. Behav. 911 (2017).

17 E.g. United States v. Semrau, 693 G.3d 510 (6th Cir. 2012); Larence A. Farwell, *Brain Fingerprinting: A Comprehensive Tutorial Review of Detection of Concealed Information with Event-Related Brain Potentials*, 6 Cogn. Neurodyn. 115, 131–32 (2012).

18 J. Peter Rosenfeld et al., *Simple, Effective Countermeasures to P300-Based Tests of Detection of Concealed Information*, 41 Psychophysiology 205 (2004); Anthony Wagner et al., *fMRI and Lie Detection: A Knowledge Brief of the MacArthur Foundation Research Network on Law and Neuroscience*, 3 (2016).

19 *Cf*. Nancy Kanwisher, *The Use of fMRI in Lie Detection: What Has Been Shown and What Has Not*, 12 in Using Imaging to Identify Deceit (Emilio Bizzi et al. eds, 2009).

20 Thomas Nadelhoffer & Walter Sinnott-Armstrong, *Neurolaw and Neuroprediction: Potential Promises and Perils*, 7 Philos. Compass. 631, 634 (2012).

21 Ligthart, *supra* note 10, at 89; Pardo & Patterson, *supra* note 4, at 153.

22 Ligthart, *supra* note 10; S. K. Thompson, *The Legality of the Use of Psychiatric Neuroimaging in Intelligence Interrogation*, 90 Cornell Law Rev. 1601, 1631 (2005).

Contrary to physical coercion, *legal coercion* does not imply any physical force in order to successfully accomplish a neuroimaging assessment. Instead, with legal coercion, the law threatens noncooperation with negative consequences for the subject, in order to make him *decide* to cooperate with a specific neuroimaging assessment. Such a legal threat could be direct (eg 'if you do not cooperate with test X, you will be punished', or 'if you do not cooperate with test X, adverse inferences might be drawn from your noncooperation') or rather indirect, formulated as an offer (eg 'you may be allowed out on parole, if you cooperate with test X').[23]

Regarding coercive neuroimaging in light of the right to privacy, the type of coercion that is used is relevant in two ways: practically and legally. The *practical relevance* is that some (functional) neuroimaging applications require the *active cooperation* of the subject.[24] For instance, in the context of brain-based lie detection, the subject has to perform a task by pressing a yes-or-no-button after each question. Furthermore, some types of brain-based memory detection, like the concealed information test, require the subject to *attentively* observe the presented stimuli.[25] In such cases, the use of physical force would probably be useless and would not assist in compelling a subject to perform a certain task, or to pay full attention to observing particular stimuli. Finally, as previously mentioned, the subject could influence the results of (most) neuroimaging applications through the use of countermeasures, like recalling emotional thoughts or moving his tongue. Physical coercion is, however, unlikely to prevent countermeasures like these.

The *legal relevance* of the distinction between physical and legal coercion is two-fold. Firstly, unlike legal coercion, physical coercion implies an (additional) interference with someone's (right to respect for) bodily integrity, which right is guaranteed by Article 8 ECHR.[26] Secondly, in the context of (indirect) legal coercion, the subject *decides* to cooperate with a certain neuroimaging application. Perhaps reluctantly he *consents* to it because, for instance, his cooperation will subsequently allow him to be released on parole. Free and informed consent to a particular governmental action removes state liability under specific European human rights, including Article 8 ECHR.[27] However, in the context of criminal justice, this may not always amount to *free* and informed consent. The circumstances when the right to respect for private life will be violated are discussed in the following section.

THE RIGHT TO PRIVACY AND ARTICLE 8 ECHR: A BRIEF INTRODUCTION

Article 8(1) ECHR states: 'Everyone has the right to respect for his private and family life, his home and his correspondence'. This paper only focuses on the right to respect

23 *Cf.* Jonathan Pugh, *Coercion and the Neurocorrective Offer*, in Treatment for Crime: Philosophical Essays on Neurointerventions in Criminal Justice (David Birks & Thomas Douglas eds., 2018).

24 Gerben Meynen, *Brain-Based Mind Reading in Forensic Psychiatry: Exploring Possibilities and Perils*, 4 J. Law Biosci. 311, 320 (2017).

25 J. Peter Rosenfeld et al, *The Complex Trial Protocol (CTP): A New, Countermeasure-Resistant, Accurate, P300-Based Method for Detection of Concealed Information,* 45 Psychophysiology, 906 (2008); Terence W. Piction, *The P300 Wave of the Human Event-Related Potential,* 9 J. Clin. Neurophysiol. 456, 459 (1992).

26 See Section 3 below.

27 Wannes Buelens, Coralie Herijgers & Steffi Illgems, *The View of the European Court of Human Rights on Competent Patients' Right of Informed Consent. Research in the Light of Article 3 and 8 of the European Convention on Human Rights,* 23 Eur. J. Health. Law. 481 (2016).

for private life. According to the Grand Chamber of the European Court on Human Rights (ECtHR), the notion of 'private life' within the meaning of Article 8 ECHR is a broad concept, which does not lend itself to exhaustive definition.[28] Since the ECtHR approaches the convention as a living instrument, which should be interpreted in light of the present-day conditions,[29] the meaning and scope of the notion of private life are continuously evolving, *inter alia* because of technological and social developments.

According to the Grand Chamber, personal autonomy is an important principle underlying the right to respect for private life.[30] In the same cases, the Court considers that it would be too restrictive to limit the notion of private life to an 'inner circle' in which the individual may live his own personal life as he chooses, but it also includes the right to lead a private social life, ie the possibility for an individual to develop his social identity.

Although the precise meaning and scope of the right to respect for private life are not fixed, it is clear that it covers the right to respect for physical and psychological integrity[31] and the protection of personal data.[32] In determining whether certain information recorded and retained by the authorities involves any of the protected private-life aspects, the ECtHR will have due regard to the specific context in which the information at issue has been recorded and retained, the nature of the records, the way in which these records are used and processed, and the results that may be obtained.[33] In any event, information relating to an identified or identifiable individual (personal data) falls within the scope of the right to respect for private life.[34]

Besides events within someone's private area, like one's home, the right to respect for private life offers, under certain circumstances, protection outside such private areas. A significant, but not necessarily conclusive, factor in this respect is the reasonable expectation of privacy of the person concerned.[35] Note, however, that the way in which the ECtHR applies the reasonable-expectation-of-privacy test differs from the way in which the Supreme Court of the USA considers privacy. Unlike Article 8 ECHR, the Fourth Amendment of the Bill of Rights only offers protection against searches if the person concerned has a subjective expectation of privacy that society recognizes to be reasonable.[36] In order to *restrict* the scope of the Fourth Amendment, it *only* protects those situations in which a person may have a reasonable expectation of his

28 ECtHR (GC) Paradiso and Campanelli v. Italy, appl.no. 25358/12, § 159 (January 24, 2017); ECtHR (GC) Aksu v. Turkey, appl.nos. 4149/04 and 41029/04, § 58 (March 15, 2012).

29 ECtHR Tyrer v. UK, appl.no. 5856/72, § 31 (April 25, 1978).

30 ECtHR (GC) Bărbulescu v. Romania, appl.no. 61496/08, § 70 (September 5, 2017); ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 66 (December 4, 2008).

31 ECtHR (GC) Paradiso and Campanelli v. Italy, appl.no. 25358/12, § 159 (January 24, 2017); ECtHR (GC) Bédat v. Switzerland, appl.no. 56925/08, § 72 (March 29, 2016).

32 ECtHR (GC) Magyar Helsinki Bizottság v. Hungary, appl.no. 18030/11, § 191 (November 8, 2016); ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 66–67 (December 4, 2008).

33 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 66 (December 4, 2008); Karin de Vries, *Right to Respect for Private and Family Life,* in Theory and Practice of the European Convention on Human Rights 673 (Pieter van Dijk et al. eds. 2018).

34 ECtHR (GC) Amann v. Switzerland, appl.no. 27798/95, § 65–67 (February 16, 2000); ECtHR (GC) Rotaru v. Romania, appl.no. 28341/95, § 43 (May 4, 2000).

35 ECtHR (GC) Bărbulescu v. Romania, appl.no. 61496/08, § 73 (September 5, 2017); ECtHR Uzun v. Germany, appl.no. 35623/05, § 44, 47 (September 2, 2010).

36 Smith v. Maryland, 442 U.S. 735 (1979), 735, 740–41. See also Farahany, *supra* note 4, at 1256–49.

privacy. Contrary to the Supreme Court of the USA, the ECtHR applies the reasonable-expectation-of-privacy test in order to *broaden* the scope of the right to privacy. Many aspects of someone's life are so private that they a priori fall within the scope of the right to respect for private life, including the right to respect for physical integrity, personal data, and the right to respect for the decisions both to have and not to have a child.[37] Furthermore, even if the private nature of, for example, certain information is not crystal clear, the ECtHR is willing to accept protection of the right to respect for private life, if one has a reasonable expectation of one's privacy. Privacy protection has for instance been acknowledged regarding secretly taking of footage of a defendant within a police station for the purposes of video identification, because the defendant did not have any expectation that such footage was being taken.[38]

If the government interferes with someone's protected private interests, the right to respect for private life will not necessarily be violated. According to Article 8(2) of the ECHR, interferences can be justified if they are in accordance with the (rule of) law and necessary in a democratic society in the legitimate interest of: national security, public safety or the economic well-being of the country, the prevention of disorder or crime, the protection of health or morals, or the protection of the rights and freedoms of others.[39]

Prior to applying the right to respect for private life to coercive neuroimaging in criminal law, what follows draws an analogy between coercive forensic neuroimaging on the one hand and, on the other hand, research methods about which case law of the ECtHR already exists, regarding rights protected by Article 8 ECHR.

AN ANALOGY: DNA AND FINGERPRINTS

As yet, there is no ECtHR case law regarding the use of coercive neuroimaging in criminal law. Therefore, it will be helpful to compare coercive forensic neuroimaging with other methods of criminal investigation, about which case law does already exist.[40] This case law about comparable methods can provide interesting insights into how we could, or, should, approach the use of coercive forensic neuroimaging in light of the right to respect for private life.

It has already been stated that neuroimaging applications acquire brain-related *information* of an individual that could assist in answering legal questions, relevant to guilt, legal insanity, fitness to plead, and recidivism risks. As mentioned earlier, the state's acquisition, retention, and use of information about an individual may fall within the scope of Article 8 ECHR. In establishing whether this is the case, the court will have due regard to the following (these are paraphrased) factors:

I. The nature of the information and the results that may be obtained
II. The specific context in which the information has been recorded and retained, and

37 ECtHR (GC) Paradiso and Campanelli v. Italy, appl.no. 25358/12, § 159 (January 24, 2017).

38 ECtHR Perry v. UK, appl.no. 63737/00, § 40–41 (July 17, 2003).

39 On this topic see David J. Harris et al., Harris, O'Boyle, and Warbrick Law of The European Convention on Human Rights 505 et seq. (2014).

40 Ligthart, *supra* note 10, at 94.

III. The way in which the information is used and processed.[41]

In this section, I argue that, in light of these three relevant aspects in the context of Article 8 ECHR, coercive neuroimaging is comparable to the compulsory taking and retaining of DNA and fingerprints. Not in the sense that they are completely similar, but that they have sufficient relevant similarities to take case law on DNA and fingerprints into account in the examination of the legal implications of coercive neuroimaging in light of Article 8 ECHR. However, there are also significant differences to which I will pay particular attention in Section 5.

I. The nature and possible results of the information. According to the Grand Chamber, a notable characteristic for DNA and fingerprints is that they contain unique data about an individual, which allows for identification.[42] This is because the information relates to an identified or identifiable individual; thus, DNA and fingerprints contain personal data.[43]

Just like DNA and fingerprints, brain anatomy and activity also relate to an identified individual (to the person who is subjected to a neuroimaging assessment). Therefore, the results of structural and functional neuroimaging must also constitute personal data. Furthermore, similar to DNA and fingerprints, the anatomy of a person's brain is arguably unique, since even the brains of monozygotic twins appear to be not identical.[44] In addition, research regarding 'brain printing' shows that brain activity (more specifically: functional brain connectivity) is also unique for any individual, just like a fingerprint.[45] For instance, as Finn et al. wrote in *Nature Neuroscience*:

> Here, we show that an individual's functional brain connectivity profile is both unique and reliable, similarly to a fingerprint. We demonstrate that it is possible, with near-perfect accuracy in many cases, to identify an individual from a large group of subjects solely on the basis of his or her connectivity matrix.[46]

So, DNA, fingerprints, and brain anatomy and activity are unique and personal. Furthermore, they are all biological in nature: they concern human characteristics and/or reactions, like the structure of someone's fingertip, the structure of one's brain, DNA in saliva or blood, hemodynamics in blood, and brain electricity. Accordingly, it is reasonable to assume that the ECtHR would find that neuroimaging data of this type constitute personal data.

Furthermore, the results that may be obtained from DNA and fingerprints may be used in the future to demonstrate information about someone's involvement, or future

41 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 67 (December 4, 2008); De Vries *supra* note 33, at 673.

42 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 72, 75, 84 (December 4, 2008); ECtHR Aycaguer v. France, appl.no. 8806/12, § 33 (June 22, 2017).

43 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 68 (December 4, 2008).

44 Alexander Mohr et al., *The Similarity of Brain Morphology in Healthy Monozygotic Twins*, 20 Cogn. Brain. Res. 106 (2004).

45 E.g. E. S. Finn et al., *Functional Connectome Fingerprinting: Identifying Individuals Using Patterns of Brain Connectivity,* 18 Nat. Neurosci. 1664, (2015); L. Waller et al., *Evaluating the Replicability, Specificity, and Generalizability of Connectome Fingerprints*, 158 Neuroimage. 371 (2017); Ienca & Andorno, *supra* note 7, at 14; Farahany, *supra* note 4, at 1281.

46 Finn et al., *supra* note 45, at 1669.

involvement, in a crime.[47] While the original taking of DNA and fingerprints pursues the aim of linking a particular person to the particular crime of which he is suspected, their retention pursues the broader purpose of assisting in the identification of future offenders.[48] The same applies *mutatis mutandis* to coercive forensic neuroimaging. In a criminal law context, brain-based lie and memory detection, as well as diagnostic neuroimaging, aim to contribute to answering questions regarding the subject's criminal responsibility, while neuroprediction helps identify the likelihood of future offending. Altogether, the nature and possible results of the information obtained with fingerprinting and DNA testing are in a relevant way comparable to those of coercive neuroimaging in criminal law.

II and III. The context and possible use of the information. Just like DNA testing and fingerprinting, coercive forensic neuroimaging will be used in the context of the criminal law.[49] The possible use of the information yielded through these tests is also similar. According to the ECtHR, the information obtained with fingerprinting and DNA testing can be used against the person concerned, but he can also reap a certain benefit from it: DNA and fingerprints also allow for the rapid elimination of a person identified as a possible suspect of a particular crime in the investigation of which DNA or fingerprints have been found.[50] This is also true for neuroimaging in criminal law. On the one hand, neuroimaging applications can contribute in the determination of a defendant's guilt, legal responsibility, and risk of recidivism, but, on the other hand, a defendant or prisoner can also *request*, for example, a brain-based memory detection or a diagnostic brain scan, in order to strengthen his statement of not knowing anything about the crime he is suspected of, or to support his claim of legal insanity.[51]

In sum, the nature, context and possible use of DNA and fingerprints are, to a relevant extent, comparable to those of the forensic neuroimaging. This enables us to compare these methods in more detail in the following section in light of case law regarding the right to respect for private life as developed through Article 8 ECHR.

AN ANALYSIS: COERCIVE FORENSIC NEUROIMAGING IN LIGHT OF THE RIGHT TO PRIVACY

INTRODUCTION

This section examines the main question of this paper: how does coercive neuroimaging in criminal law relate to the right to respect for private life as laid down in Article 8 ECHR? First, in Section 5.2, I explain how coercive neuroimaging interferes with the right to respect for private life (Article 8(1) ECHR). Subsequently, in Section 5.3, I argue that the (potential) interferences made by most neuroimaging applications can,

47 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 100, 105 (December 4, 2008); ECtHR Peruzzo and Martens v. Germany, appl.nos. 7841/08, 57900/12, § 40 (June 4, 2013).

48 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 100 (December 4, 2008).

49 For DNA and fingerprinting in this context see e.g. ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04 (December 4, 2008); ECtHR Caruana v. Malta, appl.no. 41079/16 (May 15, 2018); ECtHR Peruzzo and Martens v. Germany, appl.nos. 7841/08, 57900/12 (June 4, 2013); ECtHR W. v. The Netherlands, appl.no. 20689/08, (January 20, 2009); ECtHR Van der Velden v. The Netherlands, appl.no. 29514/05 (December 7, 2006); ECtHR Schmidt v. Germany, appl.no. 2352/02 (January 5, 2006).

50 ECtHR W. v. The Netherlands, appl.no. 20689/08, 8 (January 20, 2009).

51 Meynen *supra* note 15, at 3.

probably, be justified (using the qualifications to the right contained in Article 8(2) ECHR).

The premise of this analysis is the analogy between compulsory fingerprinting and DNA testing on the one hand and coercive forensic neuroimaging on the other hand. Based on similarities—but also on important differences—I will draw together relevant insights from case law regarding DNA and fingerprints to understand the way in which we could approach coercive forensic neuroimaging in light of the right to privacy.

HOW COERCIVE NEUROIMAGING INTERFERES WITH THE RIGHT TO PRIVACY

In contrast with the reasonable-expectation-of-privacy test employed in the US legal context,[52] in the European approach, this test is superfluous in examining whether and how coercive neuroimaging interferes with the right to respect for private life contained in Article 8 ECHR. As discussed in Section 3, the right to privacy as guaranteed by Article 8 ECHR directly protects someone's physical and psychological integrity and his personal data. As I argue below, coercive neuroimaging interferes with both of these rights.

Firstly, according to the ECtHR, a person's body concerns the most intimate aspect of private life; any medical intervention against someone's will—even if it is a minor interference—such as compulsory taking blood, saliva or urine, constitutes an interference with the right to respect for physical integrity and thus with the right to respect for private life.[53] Just like DNA testing,[54] neuroimaging is, basically, a medical procedure, that is commonly used in medical practice, for instance to locate a tumor (MRI), acquire information about bone fractures (CT), or to diagnose epilepsy (EEG).[55] Therefore, applying neuroimaging with coercion—so against the will of the subject—constitutes an interference with the subject's right to respect for private life, as would a compulsory X-ray screening for tuberculosis.[56] If the authorities use *physical coercion* in order to obtain a specific neuroimage, an additional interference will occur with the subject's right to physical integrity and thus with his right to respect for private life.[57]

Secondly, the Grand Chamber has found the protection of personal data to be of fundamental importance to a person's enjoyment of his right to respect for private life. Thus, the compulsory taking, retaining, and/or using of someone's personal data, like DNA or fingerprints interferes with the right to respect for personal data and thus

52 See *i.a.* Pardo & Patterson, *supra* note 4, at 153–54; Shen *supra* note 4, at 699; Madison Kilbride & Jason Iuliano, *Neuro Lie Detection and Mental Privacy*, 75, MD. L. Rev. 163, 192 (2015); John B. Meixner Jr., *Admissibility and Constitutional Issues of the Concealed Information Test in American Courts: An Update,* in Detecting Concealed Information and Deception: Recent Developments 423 (J. Peter Rosenfeld ed., 2018); Benjamin Holley, *It's All in Your Head: Neurotechnological Lie Detection and the Fourth and Fifth Amendments*, 28 Dev. Mental Health L. 12–3 (2009).

53 ECtHR Yuriy Volkov v. Ukrain, appl.no. 45872/06, § 84 (December 19, 2013); ECtHR Caruana v. Malta, appl.no. 41079/16, § 26 (May 15, 2018); ECtHR Schmidt v. Germany, appl.no. 2352/02, § 4 (January 5, 2006); ECtHR Young v. UK, appl.no. 60682/00, § 12 (October 11, 2005).

54 ECtHR Jäggi v. Switzerland, appl.no. 58757/00, § 38 (July 13, 2006).

55 *Cf.* Greely & Wagner *supra* note 15, at 763–65, 768, 772.

56 ECHR Acmanne and others v. Belgium, appl.no. 10435/83 (December 10, 1984).

57 *Cf.* ECtHR Coman v. Romania, appl.no. 29106/13, § 38–42 (May 31, 2016).

with the right to respect for private life.[58] As we saw in Section 4, neuroimaging results contain personal data. Therefore, obtaining (retaining and using) those results against a person's will through coercive neuroimaging also constitutes an interference with the right to respect for private life.

So, in short, coercive neuroimaging in criminal law interferes with the right to respect for private life in two ways: through an interference with (i) the subject's bodily integrity and (ii) his personal data. But potentially unlawful interferences will only occur if the neuroimaging is carried out without the subject's consent. It is because coercive neuroimaging is a medical procedure that yields personal information, and it is used *against the will of the subject*, that it interferes with the right to respect for private life. This is because, according to the ECtHR, 'Any medical intervention against the subject's will or without the free, informed, and express consent of the subject constitutes an interference with his or her private life'.[59]

Interesting, in this regard, is that a medical intervention that is applied *with* the subject's free, informed, and express consent will normally *not* interfere with the subject's right to respect for private life.[60] Regarding forensic neuroimaging, however, the question arises whether and, if so, under which conditions consent for a particular neuroimaging application could be considered to be free, since refusing cooperation with neuroimaging could in some cases have (indirect) negative legal implications for the subject. For example, if for a successful parole request, the results from a recent neuroprediction test are a prerequisite; in such a case, the prisoner who wants parole could feel pressured to give his consent and cooperate 'willingly' with a neuroprediction assessment. In cases like this, however, the question arises whether consent given under such a kind of indirect legal pressure can be considered to be free or whether such pressure will invalidate (the voluntariness of) the consent. Examining this question requires an in-depth analysis of the philosophical and legal principle of informed consent, as well as the case law of the ECtHR in which the validity of informed consent has been at stake. While in my view, it can be argued both from a legal and philosophical perspective that in cases of imbalance of power and dependency, like in prison, the voluntariness of consenting decisions should be examined closely, further examination of this question is beyond the scope of this paper.[61]

WHETHER COERCIVE NEUROIMAGING COULD BE JUSTIFIED

As was briefly mentioned in Section 3, an *interference* with the right to respect for private life will not necessarily imply a *violation* of this right. According to Article 8(2) ECHR,

58 ECtHR Peruzzo and Martens v. Germany, appl.nos. 7841/08, 57900/12, § 33 (June 4, 2013); ECtHR M.K. v. France, appl.no. 19522/09, § 29 (April 18, 2013); ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 67, 77, 86 (December 4, 2008).

59 ECtHR Juhnke v. Turkey, appl.no. 52515/99, § 76 (May 13, 2008). See also ECtHR Atudorei v. Romania, appl.no. 50131/08, § 161–64 (September 16, 2014); Buelens, Herijgers & Illegems, *supra* note 27.

60 Which is even true in the context of the absolute prohibition of ill-treatment, in which context the ECtHR has stated that, if there is informed consent for a medical procedure, no issues arises under this prohibition (ECtHR Bogumil v. Portugal, appl.no. 35228/03, § 71 (October 3, 2008). See Ligthart *supra* note 10.

61 For this discussion see *i.a.* Pugh *supra* note 23; Sjors Ligthart, *Coercive Forensic Neuroimaging and the Prohibition of Ill-treatment (article 3 ECHR)*, in Law, Science and Rationality (Anotonia M. Walterman, David Roef, Jaap Hage & Marko Jelicic, forthcoming).

such an interference can be justified if it (i) is in accordance with the law, (ii) serves a legitimate interest, and (iii) is necessary in a democratic society.

If the government develops sound legislation based on which coercive neuroimaging can be applied in criminal justice, in the legitimate interest of national security, the detection and prevention of crime, or the protection of the rights and freedoms of others, the first two requirements to justify an interference with the right to respect for private life are unlikely to give rise to much discussion.

The third requirement—whether the interference is necessary in a democratic society—is more open for debate. According to the ECtHR, an interference can be necessary if it corresponds to a pressing social need and, in particular, if it is proportionate to the legitimate interest pursued.[62] In this regard, the Court takes into account whether the reasons adduced to justify a particular measure are relevant and sufficient for the legitimate interest that the measure serves.[63] Ultimately, a 'fair balance' has to be struck between the competing interests of the individual on the one hand and of society on the other hand.[64]

In determining a fair balance and the necessity of an interference with the right to respect for private life, the ECtHR takes into account that a 'margin of appreciation' is left to the national authorities. The broader this margin, the more discretion States have in finding a fair balance between the competing interests at stake. The breadth of the margin of appreciation depends on a number of relevant circumstances, including the nature of the human right in issue and the nature and purpose of the interference.[65] If the right in issue is crucial to the individual's effective enjoyment of intimate or key rights, such as the right to personal autonomy, or, if another, particularly important facet of an individual's existence, or identity is at stake, the margin of appreciation allowed to the State will normally be restricted.[66] On the other hand, if there is no consensus within the member States of the Council of Europe, either as to the relative importance of the interest in issue or as to the best way of protecting it—particularly where the case raises sensitive moral or ethical issues—the margin will be wider.[67] So in sum, whether coercive neuroimaging in criminal law is necessary in a democratic society depends on whether it corresponds to a pressing social need and is proportionate with the aims pursued. This will be assessed within the margin of appreciation that is afforded to the member States. These three factors - margin of appreciation, pressing social need and proportionality - are discussed below regarding coercive forensic neuroimaging.

I. The margin of appreciation. In the investigation, punishment and prevention of crime, the member States of the Council of Europe are entitled to a certain

62 ECtHR (GC) Khoroshenko v. Russia, appl.no 41418/04, § 118 (June 30, 2015); ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 101 (December 4, 2008).

63 ECtHR (GC) Paradiso and Campanelli v. Italy, appl.no. 25358/12, § 179 (January 24, 2017); ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 101 (December 4, 2008).

64 ECtHR (GC) Paradiso and Campanelli v. Italy, appl.no. 25358/12, § 181 (January 24, 2017); ECtHR (GC) A, B and C v. Ireland, appl.no. 25579/05, § 229 (December 16, 2010).

65 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 102 (December 4, 2008).

66 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 102 (December 4, 2008); ECtHR (GC) Paradiso and Campanelli v. Italy, appl.no. 25358/12, § 182 (January 24, 2017).

67 ECtHR (GC) Paradiso and Campanelli v. Italy, appl.no. 25358/12, § 182 (January 24, 2017); ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 102 (December 4, 2008).

margin of appreciation.[68] However, since the discussion about the legal implications of (coercive) neuroimaging in criminal justice in Europe is still in its infant stage, there is no, as yet, consensus as to how to regulate the coercive use of these technologies in criminal law. Moreover, besides the lack of consensus regarding the possible *legal* implications, coercive forensic neuroimaging also raises important *ethical* and *moral* (privacy) issues, which are currently being debated.[69] These two elements—the lack of legal consensus and the ethical and moral sensitivity of coercive neuroimaging—suggest that the ECtHR might advocate a wider margin of appreciation for States that want to implement coercive neuroimaging in their criminal legal systems. However, in a landmark case concerning forensic DNA testing, the Grand Chamber considered that:

> The protection afforded by Article 8 of the Convention would be unacceptably weakened if the use of modern scientific techniques in the criminal-justice system were allowed at any cost and without carefully balancing the potential benefits of the extensive use of such techniques against important private-life interests. (. . .) The Court considers that any State claiming a pioneer role in the development of new technologies bears special responsibility for striking the right balance in this regard.[70]

So, where the ethical and moral sensitivity and the lack of legal consensus on the one hand might argue for a wider margin of appreciation, being a pioneer in applying coercive neuroimaging seems on the other hand also to narrow that margin. From a historical perspective, it is understandable that the ECtHR underlines the importance of cautiousness in introducing new technologies that yield personal information about civilians for purposes of criminal justice. After all, during the Second world war, and also during the *Stasi* regime in East Germany—only 35 years ago—certain thoughts and beliefs could have far-reaching negative consequences for individual civilians.

One could, however, argue that the use of some neuroimaging technologies in criminal law is not reserved for pioneering European countries anymore, since particular (mostly structural) neuroimaging technologies have already entered the criminal courtrooms of, *inter alia*, Slovenia, England and Wales, and the Netherlands. Although some neuroimaging technologies are indeed already being used in different criminal justice systems within Europe, yet there is no evidence that these technologies are applied with coercion. Therefore, being a pioneer in the use of *coercive* forensic neuroimaging will most probably restrict the margin of appreciation of the concerned State.

Besides the ethical and moral debates and the lack of legal consensus, the breadth of the margin of appreciation may be influenced by the nature of the right at stake. Thus, if coercive forensic neuroimaging interferes with the subject's effective enjoyment of intimate or key rights, or with another particularly important facet of his existence or identity, the margin of appreciation will be relatively small. As discussed in Section 4, coercive neuroimaging in criminal law interferes with the right to respect for privacy in two ways: through an interference with (i) the subject's physical integrity and (ii) his

68 ECtHR Klass and others v. Germany, appl.no. 5029/71, § 49 (September 6, 1978); ECtHR (GC) Murray v. UK, appl.no. 14310/88, § 90 (October 28, 1994).

69 Jesper Ryberg, *Neuroethics and Brain Privacy: Setting the Stage*, 23 Res. Publica. 153 (2017); Meynen *supra* note 15; Adina L. Roskies, *Mind Reading, Lie Detection, and Privacy*, in Handbook of Neuroethics 679–95 (Jens Clausen & Neil Levy eds., 2015).

70 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 112 (December 4, 2008).

personal data. However, using neuroimaging against someone's will in order to examine whether, for instance, a defendant answers a *specific* question truthfully, or whether he recognizes a *particular* object (like a gun) does not, in my view, interfere with an intimate or key right, nor with any important facet of someone's existence or identity. Therefore, the margin of appreciation within which States may balance the competing interests of coercive forensic neuroimaging should not be restricted.

It could be argued that some coercive neuroimaging applications, such as memory detection with the concealed information test, do interfere with a key or intimate right, namely with the right to personal autonomy.[71] The line of argument then is more or less the following. Memories are shielded from the outside world in such a way that, when they are not revealed by the person himself, others can never take cognizance of them. In addition, memories are an important part of someone's personal identity, because based on their experiences people continue or adapt their behavior and shape their identity. Any infringement with someone's autonomy to disclose his memories (or other thoughts) constitutes an interference with an intrinsic component of one's personality: if undisclosed, personal information is no longer separable, the right to privacy becomes illusory. Since brain-based mind reading is a method, which can reveal undisclosed information regarding someone's thoughts or memories, the margin of appreciation, in this regard, should be restricted.[72]

This line of argument seems to presuppose that neuroimaging applications, such as memory detection, extract a whole bunch of memories about all kind of experiences the subject has had so far. However, this is not very likely. Neuroimaging applications, which can, in a certain way, yield information regarding someone's thoughts or memories, such as brain-based lie and memory detection, only enable the examiner to detect some *specific* lies or memories regarding a *specific* event, such as a *particular* crime. Whether a defendant *recognizes* some particular objects, like a gun, getaway car, and sports bag, is, in general, not significant for his personal identity. Notice, however, that some neuroimaging applications can yield intimate information about someone's identity, eg regarding sexual preferences, which is relevant in the context of whether coercive neuroimaging application is proportionate (see point III below). However, in my view, *detecting* such information does not per se interfere with the subject's personal autonomy, which the ECtHR has defined as 'the right to make choices as to how to lead one's own life'.[73] In contrast, cases in which personal autonomy has been at stake have concerned topics like abortion, voluntary euthanasia, and recognition of transsexuals.[74]

Furthermore, it is questionable whether neuroimaging applications are indeed the only methods that can yield undisclosed personal information.[75] Such undisclosed

71 Andrea Lavazza, *Freedom of Thought and Mental Integrity: The Moral Requirements for Any Neural Prosthesis*, 12 Front Neurosci. 4 (2018); Van Toor *supra* note 6, at 298, 363–67.

72 Van Toor *supra* note 6, at 298, 363–67. *Cf.* Andrea Lavazza, *Freedom of Thought and Mental Integrity: The Moral Requirements for Any Neural Prosthesis*, 12 Front Neurosci. 4 (2018); Nita A. Farahany, *Incriminating Thoughts*, 64 Stan. L. Rev. 351, 406 (2012).

73 ECtHR M. and M. v. Croatia, appl.no. 10161/13, § 171 (September 3, 2015).

74 ECtHR (GC) A, B and C v. Ireland, appl.no. 25579/05, § 216 (December 16, 2010); ECtHR Pretty v. UK, appl.no. 2346/02, § 61–67 (April 29, 2002); ECtHR I./UK, appl.no. 25680/94, § 70–73 (July 11, 2002).

75 Moreover, one could also doubt whether neuroimaging indeed yields *undisclosed* information since thoughts, moods and emotions are also expressed by the way in which a person looks, reacts and behaves: Jesper Ryberg, *Neuroscience, Mind Reading and Mental Privacy*, 23 Res. Publica. 197, 206, 209 (2017).

information can, for instance, also be obtained through a compulsory blood alcohol test. This is because nobody knows how many beers a particular person drank during the time he was home alone, prior to driving—except for the person himself. If someone suspected of impaired driving does not disclose any information about his alcohol consumption by for example remaining silent and refusing to supply breath for a breathalyzer test, the undisclosed information can nevertheless be revealed by the authorities through a compulsory blood alcohol test. The fact that such a blood test reveals undisclosed information has not been held to contravene the right to respect for private life contained within Article 8 ECHR.[76] Blood alcohol tests do not interfere with a person's right to personal autonomy, ie with a person's right to make choices as to how to lead one's own life. The mere obligation to supply a small amount of blood, urine or saliva, or to cooperate with a single MRI or EEG scan does in principle not restrict a person in making choices about how to lead his life.[77]

Altogether, coercive forensic neuroimaging does not, in my view, interfere with any key right or other important facet of someone's existence or identity. Accordingly, the margin of appreciation afforded to participating States should not be restricted in this way. Furthermore, the ethical and moral sensitivity of coercive forensic neuroimaging and the lack of legal consensus, together with the aims of coercive neuroimaging, advocate a wider margin of appreciation. This margin, however, finds its limits in the statement of the ECtHR that any State claiming a pioneer role in the development of new technologies bears special responsibility for striking the right balance. However, the extent to which this special responsibility restricts the margin of appreciation for the use of coercive neuroimaging is hard to predict.

II. A pressing social need. To be necessary in a democratic society, coercive forensic neuroimaging should, within the margin of appreciation, correspond to a pressing social need. This requirement should not be very problematic for the use of coercive neuroimaging, since the Grand Chamber finds the application of new technologies, for example in the context of DNA testing, essential in the fight against crime:

> The Court finds it to be beyond dispute that the fight against crime, and in particular against organized crime and terrorism, which is one of the challenges faced by today's European societies, depends to a great extent on the use of modern scientific techniques of investigation and identification.

Especially with current levels of terrorism threat, the use of new technologies such as coercive neuroimaging will probably correspond to the pressing social needs of protecting national security and preventing (serious) crime and public disorder.

III. Proportionality. Finally, an interference in someone's right to respect for private life caused by a coercive neuroimaging application, has to be proportionate with the legitimate aim pursued in order to be recognized by the ECtHR as justified. Whether a

76 ECtHR Tirado Ortiz and Lozano Martin/Spain, appl.no. 43486/98 (June 15, 1999); ECHR X. v. The Netherlands, appl.no. 8239/78 (December 4, 1978).

77 This could be different though regarding compulsory neuroenhancement: Jan Christoph Bublitz, "*The Soul is in the Prison of the Body"—Mandatory Moral Enhancement, Punishment & Rights against Neuro-rehabilitation*, in Treatment for Crime: Philosophical Essays on Neurointerventions in Criminal Justice 302 (David Birks & Thomas Douglas eds. 2018).

specific coercive neuroimaging assessment will be proportionate, will depend on the circumstances of the particular case. Nevertheless, some general statements can be made in this regard.

In order to examine whether a fair balance has been struck between an interference with someone's right to respect for private life on the one hand, and the aim of that interference on the other, the ECtHR will determine the seriousness of the interferences made through coercive neuroimaging. As discussed in Section 4, coercive neuroimaging interferes with the subject's physical integrity and with his right to respect for personal data. The seriousness of both interferences is discussed below.

In the context of compulsory DNA testing through taking blood and saliva, the ECtHR considers that such methods are of very short duration, usually causes no bodily injury or any physical or mental suffering. Therefore, the interferences with the subject's physical integrity made through these compulsory methods are, according to the ECtHR, of 'minor importance' and 'relatively slight'.[78] Although a neuroimaging assessment usually takes longer than obtaining a blood sample, it normally causes no bodily injury nor mental suffering (except in specific cases where eg a pregnant or claustrophobic person is coerced to undergo a CT or fMRI scan). Some neuroimaging techniques do require injection of contrast liquid into the bloodstream of the subject, which is physically intrusive. However, although *injecting* contrast liquid may be more intrusive than *obtaining* a blood sample, such an injection does not constitute, in my view, a significantly more serious interference with someone's physical integrity than a compulsory blood test. So, because (coercive) neuroimaging usually causes no bodily injury nor any physical or mental suffering, the interference with the subject's physical integrity might, in the eyes of the ECtHR, be relatively slight and of minor importance. This could of course be different if the authorities use physical or chemical coercion in order to apply a particular neuroimaging application.[79]

The seriousness of the interference with the right to respect for personal data, respecting the collection and retention of personal data, like cellular material, DNA profiles, and fingerprints, depends on the sensitivity of the particular data in issue.[80] For instance, according to the Grand Chamber, cellular material is of a highly personal nature, contains much sensitive information about an individual, including information about the person's health, and contains a unique genetic code of great relevance to both the individual and his relatives.[81] Additionally:

> bearing in mind the rapid pace of developments in the field of genetics and information technology, the Court cannot discount the possibility that in the future the private-life interests bound up with genetic information may be adversely affected in novel ways or in a manner, which cannot be anticipated with precision today.[82]

78 ECtHR Van der Velden v. The Netherlands, appl.no. 29514/05, § 9 (December 7, 2006); ECtHR Caruana v. Malta, appl.no. 41079/16 (May 15, 2018); ECtHR Schmidt v. Germany, appl.no. 2352/02, § 4–5 (January 5, 2006).

79 See Ligthart *supra* note 10.

80 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 86, 120 (December 4, 2008).

81 *Id.* at § 72. That only a limited part of this information is actually extracted or used by the authorities through DNA profiling and that no immediate detriment is caused in a particular case does, according to the Court, not change this view (§ 73).

82 *Id.* at § 71. In this regard, we could for instance think of the possible predictive value of genetics in the context of criminal justice: Glenn & Raine *supra* note 14; Daniel R. Rosell & Larry J. Siever, *The Neurobiology of*

The ECtHR has been firm in stating that although DNA profiles contain a more limited amount of personal information than cellular material, the profiles do contain substantial amounts of unique personal data. In this regard, the Court notes that DNA profiles contain sensitive information about a person's ethnic origin and could be used for familial searching with a view to identifying a possible genetic relationship between individuals.[83] Following the Court's reasoning, fingerprints contain the least sensitive data in this respect, but nevertheless are protected by Article 8 ECHR since they contain unique information about an individual, allowing for his identification.[84]

The privacy sensitivity of the results of different neuroimaging applications is also distinctive. This has similarities with the results of fingerprinting and DNA testing. Most sensitive in this regard are probably the results of diagnostic neuroimaging. Just like current methods of diagnostics, diagnostic neuroimaging yields information that contains information regarding someone's (mental) health. In the view of the ECtHR, such information 'by its very nature constitutes highly sensitive personal data regardless of whether it was indicative of a particular medical diagnosis'.[85] If a specific diagnosis focusses on a sexual disorder, like paraphilia, the results will be even more sensitive in terms of privacy, since, according to the Court, someone's sexual interests concern a most intimate aspect of private life.[86] Additionally, it is not possible to discount the possibility that in the future, the privacy interests bound up with the results of diagnostic neuroimaging may be adversely affected in novel ways or in a manner, which cannot be anticipated with precision today in view of the developments in neuroprediction and brain printing.[87]

Secondly, similar to current risk assessment tools, neuroprediction could contribute to predicting somebody's behavior and his risk of criminal offending. Although the individual himself may not be aware of the information, which is yielded in this context,[88] the results of neuroprediction are quite sensitive in terms of privacy. After all, disclosing someone's (brain-based) risk to criminal offending, for instance through a legal verdict, could have far-reaching consequences for the person involved. Evidence as to the risk of future offending, or even of future arrest,[89] could for instance be problematic in the context of a job application or mortgage request.

Similar to diagnostic neuroimaging, the privacy sensitivity of the results of neuroprediction will increase if they relate to the subject's sexual life, such as the risk of child molestation or bestiality. The sensitivity of the yielded information will also increase if it (unforeseeably) contains information regarding the subject's health, for instance

Aggression and Violence, 20 CNS Spectrums. 254 (2015); Hannah L. Bedard, *The Potential for Bioprediction in Criminal Law* XVIII, Colum. Sci. & Tech. L. Rev. 268 (2017).

83 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 74–76 (December 4, 2008).

84 *Id*. at § 84.

85 ECtHR Surikov v. Ukraine, appl.no. 42788/06, § 75 (January 26, 2017); ECtHR Mockutė v. Lithuania, appl.no. 66490/09, § 94 (February 27, 2018).

86 ECtHR Dudgeon v. UK, appl.no. 7525/76), § 52 (October 22, 1981); ECtHR Stübing v. Germany, appl.no. 43547/08, § 59 (April 12, 2012).

87 *Supra* note 14, 44 and 45.

88 Meynen *supra* note 15, at 319.

89 Aharoni et al. *supra* note 14.

because the imaging results unexpectedly show the presence of a brain tumor.[90] As with diagnostic neuroimaging, we cannot discount the possibility that brain activity, which is measured in the context of neuroprediction, could in the future also be used for biometric identification of the person involved.

Finally, brain-based lie and memory detection, in general, probably yield the least sensitive information. Similar to fingerprinting and a blood alcohol test, the information acquired with memory and lie detection does not normally concern a sensitive area of someone's private life, but only relates to one specific, criminally relevant past event or act of the person concerned, on which the examination focusses (eg whether a defendant has been on a particular place, consumed alcohol before driving, recognizes a specific hammer, or was indeed visiting his parents at the time of a particular crime). Whether someone recognizes a specific object or visited his parents, is, in my view, not very sensitive in terms of privacy. Furthermore, contrary to, for instance, the neuroimaging results of neuroprediction and DNA testing, which can also be relevant in the context of a future job application or the determination of familial connections, the results of lie and memory detection are in principle only relevant within the context of a particular criminal procedure.

Ultimately, however, the sensitivity of the results will depend on the circumstances of a particular case. Applying brain-based lie detection in order to examine whether a sex offender watched child pornography during his probation, for instance, yields sensitive information regarding the subject's sexual life. Furthermore, brain-based lie and memory detection in the context of forensic diagnostics yield sensitive information regarding the subject's health. Such information could also be gathered unexpectedly, for instance if the fMRI results suggest that the subject suffers from a tumor or traumatic brain injury. Finally, the results of brain-based lie and memory detection could potentially be subjected to future scientific interpretation and could therefore affect the subject's privacy interests in a way that is not foreseeable.[91]

In sum, the privacy sensitivity of the results of the four neuroimaging applications that are discussed in this paper, are distinctive. Generally, the results of diagnostic neuroimaging are the most sensitive in terms of privacy, whereas those of brain-based lie and memory detection are likely to contain the least sensitive information.

However, irrespective of these differences in privacy sensitivity, these neuroimaging applications will yield a limited amount of personal data compared with (forensic) DNA testing. Cellular material, which is being obtained in the context of a DNA examination, contains much more sensitive personal information about the individual, eg regarding his health, ethnic origin, and familial connections. Although only a specific part of this information is relevant for the actual examination, taking cellular material implies that all sensitive information it contains will be acquired, just like a trawl catches marketable as well as undesirable fish. The four neuroimaging applications discussed above, however, do not serve as a trawl. The meaning, sensitivity and information richness of the data, which can be acquired through these applications, are, in prin-

90 *Cf.* Meynen *supra* note 15, at 2; Judy Illes et al., *Ethical and Practical Considerations in Managing Incidental Findings in Functional Magnetic Resonance Imaging*, 50 B&C, 358 (2002).

91 *Cf.* Lisa Claydon, *Brain-Based Mind Reading for Lawyers: Reflecting on Possibilities and Perils*, 4 J. Law Biosci. 594, 598 (2017).

ciple, limited by the specific purpose for which a particular test is applied and the question that precedes the test. Depending on the aim of a particular neuroimaging application in a specific case, these applications yield information regarding a specific mental or neurological disorder, a risk of particular criminal behavior, the recognition of a specific stimulus, or the truthfulness of a specific answer to a particular question.

Note, however, that further scientific developments could change this view. If neuroimaging (together with machine-learning) was able to detect all current thoughts of the subject, in the manner of real-time neurotechnological mind reading,[92] it could be possible that the subject's thoughts, which are detected unfiltered, could also contain sensitive and highly personal information: regarding political opinions, sexual orientation, or religious beliefs.[93] Contrary to the four neuroimaging applications discussed above, the information that such types of real-time mind reading yield is not limited by the specific purpose of the test or the questions of the examiner, but depends on the specific items the subject (accidently) thinks about during the examination (such as his political or sexual preferences).

Returning to the requirement that an interference with the right to respect for private life must, to be justified, be proportionate with the legitimate aim(s) pursued. Just like coercive forensic neuroimaging, compulsory DNA testing aims to contribute to the detection and/or prevention of crime and the protection of the rights and freedoms of others.[94] According to the Grand Chamber, a strong consensus exists among the member States about compulsory DNA testing, and as a result, a narrow margin of appreciation is permitted to the States in the assessment of the permissible limits in this context.[95] In individual cases, the ECtHR has ruled that compulsory taking, examining, and retaining (cellular material and) DNA was—within the narrowed margin of appreciation—proportionate with the legitimate aims pursued.[96]

Contrary to compulsory DNA testing, as yet, no consensus exists about how to regulate coercive neuroimaging in criminal law. Moreover, the coercive use of neuroimaging raises ethical and moral issues, which on the one hand advocate a wider margin of appreciation in comparison with forensic DNA testing. However, on the other hand, being a pioneer in introducing new neuroimaging applications in the context of criminal law also requires the State to bear special responsibility in striking the right, proportionate balance between the competing interests. So, in the end, the

92 *Supra* note 16.

93 *Cf*. Gerben Meynen, *Ethical Issues to Consider Before Introducing Neurotechnological Thought Apprehension in Psychiatry,* 10 AJOB Neurosci. 8 (2019).

94 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 100 (December 4, 2008); ECtHR Peruzzo and Martens v. Germany, appl.nos. 7841/08, 57900/12, § 40 (June 4, 2013); ECtHR W. v. The Netherlands, appl.no. 20689/08, § 8 (January 20, 2009); ECtHR Van der Velden v. The Netherlands, appl.no. 29514/05, § 9 (December 7, 2006).

95 ECtHR (GC) S. & Marper v. UK, appl.nos. 30562/04, 30566/04, § 112 (December 4, 2008).

96 E.g. ECtHR Caruana v. Malta, appl.no. 41079/16, § 28–42 (May 15, 2018); ECtHR Peruzzo and Martens v. Germany, appl.nos. 7841/08, 57900/12, § 44–49 (June 4, 2013); ECtHR W. v. The Netherlands, appl.no. 20689/08, § 9 (January 20, 2009); ECtHR Van der Velden v. The Netherlands, appl.no. 29514/05, § 9 (December 7, 2006). In the Case of S. & Marper v. UK, however, the unlimited and indiscriminate retention of DNA and fingerprints of arrested individuals who were later acquitted or had the charges against them dropped, constituted a violation of article 8 ECHR.

margin of appreciation regarding compulsory DNA testing and coercive neuroimaging may be (more or less) the same. Furthermore, as I argued, the seriousness of the interferences made by current forms of coercive forensic neuroimaging regarding the right to respect for bodily integrity and personal data, will, in general, be similar to or less serious than the interferences made by compulsory DNA testing. So, if compulsory DNA testing is proportionate with the interests of detecting and preventing crime, it is likely that coercive forensic neuroimaging, generally constituting similar or less serious interferences with the right to respect for private life, could—within a comparable margin of appreciation—also be necessary in a democratic society in order to detect and prevent (serious) criminal offenses and to protect the rights and freedoms of others.

CONCLUSION

Coercive neuroimaging in criminal law interferes with the right to respect for private life in two ways: through an interference with the subject's (i) right to respect for bodily integrity and (ii) personal data. I have argued that the interferences made by coercive neuroimaging are generally similar to, or, less serious than, those of compulsory DNA testing. Unlike forensic DNA testing, as yet no legal, ethical and moral consensus exists as to how to regulate coercive neuroimaging in criminal law, which advocates the application of a wider margin of appreciation by the ECtHR. Alternatively, it could be argued that being a pioneer in introducing new neuroimaging applications in criminal justice narrows the margin of appreciation. Therefore, in the end, the margin of appreciation regarding compulsory DNA testing and coercive neuroimaging may be, more or less, the same. The ECtHR has repeatedly considered compulsory DNA testing to be proportionate with the aims of the prevention and detection of crime.[97] Taking into account a similar margin of appreciation and a similar seriousness of the interference with the right to respect for private life, I argued that it is likely that the coercive use of existing neuroimaging applications in criminal law could, under certain restricting legal conditions, be justified in light of the right to respect for private live, just like compulsory DNA testing.

DISCUSSION

In this paper, I have argued that coercive neuroimaging in criminal law interferes with the right to respect for private life contained in Article 8 ECHR, but it is likely that the interferences made can be justified. Therefore, in my view, the generic European human right to privacy arguably does not offer very strong protection to defendants or prisoners who are coercively subjected to brain-based lie or memory detection, diagnostic neuroimaging, or neuroprediction. This conclusion raises the interesting question of whether an additional, specific European human right should be developed in order to adequately protect the notion of 'mental privacy' in times of technological advances.[98]

On the one hand, the conclusions of this paper suggest that such a right is desirable. This is because the current general right to privacy, in all likelihood, does not offer very

97 But it has come down against the unlimited and indiscriminate retention of DNA in some circumstances.

98 *Cf.* Ienca & Andorno, *supra* note 7; Lavazza, *supra* note 71; Bublitz *supra* note 7.

strong protection to the privacy interests of defendants or prisoners whose brains are being examined against their will. On the other hand, however, the fact that under the generic European human right to privacy, some coercive neuroimaging applications seem to be permitted, could also indicate that the privacy interests regarding those applications may be less substantial than one would intuitively assume. This raises the question why we should develop a specific human right for the protection of brain data, but, for instance, not for the protection of DNA and other highly sensitive genetic information, which, just like brain data, already fall within the scope of the generic right to privacy contained within Article 8 ECHR.[99]

Furthermore, as the right to respect for private life may not offer strong protection against forensic coercive brain imaging, other European human rights, such as the privilege against self-incrimination (Article 6 ECHR) and the prohibition of ill-treatment (Article 3 ECHR), may be more promising with regard to particular forms of coercive neuroimaging.[100] In addition, the right to freedom of thought, conscience, and religion (Article 9 ECHR) could come into play,[101] since this right (also) prohibits coercion to express thoughts or to divulge a religion or nonreligion conviction.[102]

Before we start thinking about an additional human right to mental privacy, the overall protection that the current legal framework of European human rights offers with respect to coercive neuroimaging should be examined with precision. The need for a novel European human right to mental privacy, which should protect against coercively acquiring information from people's brains, deserves further discussion from both legal and ethical perspectives.

99 See e.g. Council of Europe/European Court of Human Rights, Bioethics and the case-law of the Court (2016).

100 *Cf.* Ligthart *supra* note 10.

101 Jan Christoph Bublitz, *Freedom of Thought in the Age of Neuroscienc,* 100 ARSP. 1, 25.

102 Ben Vermeulen & Marjolein van Roosmalen, *Freedom of Thought, Conscience and Religion*, in Theory and Practice of the European Convention on Human Rights 738–39 (Pieter van Dijk et al. eds. 2018); Harris et al., *supra* note 39, at 595.