

Brain Scanning and Lie Detectors: The Implications for Fundamental Defence Rights

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Abstract

This paper will examine how advancing neuroscientific technologies may impact on the fundamental human rights of the citizen accused. The paper takes an exploratory approach to analysis; the techniques explored throughout the paper are in their infancy and yet to permeate the criminal justice process of England and Wales. As such technology develops, other jurisdictions may start relying on the technology and they may be utilized more frequently in criminal trials in countries around the world; which may influence the techniques use in England and Wales. The paper will argue that adversarial criminal justice process of England and Wales should be concerned with both the domestic and international developments in “lie detection” technology. Furthermore, England and Wales should resist any advances to utilize the technology at the pre-trial investigation or trial stage. The paper will conclude that there is a role for neuroscientific evidence to play in the criminal justice process; we just need to ascertain the parameters for its use.

1. Introduction

Currently, England and Wales do not employ the use of lie detectors in either the pre-trial¹ or trial stage; however, polygraph examinations are used to a limited extent in the post-conviction stage. The Offender Management Act 2007² provides that participation in a polygraph³ examination may be a condition placed upon the release of a convicted sexual offender.⁴ However, a safeguard is built into the statute that prohibits any statement made by an offender, in a polygraph examination, being used in criminal proceedings.⁵ Despite this exclusion, clinical trials have taken place to potentially widen the use of the polygraph tests in the criminal justice process. In April 2012, Hertfordshire Police and Professor Don Grubin from Newcastle University examined twenty-five “low-level” sexual offenders.⁶ The force claimed that the tests would be administered pre-charge and with the aim of ‘speed[ing] up the risk assessment process.’⁷ Although the twelve-month trial was voluntary, it raises a

number of questions about the potential impact for the suspect at the police station and trial stage.

2. Admissibility of Expert Evidence

The general rule of admissibility under English law is that witnesses should only testify to matters within their knowledge; evidence of both opinion and belief are inadmissible.⁸ However, there are common law exceptions to this. For an expert opinion to be admissible, the following needs to be satisfied:

- It will be of assistance to the court;⁹
- The expert has relevant experience;¹⁰
- The evidence is impartial¹¹ and;
- The evidence is reliable.

reliability of the evidence is of pivotal importance. There should be a sufficiently reliable scientific basis for the expert evidence.¹² Although, the neuroscientific technologies are yet to infiltrate the criminal trial process of England and Wales, therefore, it is difficult to conceive if the technologies would pass the reliability test.¹³

In some jurisdictions, such techniques have rendered inadmissible at the trial stage because of issues with reliability. In the US case of *Frye*¹⁴ the Court stated that the opinion of an expert, based on a scientific technique, would be inadmissible unless the test “[has been] sufficiently established to have gained the general acceptance in the particular field in which it belongs.”¹⁵ *Frye* involved a defendant who wanted to use a Systolic Blood Pressure Deception test to prove he was telling the truth when he denied a charge of murder. This test was the precursor the traditional polygraph test. However, the test at the time was not generally accepted by the scientific community and therefore affirmed the decision of the lower court. The Court did acknowledge the great difficulty, which existed in determining whether a scientific discovery crossed the line between experimental and demonstrable stages.¹⁶ But this traditional stance¹⁷ altered in the early 1990s when the Supreme Court held that it is for the judge to make an assessment of the reliability and relevance of the evidence.

In *Daubert*,¹⁸ the Supreme Court ruled that the 1923 *Frye* test superseded the 1975 Federal Rules of Evidence, Rule 702 governing expert testimony. The rule stated:

“If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.”

*Daubert*¹⁹ provided substantive criteria setting out the factors a court ought to consider when assessing scientific evidence: (1) whether the theory or technique can, and has been, tested; (2) whether the technique has been subjected to peer review and publication; (3) the known or potential error-rate of the technique; (4) the existence and maintenance of standards controlling the technique’s operation and; (5) the scientific technique’s degree of acceptance in the relevant scientific community.²⁰ This ruling means that the trial judge inevitably performs a role akin to that of a gatekeeper; determining if the evidence should pass these criterion and be admitted at trial.²¹ Guadet suggests that judges have embraced their role as gatekeepers²² and the standard has led to a reduction in excluded evidence on the basis of admissibility; lawyers will either advance a higher quality of expert evidence or refrain from making any submissions.²³

The *Daubert* case opened the door for the use of polygraph data in post-conviction sex offender management cases. In *Kansas v Lumley*²⁴ the defendant appealed against a prison sentence that resulted from a question he ‘failed’ to answer on a polygraph examination. On appeal, judge found the reliability of the examination robust enough to satisfy any evidential threshold required for a parole or probation hearing; as the standard of proof is lower than in a criminal trial. Thus granted his appeal. Nonetheless lie detection methods are still inadmissible at the trial stage. In *United States v Semrau*,²⁵ the defendant was charged with multiple counts of health care fraud and money laundering. Semrau attempted to call Dr. Steven Laken to testify about the results of the fMRI ‘lie detection’ test he undertook. The court excluded the evidence under Federal Rules of Evidence, rule 702(c), as the evidence is not the product of reliable principles or methods. However, the court did leave the door ajar concerning the future admissibility of such technology:

“[I]n the future, should fMRI-based lie detection undergo further testing, development and peer review, improve upon standards controlling the technique’s operation, and gain acceptance by the scientific community for use in the world, this methodology may be

found to be admissible.”²⁶

Likewise in England and Wales, new or novel experts have become welcome at trial. The court highlighted in *R v Clarke (Robert Lee)*²⁷ that there are no closed categories of expert evidence that could be placed before a jury. For it would ‘be entirely wrong to deny to the law of evidence the advantages to be gained from new techniques and advances in science’.²⁸ Despite the apparent open arms of the court to neuroscientific technology, the courts have exercised a great deal of caution to embracing new techniques.

In *Lundy v R*²⁹ the court outlined four factors that contained similarities to the *Daubert* standard the courts ought to consider when assessing a new technique or novel science:

1. Whether the theory or technique can be or has been tested;
2. Whether the theory or technique has been subject to peer review or publication;
3. The known or potential rate of error or existence of standards; and
4. Whether the theory of technique has been generally accepted.³⁰

This Privy Council four-fold test bears a striking resemblance to the tests outlined in the aforementioned USA cases and Part 19 of the Criminal Procedure Rules (2015). Arguably, however, The Criminal Practice Direction³¹ accompanying the rules in fact moves England and Wales towards making a *Daubert*³² decision. For the Directions provide factors the court may take into account when determining the reliability of expert evidence, these include: (a) the extent and quality of the data which the expert opinion is based; (b) if the opinion relies on an inference from the findings, whether the opinion explains how safe the inference is; (c) if the opinion is based on a test, measurement or survey, whether the opinion takes into account the degree of precision or margin of uncertainty; (d) whether the material upon the opinion is based has been reviewed by others with relevant experience; (e) the extent to which the expert opinion is based on material outside the field of expertise; (f) whether the expert took into account all relevant information in arriving at an opinion; (g) where in a range the expert opinion resides and whether the expert’s preference has been properly explained; and (h) whether the methods followed established practice in the field.

The Practice Direction incorporates all five aspects of the *Daubert* test. What is clear is that new technologies will not be prohibited from entering the courtroom, should the technology

satisfy the limbs of the onerous test. The remaining sections of this paper will examine if it will be possible for the scientific advances to obtain judicial approval. If it is not possible, the paper will examine if the criminal justice process should employ the technology at any stage.

3. Lie Detection Evidence

The allure in creating a technology that can accurately detect human deception has been around for centuries.³³ As scientists have attempted to develop techniques for detecting deception for as long as people have been deceiving each other.³⁴ This paper will examine the utility of the traditional Polygraph Examination, the Brain Electrical Oscillation Signature (BEOS) and Functional Magnetic Resonance Imaging (fMRI).

A polygraph test is known as a “lie detector,” however this label is somewhat of a misnomer. The test does not measure lies. In fact, it measures the physiological changes associated with the central nervous system; something which is largely outside the conscious control of the subject.³⁵ The accuracy of the polygraph test is a concern since “specific-incident polygraph tests can discriminate lying from truth telling at rates well above chance, although well below perfection.”³⁶ This is further compounded by the fact that little case law exists in the use of polygraph evidence in the courts of England and Wales. One of these cases in England and Wales is *Fennell v Jerome Property Maintenance Ltd.*³⁷ In *Fennell* it was suggested that the courts should not admit any ‘truth’ [seeking] drug as evidence as it will usurp the function of the trial judge. As a result, this technique remains on the periphery of both the pre-trial and trial stages.

The use of polygraph evidence in criminal proceedings in England and Wales has existed for over thirty years. The Phillips Commission in 1981 considered the use of these techniques at trial but was ultimately criticised for its “lack of certainty from an evidential point of view [for the purpose of court proceedings].”³⁸ Similarly, in the United States, the Federal Bureau of Investigation conceded that the results from the tests do not meet the standards to be admitted as evidence at the trial stage.³⁹ What this shows is that the scant availability of case law is not exclusively a problem attributed England and Wales since the United States also ruled polygraph evidence to be inadmissible at trial. Furthermore, Canada also excludes such evidence on the basis of a general “mistrust ... as a method for determining the truthfulness of an individual’s statements ... and there is a generally antipathy toward the use of the

technique in any court-related context.⁴⁰ However, Frederiksen argues that the technique is inadmissible, not because it is unreliable, but because the examiner provides direct expert evidence as to the credibility of the subject.⁴¹ Canadian courts, on the one hand, have allowed confessions founded on failed polygraph tests during a pre-trial investigation. This occurred in *R v Oickle*;⁴² the case concerned a suspect that undertook a voluntary polygraph, the interpretation of which would not provide admissible evidence since anything the suspect said during the test would be admissible. He was then informed he “failed” the test and he later made admissions. He was convicted; the court at first instance held that the polygraph was not a ground for exclusions because the police made it abundantly clear that any evidence obtained would be inadmissible. The Supreme Court overturned the ruling of the appeal court. Justice Iacobucci outlined four factors that should be used to determine whether a confession was voluntary:

1. The court must consider any threats or promises made by the police.⁴³
2. The court should look for oppression, if it is distasteful or inhumane that would amount to an involuntary confession.⁴⁴
3. The court must consider whether the suspect has an operating mind; are they aware what they are saying and who they are saying it to.⁴⁵
4. The court can consider the tactics used by the police to elicit a confession. If it goes as far as to ‘shock the community’, it should be inadmissible.⁴⁶

The Supreme Court’s decision was not unanimous; Arbut JJ dissented that the confession be excluded for two reasons.⁴⁷ First, the statements obtained were procured as a result of some kind of fear, prejudice or advantage held by the authorities. Second, the respondent was placed in an unfair position by having to lead prejudicial, unreliable and inadmissible evidence against himself in order to impeach the veracity of the statements he made.⁴⁸ Despite this argument, however, the Supreme Court re-instated the conviction.

Notwithstanding the decision in *Oickle*, there has been a general reluctance to use this technique in the courtroom. Even though polygraph examinations have infiltrated the post-conviction stage. Despite the criticisms of the method, the United States routinely uses polygraphs to manage offenders post-conviction. In 2007, over 80% of community treatment plans in the USA for adult sex offenders made use of the test.⁴⁹ It is estimated that polygraph accuracy is likely to be in the region of 80-90%.⁵⁰ In the early part of the Twenty-First

Century, the Home Office supported a voluntary polygraph pilot with a small group of sexual offenders.⁵¹ This study led to the National Offender Management Service (NOMS) commission a more sizable study across ten probation areas. NOMS then commissioned compulsory polygraph tests for sexual offenders;⁵² here, the test acted as a truth facilitator, where those who failed to comply with their polygraph license or those who disclosed clear license breaches as a result of the test could face being re-called to prison.⁵³ Offender managers welcome the technique at the post-conviction stage. They indicated that the test was helpful as it disclosed risk and provided them with confidence in the offenders' honesty. Furthermore, the study indicated that the sexual offenders in the community could make more disclosures, assisting in their post-conviction management and supervision.⁵⁴

Whilst the current use of polygraph testing is firmly rooted in the post-conviction stage of offender management, a potential new avenue for its use has arisen. Professor Don Grubin conducted a study on using the technique in the police station. Hertfordshire Police force used the technique on low-risk offenders on a voluntary basis. A "low-risk" offender was defined as those whose offending was believed to be limited to the downloading of indecent images and no police intelligence suggest any other involvement with sexual activity with children.⁵⁵ The findings of the study indicated that the testing can be useful for the investigation of men arrested for downloading indecent images.⁵⁶ Furthermore, the study claimed that significant cost savings could be made if the results of the testing meant suspects were confirmed as "low-risk". These savings would occur as the test would circumvent any need for a full investigation of the suspect and their IT devices.

4. Brain Based Lie Detection

The case of *State of Maharashtra v Sharma*⁵⁷ was one of the first worldwide to admit evidence of a controversial technique called Brain Electrical Oscillation Signature (BEOS).

In BEOS profiling the subject is presented with a probe, which contains references to the episode to be remembered. The electrical oscillations/ activity related to remembrance is called the "Signature" of the experience. The awareness of the remembered episode is called "Experiential Knowledge";⁵⁸ thus it can be said that the test measures remembrance of the Experiential Knowledge. The results of BEOS are obtained in form of electrical activity from the brain. Whilst the evidence was not a determining factor in her conviction, enough evidence existed to secure a conviction without the admissibility of the BEOS test,⁵⁹ the

application and admissibility of the test is a concern for the procedural rights of the defendant. The defendant fitted with a cap with 32 sensors was told to close her eyes and listen to statements. Note that she was not required to verbally respond to any of the questions asked. The questions were classified into three distinct categories, neutral, control and relevant.⁶⁰ The neutral categories allow the examiner to establish a baseline of answers, the control questions relate to personal information and the relevant questions are about the investigation. The BEOS computer based system analyses the electrical activity generated by the responses and compares it to the defendant's baseline. At trial, an expert witness for the prosecution claimed the BEOS system detects the difference between responses that are conceptual and experiential.⁶¹ Experiential knowledge is something the individual has experienced or witnessed personally. It is not something that they have second-hand knowledge of. It is something the defendant would have experienced. The experiential knowledge in this instance was the fact the defendant was alleged to hold was going into a shop to buy arsenic, mixing it with sweets and giving the sweets to her fiancé.⁶² The defendant was convicted and sentenced to life imprisonment.⁶³

Another form of brain based lie detection is Functional Magnetic Resonance Imaging (fMRI). This type of brain scan determines whether subjects are lying or being deceptive when being asked a series of yes or no/true or false questions. It does so by reading the subject's neural data and measuring the blood flow to different areas of the brain to distinguish whether subjects are engaged in non-deceptive behaviours.⁶⁴ Broadly speaking, it is argued that conclusions can be drawn about the brain activity at the time a particular question is asked. The basic idea behind fMRI⁶⁵ is that the signal for one area is increased when the person is telling the truth and the signal is increased for a completely different area when they are lying.⁶⁶ Studies illustrate that certain areas of the brain are correlated more with lying than telling the truth. One study suggested that if the subject did not use countermeasures,⁶⁷ deception accuracy was 100%; however, when the subject employed countermeasures, this fell to 77%. Kozel conducted a study where subjects were instructed to steal a watch or a ring from a room. When in the scanner, they were instructed to answer as if they had not stolen an item. The study identified what item was stolen 90% of the time.⁶⁸ Whilst it is outside the remit of this paper to assess the scientific validity of the technique, the results discussed represent a persuasive argument as to the effectiveness of the technique.⁶⁹ However, the technique can be cheated for it is easily disrupted by simple countermeasures.⁷⁰ Despite the

potential limitation posed by the impact of countermeasures, the technique has entered the USA courtroom.

*Wilson v Corestaff Services L.P*⁷¹ concerned a case of sexual harassment in the work place. A pivotal witness was an employee who would testify that a Corestaff employee told him not to offer work to the complainant, as she complained of sexual harassment. The complainant wanted to introduce expert evidence from an fMRI scan the witnesses undertook; the expert would testify that there was a “high probability” the witness was telling the truth.⁷² However, the evidence was held to be inadmissible using the *Frye* standard. This two-stage test requires the acceptance of the relevant scientific field and the testimony must be on a topic “beyond the ken of the average juror.”⁷³ In this instance, excluded the evidence as it raised a question of the credibility of the witness; the court held the deciding on credibility was solely a matter for the jury and clearly within the ken of the jury.⁷⁴

The case of *United States v Semrau*⁷⁵ also yielded a similar result of fMRI admissibility. The defendant sought to admit evidence of his own fMRI scan results which indicated that he was not being deceptive when he claimed he did not intend to commit fraud via his method of billing; the mistakes were a result of confusing billing codes. The defendant sought to call Steven Laken⁷⁶ to testify about his fMRI results. However, the evidence was again ruled inadmissible, as the technique does not have the general acceptance of the scientific community, owing to the lack of “real world testing.”⁷⁷ The door clearly is left ajar for neuroscience to enter the courtroom; despite the door being ajar, the technology cannot find a way into the courtroom and the case *Smith v Maryland*⁷⁸ further ruled expert evidence of fMRI scans as inadmissible. During a sentence hearing in a death penalty case, the court allowed fMRI evidence to be introduced. Brian Dugan had already entered a guilty plea for the rape and murder of 10-year-old child. The defendant claimed he should be spared the death penalty because he suffered from a psychopathic condition that impaired his ability to control his impulses to kill.⁷⁹ The court allowed the expert to explain the scans and to use diagrams of the brain but stopped short of allowing the jury to see scans of Dugan’s brain activity. Consequently Dugan received the death penalty. There is evidence to suggest that influence of the expert evidence was almost convincing. Two newspaper reporters, Barnum and St. Clair, suggest they have seen a signed verdict form discovered after sentencing. This form indicated the jury may have settled on a verdict of life in prison but later changed their

minds in further deliberations. If this is the case, it goes a little way to suggest the testimony may have been influential.⁸⁰

5. Implications: What if the evidence enters the courtroom - The Privilege against Self-Incrimination

fMRI technology is struggling to enter US courtrooms and it is highly probable the technology will suffer a similar fate in England and Wales. The evidence would fall foul of the test outlined in the CrimPR and the accompanying Practice Direction.⁸¹ However, if it were possible to satisfy the four-stage test of sufficient testing; peer review or publication; identifying the known or potential rate of error; and being generally accepted by the scientific community, there are potentially colossal ramifications for criminal procedure in England and Wales. Article 6 of the European Convention on Human Rights states that the right to a fair trial is absolute. In *Blunt v Park Lane Hotel Ltd*⁸² Goddard LJ said “the rule ... that no person is bound to answer any question if the answer thereto would, in the opinion of the judge, have a tendency to expose [him] to any criminal charge...”⁸³ The basic rationale for this privilege is to ensure the accused is protected from improper compulsion to answer questions by the State to avoid a miscarriage of justice. Furthermore, the Right ensures the evidence in the prosecution case was not obtained through illegitimate methods such as oppression or coercion.⁸⁴ In essence, the privilege strengthens the burden of proof; it is firmly placed on the prosecution and it is for them to prove the guilt of the defendant beyond a reasonable doubt. However, both domestic courts and the ECtHR have held the right not to incriminate oneself is not absolute. In *Murray*⁸⁵ there was no violation of Art. 6(1) when adverse inferences were drawn from the fact the accused exercised his right to silence after the police found the defendant in a house with an IRA kidnap victim. Finally, *Saunders*⁸⁶ held that transcripts taken under compulsory powers in an investigation into a company takeover did not contravene the Article 6(1).

Despite a lack of recognition from the Convention for the privilege, it is still a “generally recognised standard, which lies at the heart of fair procedure.”⁸⁷ If England and Wales were to admit such techniques to gather evidence, the method would almost certainly erode the privilege against self-incrimination. In the wake of the *Sharma*⁸⁸ appeal, *Smt. Selvi and Others v State of Karnataka*⁸⁹ further illustrates the potential threat to the privilege should neuroscientific evidence be admitted at trial. The case concerned both brain mapping and polygraph evidence; the Supreme Court held that the techniques were unconstitutional. The

court reiterated⁹⁰ the importance of the privilege against self-incrimination. To circumvent the privilege, the prosecution attempted to argue that polygraph evidence could be admitted into physical evidence (similar to blood, semen and hair) enabling it to, fall outside the remit of constitutional protection. But, the court rejected this contention and directed that the results from a polygraph examination are not dissimilar from admissions contained in oral or written reports. Furthermore, the types of evidence can be distinguished from bodily evidence, as the examiner will be extracting information that might not readily be available.⁹¹ However, the possibility remains that different jurisdictions will interpret the differently. As such, it is entirely plausible to believe that one jurisdiction will allow the evidence to be admissible at the trial stage.

6. Implications: The Right to Silence

The right to silence that a person, suspected of committing a crime, is within their rights to not contribute to either the pre-trial investigation⁹² or their own defence at trial. However, the right is not explicitly mentioned in the ECHR; it is a generally recognised international standard which lies at the heart of the notion of a fair procedure under Article 6.⁹³ Despite being a generally recognised standard, the right is not absolute,⁹⁴ although it is not possible for a defendant to be convicted “solely or mainly based on his silence or refusal to answer questions or give evidence himself.”⁹⁵ For strategic or tactical reasons, the suspect may wish to conceal knowledge about a particular crime and allow the prosecution to discharge the burden of proof. However, the suspect runs the risks of the jury being permitted to draw an adverse inference if the accused failed to ‘mention a fact which in the circumstances existing at the time the accused could reasonably have been expected to mention when so questioned.’⁹⁶ The inference the jury can draw is that the defendant has no answer or none that would stand up to cross-examination.⁹⁷

Whilst the current law of England and Wales does not permit an absolute right to silence, the accused is permitted to stay silent and the risk of inferences. However, if brain based lie detection were to become standard procedure, it is clear that the privilege against self-incrimination and the right to silence will effectively cease to exist. The defendant will not be providing answers to the questions orally, but his brain will be “answering” them; these answers potentially breach the privilege against self-incrimination. Interwoven with these concerns is the dilution of another fair trial right; access to a defence lawyer. In England and Wales, a suspect has the right to consult privately with a defence lawyer during the pre-trial

investigation.⁹⁸ The lawyer might advise the client to adopt a particular approach to question, one of which may be remaining silent. Arguably, the fMRI testing will dilute the effectiveness of the legal advice and potentially erode another fair trial right of the accused, scan would effectively be characterised as redundant evidence. This would be especially true if advice given in a conventional interview sought to keep the defendant silent throughout.

7. The Rise of Efficiency: The attraction of technology

Up to this point, this article has explored a number of technological advances in lie detection. The article has also examined the potential ramifications of such methods if the fundamental fair trial rights of the defendant were to be breached such as, the privilege against self-incrimination and the right to silence. As of yet it seems that these methods are unlikely to enter the criminal justice process of England and Wales because of technical issues. This is not to say that this will remain the case for long. Over the last fifteen years there has been a fundamental departure from the classic notion of adversarialism in England and Wales. This departure has given rise to a new form of process, namely managerialism. Underpinning the managerial approach to criminal justice is a goal to deal with cases as efficiently as possible. Lord Justice Auld's *Review of the Criminal Courts of England and Wales*⁹⁹ (hereafter, the Auld Review) provided the catalyst for a change in judicial culture in England and Wales. Auld LJ suggested that the 'criminal trial is not a game under which a guilty defendant should be provided with a sporting chance. It is a search for the truth ...'¹⁰⁰ and an implicit driver was to search for the truth as efficiently as possible. However, there are many possible purposes of the criminal trial.¹⁰¹

Is the adversarial criminal trial a search for the truth? The adversarial trial pits two opposing accounts of a situation in a battle against each other. The prosecution and defence are charged with the responsibility to examine the facets of each other's account and expose any weaknesses discovered during the public forum of the trial. It is during the trial where the advocates endeavour to 'reveal to the tribunal which witnesses can be relied upon and which can be cast aside.'¹⁰² In contrast, the inquisitorial trial process is believed to be to be more determined to discover the truth, opposed to the proof of the matter, as all parties involved in the process are obliged to discover all evidence (both inculpatory and exculpatory evidence). However, advocates in the English adversarial approach do have an overriding duty to the court; this ensures that they do not mislead the court.¹⁰³

Despite the search for the truth being central to the adversarial process, this search is balanced against various other considerations. These considerations include, maintaining the integrity of the system. The prosecution's case will only succeed should they be able to present enough evidence to convince, the jury in Crown Court cases or the Magistrates, that the defendant is guilty of the alleged offence beyond reasonable doubt. Procedural safeguards that not only protect the defendant but also help maintain the integrity of the system may also inhibit the search for the truth. These safeguards include the exclusion of evidence that was obtained inappropriately; this protects the defendant from any abuse of state power.¹⁰⁴ The skill, knowledge and experience of the advocate may also inhibit the search for the truth. The prosecution and defence lawyers may present polar opposite versions of an alleged incident. In trying to convince the jury or the magistrate that their version is the 'truth' this is dependent on the skill and experience of the advocate presenting the case, as well as the quality and temperament of the witnesses. The art and skill of advocacy is 'a highly refined one whose very best practitioners may manage to persuade in the face of facts...'¹⁰⁵ whereas an inexperienced ineloquent practitioner may not be able to convince the jury or magistrate. Could neuroscience assist in this quest for the truth?

Although this article accepts that the 'purpose' of the trial is a quest for the truth. There is no set definition, in either adversarial or inquisitorial jurisdictions, as to what the purpose should be even though the modern purpose is clear, to "deal with cases justly."¹⁰⁶ The courts have inevitably moved quickly in adopting this notion of efficiency espoused in *The Auld Review*.¹⁰⁷ In *Chabaan*¹⁰⁸ the judge refused the application on the basis that he expected the case to be dealt with expeditiously and it should not conclude beyond a pre-defined date. The defendant was convicted and he appealed *inter alia* that the judge should not have refused his expert application. The appeal was dismissed; Judge LJ stated that 'a judge has always been responsible for managing the trial ... that is one of his most important functions'.¹⁰⁹ Judge LJ highlighted the importance of dealing with cases expeditiously. He said that 'time is not unlimited ... the entitlement of a fair trial is not inconsistent with proper judicial control over the use of time ... every trial that takes longer than necessary is wasteful of limited resources.'¹¹⁰ The importance of dealing with cases efficiently and effectively is clear. Furthermore that adjournment to instruct experts in the making of speculative investigations is no longer tolerated. In fact, Judge LJ took the opportunity to reinforce this notion by explaining that the era of active case management had dawned. In *Jisl*¹¹¹ Judge LJ reiterated this point in addition to outlining the purpose of a criminal case is:

“Justice must be done. The defendant is entitled to a fair trial: and, which is sometimes overlooked, the prosecution is equally entitled to a reasonable opportunity to present the evidence against the defendant. It is not however a concomitant of the entitlement to a fair trial that either or both sides are further entitled to take as much time as they like, or for that matter, as long as counsel and solicitors or the defendants themselves think appropriate. Resources are limited ... [I]t follows that the sensible use of time requires judicial management and control.”¹¹²

With the goal to erode the ‘sporting chance’, Auld LJ suggests, by creating a single corpus of rules for a unified criminal court.¹¹³ As a matter of fact it has led to several recommendations that inspired the construction of the Criminal Procedure Rules 2005¹¹⁴ and with it, an implicit driver of efficiency. The quest for efficiency and desire to fulfil this Overriding Objective can, however, be seen to come at the expense of the privilege against self-incrimination. *Firth v Epping Magistrates’ Court*¹¹⁵ concerned an assault; at trial the prosecution was unable to establish the defendant’s presence at the scene. In the pre-trial case management form, the accused identified the real issues at hand was the matter was self-defence. At trial, the prosecution successfully relied on this as an admission that the accused was the assailant. However the defence argued the prosecution should not be allowed to rely on the case management form, as doing so will breach the privilege of self-incrimination. The court disagreed and the defendant was convicted. Without the admission on the case management form, the prosecution would not have been able to establish presence at the scene and therefore could not prove a cornerstone of their case. However, by admitting the case management form, the defendant is effectively incriminating themselves by admitting they were present at the scene by disclosing their defence of self-defence. On appeal, the court insisted this did not breach the privilege against self-incrimination.

This decision was reversed in *Newell*¹¹⁶ the appellant appealed against a conviction for possession of cocaine with intent to supply. At the Plea and Case Management Hearing (PCMH), the appellant did not serve a defence statement then when completing the case management form, the lawyer, who did not represent the defendant at trial, stated ‘no possession.’ On the morning of the trial and under the instruction of new solicitors, a defence statement was served in which he accepted possession of cocaine, but denied the intent to supply. The CPS sought to cross-examine him because there were inconsistencies with his case progression form and the defence statement admission. The judge allowed the cross-examination. The Court of Appeal allowed the appeal, as the judge should have excluded the

case progression form under s.78 Police and Criminal Evidence Act 1984, as the sanction of adverse inferences for the failure to serve the defence statement was sufficient.¹¹⁷ The position should be, provided the case is conducted in accordance with the letter and spirit of the Criminal Procedure Rules, that information or a statement written on a PCMH Form should in the exercise of the court's discretion under s.78 not be admitted in evidence as a statement that can be used against the defendant.¹¹⁸ The Court is making it clear that in certain circumstances there might be exceptions to this general rule where the spirit of the Criminal Procedure Rules has not been followed. This appears to re-establish the importance of the privilege and highlights the resulting unfairness should this be breached.

The paper has highlighted the implication of lie detection technology may breach the Article 6 rights of a defendant. Further to this breach, there is an argument that the use of the technology may also breach the Article 8 rights. This would mean that England and Wales would require re-drafted legislation to deal with authorities using the technology. Article 8 states that everyone has the right to respect for his private and family life, his home and correspondence.¹¹⁹ Furthermore, the Article allows that no interference by a public authority with the exercise of this right; except such as is in accordance with the law and is necessary in the interest of national security, public safety or the economic well-being of the country, for the prevention of disorder or crime.¹²⁰ In *Gillan and Quinton v United Kingdom*¹²¹ it was held that the current Stop and Search provisions under the Terrorism Act 2000 were neither sufficiently circumscribed nor subject to adequate legal safeguards against abuse; therefore there were not in accordance with the law. It is important to note, that the European Court focused on the notion of proportionality; in the case, there was no assessment of whether the measure was proportionate. This provides an interesting theoretical dilemma. To what extent would it be proportionate to invade the private space of a person, a person's brain, in order to elicit facts concerning possibly criminal activity? According to Article 8, any breach would have to 'necessary' and a threat to National Security. However, is the encroachment into Article 8, justified? Perhaps an encroachment could be permitted in "serious" or "grave" offences. This effectively renders the use of the technique redundant in the vast majority of ordinary criminal offences. However, in the case of terrorist offences, the technique may prove to be a valuable weapon in the investigation of such offences. This would be especially true, if the technique provides valuable evidence that stops an anticipated terrorist threat.

If the purpose of the criminal trial is a search for the truth, in the most efficient manner possible, then employing neuroscientific evidence may prove very attractive to our domestic criminal justice process. However, the lie detection technology would need to gain the acceptance of the relevant scientific fields but the ultimate quest for efficiency may mean the allure of neuroscience is too great to ignore. In the end, despite how desirable the use of evidence maybe, Article 8 effectively makes this use redundant, unless of the offence is one that affects national security. However, there may still be other uses for neuroscientific evidence in the criminal justice process.

8. The Implications of the use: The Jury

A function of a jury is to decide on the facts of what happened in a particular event. The conventional wisdom holds that a jury in applying the law, upon instruction by the court, can render their verdict accordingly.¹²² If the role of jury is carefully considered, they are in fact human lie detectors; they attempt to detect lies and deception that may challenge the credibility of any given witness. These challenges will allow them to provide the court with a carefully considered verdict. If the role of the jury as a lie or deception detector is of paramount importance, could they, or should they, be replaced by a superior lie detector. Humans are fallible and make mistakes when trying to detect when another person is lying. A 2006 study examined the ability of more than two hundred people to detect deception. The study found that the average detection rate was around 54%.¹²³

Currently fMRI technology is in its infancy in regards to entering the criminal court. Furthermore, the technique does not command the respect of the relevant scientific community. However, the success rates do look attractive; 90% success in detecting deception or 77% success when a counter-measure is employed.¹²⁴ If the technique did command the respect of the relevant scientific community, Rosen believes the admission into the arena of the criminal trial is inevitable.¹²⁵ However, if humans offer odds of success that are little better than one-in-two at identifying deception an argument emerges that it may be better to leave the deception detection to the technology. But this approach seems to present some danger to a jury since it is unclear how it will impact their decision. In particular, Pardo and Patterson believe there could be two potential ramifications. The first, they might misunderstand what they are seeing and the second, the evidence may “usurp the jury’s function of determining witness credibility.”¹²⁶ A result of this usurping it means that jurors may blindly defer to an expert witness forgoing their obligation to the court in assessing the

credibility of a witness. According to a 2011 study, it has been established that this may not be the case, because the role of jury can never be shadowed by neuroscientific evidence. The study found that jurors place a great deal of weight on expert opinion, specifically for interpreting fMRI evidence. The test results were presented to a mock jury¹²⁷ and the study found that potential jurors might consider evidence of a witness lying more compelling if it is accompanied by information ‘measured’ directly from the brain.¹²⁸ However, when the validity of fMRI testing was called into question under cross-examination, the results fell in line with the control condition that contained no detection.

Neuroscience could provide a valuable asset for the criminal trial. Neuroscientific testing could inform us if a juror or a witness holds a particular prejudice against a suspect owing to his race, religion, sexuality or something as frivolous as occupation or hobbies. Professor Hank Greely suggests that one could test for bias as people hold a variety of prejudices.¹²⁹ A potential juror could be asked to undergo a brain scan and asked a series of questions. Their answers could be examined to ascertain whether or not they were telling the truth. This could potentially re-affirm a central core component to the adversarial criminal justice trial; the notion that you will be tried by an unbiased jury of your peers. Damaska states that judgment by one’s peers is not an essential characteristic but it emerges naturally as a workable system.¹³⁰ In the high profile George Zimmerman case, a juror claimed that racial bias played a part in the acquittal of Zimmerman.¹³¹ However, claims of racial bias by jurors are nothing new. Research indicates that the application of justice is highly uneven, as even small changes in the composition of the jury pool have a large impact on average conviction rates for black versus white defendants. They also show that defendants of a particular race is treated more favourably when the jury pool contains more members of their own race.¹³² If one could conduct neuroscientific screening tests on juries to ascertain if they hold any prejudices be it racial or otherwise, what would that mean for the defendant’s right to a fair trial. It would surely only enhance, that core, fundamental right.

9. Conclusion

This article has explored the theoretical ramifications and dangers of the fair trial rights of the defendant should neuroscientific techniques used to detect lies are to become admissible at trial. At face value, the dangers are stark. For it would be almost impossible for the accused to rely on his right to silence when his brain inadvertently provides non-verbal answers to questions asked by the investigating authorities. Thus providing the prosecution with

potential incriminating evidence against a defendant. It is therefore difficult to envisage that the extraction of such answers do not erode the privilege against self-incrimination; as aforementioned in the Indian case of *Sharma*.¹³³ It has been defended that the fundamental right of legal advice could also be fundamentally diluted if such techniques became mandatory since it is not impossible for a suspect to follow the legal advice to remain silent when his brain at the same time was involuntary providing the answers sought by investigators. Additionally, there are also further fair trial concerns when the impact on the jury is examined. The evidence has the propensity to usurp the jury from its traditional domain of fact judging and tester to credibility. Research evidence suggests that juries place an inordinate amount of weight on the fMRI lie detection and may actually deprive the juror of their primary role of judging facts.¹³⁴

In a classic adversarial process, these concerns may remain theoretical for a great deal of time. However, England and Wales have arguably departed from classic adversarialism and transformed the criminal justice process to one that desires, and arguably prioritises, efficiency and effectiveness. The CrimPR permit judges to manage cases in order to fulfil the overriding objective of dealing with cases justly.¹³⁵ On a side note, to meet this overriding objective the court has equipped itself with various case management powers. One such power is ‘making use of technology’¹³⁶ Sir Brian Leveson, President of the Queen’s Bench Division has called on courts to make a better use of technology.¹³⁷ The question, whether or not neuroscience should play apart in criminal proceedings in England and Wales is difficult to answer. In its current guise, the answer is quite evidentially no, it should not. The techniques have not been subjected to enough rigorous peer reviewing and therefore the techniques do not have the respect of the scientific community. However, if the techniques are able to satisfy the admissibility rules of England and Wales, the question is still difficult to answer.

Theoretically, the quest for efficiency may fundamentally weaken core fair trial rights of the defendant, as the essential role of legal advice is somewhat usurped. However, if the purpose of the criminal trial is to ascertain the truth and the technology enables the truth to be revealed more efficiently, is there an argument that such technology should be embraced? After all, the overriding objective of the CrimPR is to deal with cases justly.¹³⁸ The definition of justly involves ‘acquitting the innocent and convicting the guilty,’¹³⁹ if neuroscientific techniques can assist in reaching this objective, perhaps the use of the techniques requires serious consideration; especially when considering how to use the technology and offending

the rights of the accused. For the sake of ‘dealing with cases justly’, it is important for the law to keep pace with science.

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¹ However, a pilot was conducted to examine the use of polygraph tests in the pre-trial stage; see, D. Grubin, A. Joyce and E.J. Holden, ‘Polygraph Testing of “Low Risk” Offenders Arrested for Downloading Indecent Images of Children’, *Sexual Offender Treatment*, (2014), Volume 9(1), available here: <http://www.sexual-offender-treatment.org/131.html> [last accessed 1/3/2016].

² S.28-30 The Offender Management Act 2007.

³ Although polygraph testing might not fall under traditional neuroscience, it is a technique used to detect deception. Other techniques may strictly speaking be more ‘neuroscientific’; the traditional polygraph test involves measuring a person’s nervous system so it is neuro if not cognitive neuro. Polygraph tests are often mentioned under the same umbrella as brain imaging and scanning; see Fox, D. (2011) ‘The right to silence protects mental control’, in Freeman, M. (Ed.): *Law and Neuroscience Current Legal Issues*, Vol. 13, p.347, Oxford University Press, Oxford. For the purposes of this paper, the author takes an umbrella approach to neuroscience to include polygraph testing.

⁴ Section 28(1) Offender Management Act 2007 provides that ‘The Secretary of State may include a polygraph condition in the licence of a person to whom this section applies.’

⁵ S.30(2)(a) Offender Management Act 2007.

⁶ D. Grubin, A. Joyce and E. J. Holden ‘Polygraph Testing of ‘Low Risk’ Offenders Arrested for Downloading Indecent Images of Children’, *Sexual Offender Treatment*, Volume 9 (2014), Issue 1. Available here: <http://www.sexual-offender-treatment.org/131.html> [Last Accessed 20/11/2015].

⁷ <http://www.bbc.co.uk/news/uk-16371043> (accessed 20/11/2015) at para 5.

⁸ CPS, Crown Prosecution Service, ‘Guidance on Expert Evidence, (2014), First Edition at p.6

⁹ The opinion must provide the court of jury with information that is likely to be outside their knowledge or experience. In *R v Turner* (1970) 60 Cr. App 80 the credibility of the witness was a matter for the jury. Psychiatric evidence concerning how an ordinary person, not suffering with a mental disorder would react, was held to be inadmissible.

¹⁰ Evidence should not be given by unqualified or amateurs. In *R v Clarke & Morabir* [2013] EWCA Crim 162 an expert in bone fractures could not ascertain cause of death. Lord Justice Atkins [at para 77] held he did not have the expertise to give an opinion on the cause of death; he had never conducted a post-mortem and was distinguished in the field of osteoarticular pathology.

¹¹ See *R v Cleobury* [2012] EWCA Crim 17. A report of a DNA expert for an Appeal criticized the summing-up of the original trial judge and over emphasized the importance of forensic evidence to the case.

¹² CPS, Crown Prosecution Service, ‘Guidance on Expert Evidence, (2014), First Edition at p.6.

¹³ The factors the court take into account can be found in Criminal Practice Directions Amendment, No.1 [2014] EWCA Crim 1569 at paragraphs V33A.5-6.

¹⁴ *Frye v United States*, 54 App. D.C. (1923).

¹⁵ *Ibid* at 1014

¹⁶ *Ibid* at 1014

¹⁷ Although a number of states still use the guidance outlined in *Frye*. These States include, California, Illinois, Maryland, New York and New Jersey. However, in July 2013 Florida adopted the *Daubert* standard and Kansas adopted it in 2014.

¹⁸ *Daubert v Merrel Dow Pharmaceuticals, Inc.*, [509 U.S. 579], 1993.

¹⁹ *Ibid.*

²⁰ *Ibid* at 593-94

²¹ *Ibid* at 5.92.

²² L. M. Gaudet, Note, 'Brain Fingerprinting, Scientific Evidence and *Daubert*: A Cautionary Lesson from India', 51 *Jurimetrics J.* 293-318 (2011) 293-318 at 298.

²³ L. Dixon and B.Gill, 'Changes in the Standards for Admitting Expert Evidence in Federal Civil Cases since the *Daubert* decision' *Psychol. Pub. Pol'y & L.*(2001) 251 at 299.

²⁴ *Kansas v Lumley* (WL 218704) 1999.

²⁵ *United States v Semrau* United States Court of Appeals for the Sixth Circuit, 693 F.3d 510 (6th Cir 2012)

²⁶ *United States v Semrau*, No. 07-10074 M1/P, Report and Recommendation (W.D Tenn. May 31, 2010), *aff'd*, 693 F.3d 510 (CA 6, 2012) at p.31.

²⁷ [1995] 2. CR. App. R 425.

²⁸ *R v Clarke (Robert Lee)* 2 Cr. App. R 425 per Steyn LJ at 430.

²⁹ *Lundy v R* [2013] UKPC 28.

³⁰ It is important to highlight that the *Lundy* case was heard by the Privy Council. The decisions of the Privy Council are not binding on English courts, as the court is not part of the court hierarchy of England and Wales. Its decisions are very persuasive. However, the Council's decisions are considered by the English courts to be important and very worthy of consideration, particularly because many of the judges sitting in the Privy Council also sit in the UK Supreme Court. See further S. Voigt, 'Improving Credibility by Delegating Judicial Competence – the case of the Judicial Committee of the Privy Council', *Journal of Development Economics*, Vol 82(2), 2007, p348-373.

³¹ See Part 19, Criminal Practice Directions 2015, Division V, Evidence, available here:

<http://www.justice.gov.uk/courts/procedure-rules/criminal/practice-direction/2015/crim-practice-directions-V-evidence-2015.pdf> [Last accessed 7th March 2016].

³² *Daubert v Merrel Dow Pharmaceuticals, Inc.*, [509 U.S. 579], 1993.

³³ See K. Alder, 'The Lie Detectors: The History of an American Obsession (2009), (Nebraska: Bison Books). See also, National Research Council (2003), *The Polygraph and Lie Detection*, Committee to Review the Scientific Evidence on the Polygraph, Division of Behavioral and Social Sciences and Education, Washington D.C., The National Academies Press.

³⁴ See Kleinmuntz, B., and J.J. Szucko, (1984) Lie detection in ancient and modern times: A call for contemporary scientific study. *American Psychologist* 39(7)766-776.

³⁵ M. Stockdale and D. Grubin, 'The Admissibility of Polygraph Evidence in English Criminal Proceedings', *J. Crim. L.* 2012, 76(3) 232-253 at 233.

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- ³⁶ National Research Council (2003), *The Polygraph and Lie Detection*, Committee to Review the Scientific Evidence on the Polygraph, Division of Behavioral and Social Sciences and Education, Washington D.C., The National Academies Press at p.4.
- ³⁷ *Fennell v Jerome Property Maintenance Ltd*, *The Times*, (26th November 1986) QBD.
- ³⁸ Royal Commission on Criminal Procedure (1981) *Report*, Cm. 8092 (London: HMSO) at Para 4.76
- ³⁹ T. P Cross and L. Saxe, 'Polygraph Testing and Sexual Abuse: The Lure of the Magic Lasso' (2001) *Child Maltreatment* Vol.6 (3), 195-206 at 198.
- ⁴⁰ S. Frederiksen, 'Brain Fingerprinting or Lie Detector: Does Canada's Polygraph Jurisprudence apply to emerging forensic neuroscience technologies?' *Information, Communication and Technology Law*, Vol 20(2) June 2011, 115-132 at 119.
- ⁴¹ S. Frederiksen, 'Brain Fingerprinting or Lie Detector: Does Canada's Polygraph Jurisprudence apply to emerging forensic neuroscience technologies?', *Information, Communication and Technology Law*, Vol 20(2) June 2011, 115-132 at 126.
- ⁴² [2001] 1 LRC 472.
- ⁴³ *Ibid* per Iacobucci J at paras 48-57.
- ⁴⁴ *Ibid* per Iacobucci J at paras 58-62.
- ⁴⁵ *Ibid* at per Iacobucci J at paras 63-64.
- ⁴⁶ *Ibid* at 474.
- ⁴⁷ *Ibid* at para 150-151.
- ⁴⁸ *Ibid* at para 150
- ⁴⁹ R. McGrath, G.F. Cumming, S. Hoke and M. Bonn-Miller, 'Outcomes in a community offender treatment program: A comparison between polygraphed and matched non-polygraphed offenders', *Sexual Abuse: A Journal of Research and Treatment* (2007) Vol. 19(4) 381-393.
- ⁵⁰ National Research Council (2003), *The Polygraph and Lie Detection*, Committee to Review the Scientific Evidence on the Polygraph, Division of Behavioral and Social Sciences and Education, Washington D.C., The National Academies Press.
- ⁵¹ D. Grubin, (2006), 'Polygraph Pilot Report: Final Report', London: Home Office.
- ⁵² Over the age of 18 and sentenced to one or more years imprisonment for a sexual offence.
- ⁵³ T.A. Gannon, J.L. Wood, A. Pina, N. Tyler, M.F.L. Barnoux, E. A. Vasquez 'An Evaluation of Mandatory Polygraph Testing for Sexual Offenders in the United Kingdom', (2014) *Sexual Abuse: A Journal of Research and Treatment*, 178-203 at p.182.
- ⁵⁴ T.A. Gannon, J.L. Wood, A. Pina, N. Tyler, M.F.L. Barnoux, E. A. Vasquez 'An Evaluation of Mandatory Polygraph Testing for Sexual Offenders in the United Kingdom', (2014) *Sexual Abuse: A Journal of Research and Treatment*, 178-203 at p.196. However, owing to the small sample size of the study, the authors indicated more research should be undertaken before we can be certain of the benefits and risks of the technique.
- ⁵⁵ D. Grubin, A. Joyce and E.J. Holden, 'Polygraph Testing of 'Low Risk' Offenders Arrested for Downloading Indecent Images of Children', *Sexual Offender Treatment*, Vol 9(1) (2014) available here: <http://www.sexual-offender-treatment.org/131.html> [Last Accessed 25/11/15].
- ⁵⁶ D. Grubin, A. Joyce and E.J. Holden, 'Polygraph Testing of 'Low Risk' Offenders Arrested for Downloading Indecent Images of Children', *Sexual Offender Treatment*, Vol 9(1) (2014) available here: <http://www.sexual-offender-treatment.org/131.html>

offender-treatment.org/131.html [Last Accessed 25/11/15]. Although as with Gannon's aforementioned study, the sample was small and therefore by no means definitive.

⁵⁷ *State of Maharashtra v Sharma* C.C No 508/07 Pune, June 12, 2008 (India).

⁵⁸ For a wider discussion on the BEOS test see A. Yadav and M.S. Dahiya 'Brain Electrical Oscillation Signature Profiling (BEOS) – Effective as an aid to Investigation', (2012) *Journal of Forensic Research and Technology*, (3)8-65.

⁵⁹ L. M. Gaudet, Note, 'Brain Fingerprinting, Scientific Evidence and *Daubert*: A Cautionary Lesson from India, 51 *Jurimetrics J.* 293-318 (2011) 293-318 at 294.

⁶⁰ *State of Maharashtra v Sharma* C.C No 508/07 Pune, June 12, 2008 (India) para 101 at 59.

⁶¹ *Ibid* at 59-60.

⁶² See T.R. Brown and J.B. McCormick, 'New Directions in Neuroscience Policy' in J. Illes and B.J. Sahakian, *Oxford Handbook of Neuroethics*, (2011), OUP: Oxford, at p.682-683.

⁶³ However, the defendant was subsequently released on bail. See *Sharma v State of Maharashtra* (2008) Criminal Application No. 1294 of 2008 Criminal Appeal No 802 of 2008, 1, 4 (India).

⁶⁴ M.S Pardo and D. Patterson, *Minds, Brains and Law: The Conceptual Foundations of Law and Neuroscience*, 2013, (Oxford: Oxford University Press) p.81.

⁶⁵ G. Ganis, J.P. Rosenfield, J. Meixner, R.A. Kievit and H.E. Schendan, 'Lying in the Scanner: Covert Countermeasures Disrupt Deception Detection by functional Magnetic Resonance Imaging, 2011, *Neuroimage*, 312-9.

⁶⁶ M.S Pardo and D. Patterson, *Minds, Brains and Law: The Conceptual Foundations of Law and Neuroscience*, 2013, (Oxford: Oxford University Press) p.83.

⁶⁷ A countermeasure is an attempt by the subject to defeat the test; this could include a simple movement of a finger.

⁶⁸ See F.A. Kozel, K.A. Johnson, E.L. Grenesko, S.J. Laken, S. Kose, X. Lu, D. Pollina, A. Ryan and M.S. George, *Functional MRI Detection of Deception After Committing a Mock Sabotage Crime*, 2009, *J. Forensic Sci* 54(1) 220-331.

⁶⁹ Although, it must be noted that the claims for accuracy tend to be lab based tests with participants instructed to 'lie' in response to certain questions. This is, arguably, a very different scenario from the very tense situation where a person is being investigated in relation to a potentially very serious criminal offence.

⁷⁰ G. Ganis, P.J. Rosenfeld, J.Meixner, R.A. Kievit, H.E. Schendan 'Lying in the Scanner: Covert Countermeasures disrupt deception detection by functional magnetic resonance imaging' *NeuroImage*, (2011) Vol55(1) 312 where it was suggested that trained participants can alter test results by engaging in some taxing activity like mental calculations during control sequences which will enormously reduce the power of the contrast between truthful statements and lies.

⁷¹ 900 N.Y.S 2d 639 (May 14th 2010).

⁷² *Ibid* at 640.

⁷³ *Ibid* at 642.

⁷⁴ *Ibid* at 643. The court did also highlight at the ability of fMRI to determine truth or deception is not readily accepted by the scientific community.

⁷⁵ *United States v Semrau* (2010) WL 6845092 (W.D. Tenn, 1st June, 2010).

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- ⁷⁶ Dr. Laken was also the expert witness Wilson intended to call in *Wilson v Corestaff* 900 N.Y.S 2d 639 (May 14th 2010)
- ⁷⁷ Per Circuit Judge Stranch *United States v Semrau*, 693 F.3d 510 (6th Cir. 2012), No 11-5396 at p.16. accessible here: <http://www.ca6.uscourts.gov/opinions.pdf/12a0312p-06.pdf> [last accessed 26th January 2016].
- ⁷⁸ Memorandum Opinion and Order, *Maryland v. Smith*, No. 106589C (Montgomery Cty., Cir. Ct., M.D. Oct. 3, 2012).
- ⁷⁹ V. Hughes, Science in Court: Head Case, 2010, *Nature*, 464, 340-342 available here: <http://www.nature.com/news/2010/100317/full/464340a.html> [last accessed 26th January 2016].
- ⁸⁰ A. Barnum and S. St. Clair, Dugan Juror who Switched at last minute stands by death sentence, *Chicago Tribune*, 3rd December 2009, available here: http://articles.chicagotribune.com/2009-12-03/news/0912021217_1_death-sentence-two-jurors-death-penalty [Last Accessed 26th January 2016].
- ⁸¹ Part 19, Criminal Practice Directions 2015, Division V, Evidence, available here: <http://www.justice.gov.uk/courts/procedure-rules/criminal/practice-direction/2015/crim-practice-directions-V-evidence-2015.pdf> [Last accessed 7th March 2016].
- ⁸² [1942] 2 KB 253
- ⁸³ [1942] 2 KB 253 at 257.
- ⁸⁴ See E. Cape, Z. Namoradze, R. Smith and T. Spronken, *Effective Criminal Defence in Europe*, 2010, (Antwerp: Intersentia) at p.28 for a further discussion.
- ⁸⁵ *John Murray v United Kingdom* A/593 (1996) 22 EHRR 29.
- ⁸⁶ *Saunders v United Kingdom*, A/702 (1997) 23 EHRR 313
- ⁸⁷ See also *Funke v Funke* (1993) A/256-A(1993)16 EHRR 297. Here, the court recognised the privilege [and the right to silence] as part of the concept of the right to a fair trial as prescribed by article 6(1).
- ⁸⁸ *Sharma v State of Maharashtra* (2008) Criminal Application No. 1294 of 2008 Criminal Appeal No 802 of 2008, 1, 4 (India).
- ⁸⁹ [2010] 5 LRC 137.
- ⁹⁰ (2010) 7SCC. The Court held the right is a fundamental fair trial right and Article 20(3) of The Constitution of India provides “No person accused of an offence shall be compelled to be a witness against himself.”
- ⁹¹ (2010) 7SCC at para 158-161.
- ⁹² Whilst this is generally the case, there are exceptions to this rule. For example, the Director of Serious Fraud Office, under s.2(2) Criminal Justice Act 1987, can require questions to be answered during the investigation in cases involving serious and complex fraud. Furthermore, s.2(13) Criminal Justice Act 1987 creates an offence of failing to answer such questions.
- ⁹³ European Court of Human Rights: ‘*Guide on Article 6, Right to a Fair Trial (Criminal Limb)*’ (2014), Council of Europe, available here: http://www.echr.coe.int/Documents/Guide_Art_6_criminal_ENG.pdf [Last Accessed 29th January 2016] at p.22.
- ⁹⁴ *John Murray v United Kingdom* A/593 (1996) 22 EHRR 29.
- ⁹⁵ European Court of Human Rights: ‘*Guide on Article 6, Right to a Fair Trial (Criminal Limb)*’ (2014), Council of Europe, available here: http://www.echr.coe.int/Documents/Guide_Art_6_criminal_ENG.pdf [Last Accessed 29th January 2016] at p.23
- ⁹⁶ *R v Argent* [1997] 2 Cr.App.R. 27

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- ⁹⁷ *R v Cowen* (1996) Q.B. 373.
- ⁹⁸ S.58(1) Police and Criminal Evidence Act 1984.
- ⁹⁹ Auld LJ, *Review of the Criminal Courts of England and Wales* (HMSO: 2001).
- ¹⁰⁰ *Ibid.* at 154.
- ¹⁰¹ Professor Jenny McEwan argues that the purpose of the trial is multifaceted - See J. McEwan, *Evidence and the Adversarial Process – The Modern Law*, (Hart: Oxford, 1998) generally Chapter I.
- ¹⁰² S. Solley, The Role of the Advocate in M. McConville and Wilson (eds), *The Handbook of the Criminal Justice Process*, (Oxford: Oxford University Press, 2002) at 312.
- ¹⁰³ Rule 1.1(1) Criminal Procedure Rules 2015 ensures that cases are dealt with justly.
- ¹⁰⁴ See generally s.78 Police and Criminal Evidence Act 1984.
- ¹⁰⁵ L. Zedner *Criminal Justice* (Oxford: Oxford University Press, 2004) at p. 169
- ¹⁰⁶ Rule 1.1(1) Criminal Procedure Rules 2015, dealing with cases justly is the overriding objective of the Criminal Procedure Rules 2015.
- ¹⁰⁷ Auld LJ, *Review of the Criminal Courts of England and Wales* (HMSO: 2001).
- ¹⁰⁸ [2003] EWCA 1012.
- ¹⁰⁹ *ibid* per Judge LJ at para 35.
- ¹¹⁰ *ibid* at para 36.
- ¹¹¹ [2004] EWCA Crim 696.
- ¹¹² *ibid* per Auld LJ at para 114.
- ¹¹³ *ibid* at para 277.
- ¹¹⁴ The rules were created by Part 7 of the Courts Act 2003 s.69-73.
- ¹¹⁵ [2011] EWHC 388 (Admin).
- ¹¹⁶ *R v Newell* [2012] EWCA Crim 650.
- ¹¹⁷ [2012] EWCA Crim 650 at per Dobbs J at para 36.
- ¹¹⁸ *R v Newell* [2012] EWCA Crim 650 Per Ross J.
- ¹¹⁹ Article 8(1) European Convention of Human Rights 1953.
- ¹²⁰ Article 8(2) *ibid.*
- ¹²¹ (2010) Application No. 4158/05
- ¹²² J. Seaman, ‘Black Boxes: fMRI Lie Detection and the Role of the Jury’, (2015), *Akron Law Review*, volume 42(9), 931-939 at 934.
- ¹²³ T.R. Levine, R. K. Kim, H. S. Park and M. Hughes, ‘Deception Detection Accuracy is a Predictable Function of Message Veracity Base-Rate: A Formal Test of Park and Levine’s Probability Model’, (2006), *Communications Monographs*, vol.73(3) 243-260 at 244-45.
- ¹²⁴ F.A. Kozel, K.A. Johnson, E.L. Grenesko, S.J. Laken, S. Kose, X. Lu, D. Pollina, A. Ryan and M.S. George, *Functional MRI Detection of Deception After Committing a Mock Sabotage Crime*, 2009, *J. Forensic Sci* 54(1) 220-331
- ¹²⁵ J. Rosen, ‘The Brain on the Stand: How Neuroscience is transforming the legal system, (2007), *The New York Times Magazine*, 53, March 2011.
- ¹²⁶ M. Pardo and D. Patterson, *Minds, Brains and Law: The Conceptual Foundations of Law and Neuroscience*, (2013) Oxford: OUP at 116.

¹²⁷ There are numerous pitfalls to relying on mock jurors, most notably that very little is at stake in the mock trial, where as in the ‘real world’, the liberty of the defendant is at stake. See, D. Wolchover and A. Heaton-Armstrong, ‘Debunking Rape Myths’ 25th January 2008, New Law Journal, available here:

<http://www.newlawjournal.co.uk/nlj/content/debunking-rape-myths> [Last Accessed] 30th January 2015.

¹²⁸ D. P. McCabe, A. D. Castel and M. G. Rhodes, ‘The Influence of fMRI Lie Detection Evidence on Juror Decision-Making’, (2011), *Behav. Sci. Law*, 29, 566-577 at 574.

¹²⁹ H.T. Greely, ‘Prediction, Litigation, Privacy and Property’ in B. Garland (Ed) *Neuroscience and the Law: Brain Mind and the Scales of Justice* (Dana Press: Washington, 2005) at 114-157.

¹³⁰ M.R., Damaska ‘Evidentiary boundaries to conviction and two models of criminal procedure: a comparative study’, (1973) 121 *U Penn. LR.*, p.564.

¹³¹ *State of Florida v George Zimmerman 2013* (Case No 592012CF001083A) See further: Gabriel, R. ‘Race, bias and the Zimmerman Jury’ [online] <http://edition.cnn.com/2013/07/16/opinion/gabriel-bias-zimmerman> (accessed 20 January 2016).

¹³² See, S. Anwar, P. Bayer and R. Hjalmarsson, ‘The Impact of Race in Criminal Trials, The Quarter Journal of Economics, (2012) 127(2) 1017-1055. It is important to note that this study only consider racial prejudice in a US context.

¹³³ *State of Maharashtra v Sharma* C.C No 508/07 Pune, June 12, 2008 (India).

¹³⁴ L. Capraro, The Juridical Role of Emotions in the Decisional Process of Popular Juries, in *Law and Neuroscience: Current Legal Issues Volume 13*, M. Freeman (Ed), 2011, Oxford: OUP at p.416.

¹³⁵ Rule 1.1(1) Criminal Procedure Rules 2015.

¹³⁶ Rule 3.2(2) (h) Criminal Procedure Rules 2015.

¹³⁷ Judiciary of England and Wales, *Review of Efficiency in Criminal Proceedings*, (2015) available here: <https://www.judiciary.gov.uk/wp-content/uploads/2015/01/review-of-efficiency-in-criminal-proceedings-20151.pdf>

¹³⁸ Rule 1.1(1) Criminal Procedure Rules 2015.

¹³⁹ Rule 1.1(2)(a) Criminal Procedure Rules 2015.