

Neuroscience and Law: Australia

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Abstract The Australian legal system has not been receptive to new neuroscientific technology. Current case law and legislative provisions demonstrate the hurdles imposed by the rigorous admissibility standards.

1 Introduction

Structural neuroimaging studies such as CT scans and diagnostic MRI scans are routinely admitted as evidence in civil and criminal trials in Australia. Studies are proffered as evidence in, for example, cases determining the presence of brain injury due to trauma, (*R v Jeong Ming Foo* [2008] NSWSC 587) declaration of brain death due to pathology or injury, (*R v KT* [2007] NSWSC 83) diagnosis of brain pathology, (*Tabet v Gett* [2010] HCA 12) testamentary capacity and dementia (*Burgess v Leech* [2007] NSWSC 700) and mental illness (*R v Coleman* [2010] 9 NSWSC 177). It is the advances in neuroscience technology that enable non-invasive detection of brain activity using, in particular, functional MRI (fMRI) that has aroused considerable debate and interest.¹ There has been tremendous growth and widespread acceptance of fMRI in peer review scientific journals. Indeed, neuroscience has become a dominant aspect of social enquiry.² Investigative and exploratory fMRI neurological studies have in the course of research

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¹Rosen (2007), p. 39.

²Moriarty (2008), p. 29.

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demonstrated potential legal implications.³ As anticipation grows as new and improved imaging tools allow for more detailed imaging of the brain, so too does an awareness of limitations and challenges. Lawyers are of course very keen to introduce any neurological evidence to support their cases.

This rapid expansion of knowledge is creating difficulties in the reception of expert evidence and its ultimate utility in resolving a dispute. The role of expert evidence in the interpretation of fMRI images and the display of these images in an Australian court to judge and jury raises considerable concerns.

The focus of this chapter will be centred on neuroscience and criminal law, in particular the role of fMRI as a lie-detection tool and the evidentiary rules in place.

2 The Admissibility of Neuroscientific Methods in Australian Courts

The greatest area of attention has been focused on the role that neuroscience-based lie detection may make to criminal law.⁴ Various emerging neuroscientific techniques for detecting deception have been suggested as the next generation of lie-detection tools.⁵ The main technologies being electroencephalography (EEG),⁶ fMRI and brain fingerprinting.⁷ However, despite a relatively high profile in the media⁸ and scholarly attention,⁹ these technologies are rarely used in criminal proceedings worldwide and their potential is speculative.

There have been no cases in Australia to date where these techniques have been successfully introduced as evidence in both criminal and civil trials.

The primary focus for Australian courts rests with admissibility in criminal hearings. In Australia, the responsibility for evaluating the validity of scientific tests falls on the judiciary via the rules of evidence, in particular the Evidence Acts.¹⁰ Expert testimony based on functional studies is deemed to constitute a scientific technique warranting elucidation through the provision of expert evidence and therefore subject to the strict rules of evidence.

³ Baker (2009).

⁴ Shen and Jones (2011).

⁵ Greely and Iles (2007), p. 377.

⁶ Cournos and Bavaniss (2003). See also: *Maharastra v Sharma and Khandelwal*, Sessions Case No. 508/07 (June 12, 2008).

⁷ Farwell (1999); *Harrington V State*, 659 N.W.2d 509 (Iowa 2003).

⁸ Leenaghan and Guerrera (2005).

⁹ Dickson and McMahon (2005).

¹⁰ *Evidence Act 1995* (Cth); *Evidence Act 1971* (ACT); *Evidence Act 1975* (NSW); *Evidence Act* (NT); *Evidence Act 1977* (QLD); *Evidence Act 1929* (SA); *Evidence Act 2001* (Tas); *Evidence Act 2008* (Vic); *Evidence Act 1906* (WA). Chapter will focus on Cth and NSW jurisdictions.

Whilst overseas cases¹¹ may prove persuasive in Australian jurisdictions, fMRI evidence would have to meet relevancy criteria. The threshold enquiry when considering the admissibility of expert opinion evidence, as with evidence of any kind, is to identify its relevance.

Sections 55–56 of the *Evidence Act 1995* (Cth); *Evidence Act 1995* (NSW) (“the Acts”) provide:

Section 55 Relevant evidence

- (1) The evidence that is relevant in a proceeding is evidence that, if it were accepted, could rationally affect (directly or indirectly) the assessment of the probability of the existence of a fact in issue in the proceeding.
- (2) In particular, evidence is not taken to be irrelevant only because it relates only to –
 - (a) the credibility of a witness; or
 - (b) the admissibility of other evidence; or
 - (c) a failure to adduce evidence.

Section 56 Relevant evidence to be admissible

- (1) Except as otherwise provided by this Act, evidence that is relevant in a proceeding is admissible in the proceeding.
- (2) Evidence that is not relevant in the proceeding is not admissible.

Sections 76 of the Acts provide the general rule that operates to exclude evidence of an opinion and reflects the general common law approach:

Section 76 The opinion rule

Evidence of an opinion is not admissible to prove the existence of a fact about the existence of which the opinion was expressed.

Section 79 of the Acts provides an exception to section 76 and is relevantly in the following terms:

Section 79 Exception – opinions based on specialised knowledge

- (1) If a person has specialised knowledge based on the person’s training, study or experience, the opinion rule does not apply to evidence of an opinion of that person that is wholly or substantially based on that knowledge.

The general discretionary exclusions that apply to all otherwise admissible evidence must also be considered when determining the admissibility of an expert opinion. Sections 135–137 provide:

Section 135 General discretion to exclude evidence

The court may refuse to admit evidence if its probative value is substantially outweighed by the danger that the evidence might –

- (a) be unfairly prejudicial to a party; or
- (b) be misleading or confusing; or
- (c) cause or result in undue waste of time.

¹¹ *United States Of America v Lorne Allan Semrau*, (31 May 2010), No. 07-10074, Report and Recommendations and *Wilson v. Corestaff Services*, (14 May 2010), Supreme Court, Kings County, New York State Law Reporting Bureau.

Section 136 General discretion to limit use of evidence

The court may limit the use to be made of evidence if there is a danger that a particular use of the evidence might—

- (a) be unfairly prejudicial to a party; or
- (b) be misleading or confusing.

Section 137 Exclusion of prejudicial evidence in criminal proceedings

In a criminal proceeding, the court must refuse to admit evidence adduced by the prosecutor if its probative value is outweighed by the danger of unfair prejudice to the defendant.

All evidence must be shown to be relevant, in that it “could rationally affect (directly or indirectly) the assessment of the probability of the existence of a fact in issue in the proceeding”.¹² It is highly probable that scientific evidence, purportedly showing the likelihood that a testimony is true or false, would meet this criteria.

Section 79 raises three discrete questions to be resolved when considering the admissibility of opinion evidence; does the witness have *specialised knowledge*, is that knowledge *based on the person’s training, study or experience* and is the opinion of the witness *wholly or substantially based* on that knowledge. More difficult for Australian lawyers will be demonstrating that lie-detection meets the test laid out for expert opinions under section 79 (1).

The traditional “field of expertise” test applied by the common law has the consequence that a purported expert cannot give evidence in relation to areas of knowledge that do not form part of a “formal sphere of knowledge”.¹³ There is a line of authority which suggests that the evidence must derive from a body of knowledge or experience that is accepted as being reliable.

Dixon CJ, said in *Clark v Ryan*:¹⁴

On the one hand it appears to be admitted that the opinion of witnesses possessing peculiar skill is admissible whenever the subject-matter of inquiry is such that inexperienced persons are unlikely to prove capable of forming a correct judgment upon it without such assistance, in other words, when it so far partakes of the nature of a science as to require a course of previous habit, or study, in order to the attainment of a knowledge of it . . . While on the other hand, it does not seem to be contended that the opinions of witnesses can be received when the inquiry is into a subject-matter the nature of which is not such as to require any peculiar habits or study in order to qualify a man to understand it.

The judgement of King CJ in *Bonython v R*¹⁵ is often cited both in Australia and the UK when considering the “field of expertise” test. His Honour said:

Before admitting the opinion of a witness into evidence as expert testimony, the judge must consider and decide two questions. The first is whether the subject matter of the opinion

¹² Section 55 *Evidence Act 1995* (Cth), (NSW) and may be found so in relation to witness credibility: s55 (2) (a) of the *Evidence Act 1995* (Cth) (NSW) specifically considers the possibility of evidence being relevant in relation to the “credibility of a witness” is expressly acknowledged.

¹³ Freckleton and Selby (2009).

¹⁴ (1960) 103 CLR 486 at 491.

¹⁵ (1984) 38 SASR 45.

falls within the class of subjects upon which expert testimony is permissible. This first question may be divided into two parts: (a) whether the subject matter of the opinion is such that a person without instruction or experience in the area of knowledge or human experience would be able to form a sound judgment on the matter without the assistance of witnesses possessing special knowledge or experience in the area, and (b) whether the subject matter of the opinion forms part of a *body of knowledge or experience which is sufficiently organised or recognised to be accepted as a reliable body of knowledge or experience, a special acquaintance with which by the witness would render his opinion of assistance to the court.* The second question is whether the witness has acquired by study or experience sufficient knowledge of the subject to render his opinion of value in resolving the issues before the court.

Both *Clark* and *Bonython* confirm that the “field of expertise” requirement is concerned with the need for the opinion to derive from a “body of knowledge”, which is both “organised” and “accepted”. The purpose of the test is to ensure the trustworthiness and reliability of the science or technique that is to be relied upon.¹⁶ There is a line of common law authority in Australia, which imposes a threshold requirement of evidentiary reliability before a field of knowledge upon which an opinion is based can be left to a jury.¹⁷

This threshold question of evidentiary reliability at common law has often been determined by reference to the approach advocated by the United States Supreme Court in *Frye v United States*.¹⁸ The *Frye* test, or a variant of that approach, which considers whether there is “general acceptance” of a particular discipline for determining the question of reliability as part of the field of expertise rule has come to form part of the common law in Australia.¹⁹

Furthermore, “the concept of ‘specialised knowledge’ imports knowledge of matters which are outside the knowledge or experience of ordinary persons and which ‘is sufficiently organized or recognized to be accepted as a reliable body of knowledge or experience’”.²⁰

Chief Justice Spigelman of the New South Wales Supreme Court held in *R v Tang*²¹ that the meaning of “knowledge” for the purpose of section 79 is the same as that attributed by the United States Supreme Court in *Daubert v Merrell Dow Pharmaceuticals*²² at 590:

[T]he word knowledge connotes more than subjective belief or unsupported speculation. The term applies to any body of known facts or to any body of ideas inferred from such

¹⁶ Justice Peter McClellan, Chief Judge at Common Law, Supreme Court of New South Wales, “Admissibility of expert evidence under the Uniform Evidence Act”, Judicial College of Victoria 1 of 42 Emerging Issues in Expert Evidence Workshop Melbourne, 2 October 2009.

¹⁷ *R v Gilmore* [1977] 2 NSWLR 935, *Lewis v R* (1987) 88 FLR 104.

¹⁸ 293 F 2d 1013 (1923).

¹⁹ *R v Gallagher* [2001] NSWSC 462.

²⁰ *Velevski v The Queen* (2002) 187 ALR 233.

²¹ *R v Tang* (2006) 65 NSWLR 681 (CCA).

²² 509 US 579 (1993).

facts or accepted as truths on ‘good grounds’... Proposed testimony must be supported by appropriate validation- i.e., “good grounds”, based on what is known.

Chief Justice Spigelman’s judgement has been the subject of considerable discussion. It remains to be seen whether the approach preferred by Spigelman CJ in *Tang* will continue to be followed. At present, it is a persuasive case for the inadmissibility of neuroscientific lie detection evidence.

In *R v Tang*, the accused had been convicted of robbery with an offensive weapon; much of the prosecution’s case rested on Tang’s identification in video surveillance footage. The prosecution engaged Dr Sutisno as an expert in the field of forensic anatomy, which purportedly included expertise in “facial mapping” and “body mapping”. Only the final ground of the appeal referring to the admissibility of “body mapping” evidence was upheld on appeal.²³

The case emphasised that Dr Sutisno had failed to illuminate the basis for the factual science she drew her opinions from. Chief Justice Spigelman followed *Makita Pty Ltd v Sprowles*²⁴ in which Justice Heydon identified six useful points for assessing the admissibility of expert opinion evidence. These include: the expert’s duty to demonstrate a “specialised knowledge”; identify the specific aspect which the witness is an expert in; the substantial basing of the opinion in that expert knowledge; the identification and proof of “observed”, “accepted” and “assumed” facts; proof that “the facts on which the opinion is based” are a “proper foundation for it”; and the demonstration of those bases.²⁵

Although Justice Spigelman differentiated Australian law from the application of the *Daubert v. Merrell Dow Pharmaceuticals*²⁶ test in other instances, in characterising the first limb of the section 79 test His Honour held that the meaning of “knowledge” is the same as that identified in the reasons of the majority judgment in *Daubert*. That is: “[T]he word ‘knowledge’ connotes more than subjective belief or unsupported speculation. The term applies to any body of known facts or to any body of ideas inferred from such facts or accepted as truths on good grounds”.²⁷ Therefore, while American case law on fMRI technologies does not create precedent, it is likely that the treatment of lie-detectors under the *Daubert* test for “knowledge” would be “instructive”²⁸ in the Australian discussion of admissibility.

²³ 509 US 579 (1993) at 156.

²⁴ *Makita (Australia) Pty Ltd v Sprowles* (2001) 52 NSWLR 705 (CA).

²⁵ *Makita (Australia) Pty Ltd v Sprowles* (2001) 52 NSWLR 705 (CA), JA Heydon, at 85.

²⁶ *Daubert v Merrell Dow Pharmaceuticals Inc [1993] USSC 114*; 509 US 579 (1993) (here after known as ‘*Daubert*’).

²⁷ *R v Tang* (2006) 65 NSWLR 681 (CCA) CJ Spigelman at 138.

²⁸ *R v Tang* (2006) 65 NSWLR 681 (CCA) CJ Spigelman at 139.

In the *United States of America v Lorne Semrau* (2010),²⁹ the admissibility of fMRI lie-detection was examined under the principles laid out in *Daubert*.³⁰

The defendant, Semrau, was a CEO of two corporations which contracted with psychiatrists. He was prosecuted for fraud and money laundering after allegedly indicating the services provided attracted a higher rate of reimbursement than they did. Semrau pleaded not guilty and sought the services of CEPHOS for fMRI lie-detection scans to assist. The prosecution brought a motion to exclude the evidence and on 13 May 2010 a *Daubert* hearing was conducted by Judge Pham. His report examined the evidence put forward under Evidence Rule 702 (as set out by *Daubert*) providing:

If scientific, technical, or other **specialized knowledge** will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert. . . may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.³¹

The Supreme Court in *Daubert* established two prongs of this test: first, that the testimony is reliable and “grounded in the methods and procedures of science and *must be more than unsupported speculation or subjective belief*”.³² The second prong examined whether the application of the methodology to the facts in question was “fit”.³³

Judge Pham, in discovering whether Dr Laken held a “specialised knowledge” within the first limb, employed the four non-exclusive factors given in *Daubert*:

- (1) Whether the theory or technique can be tested and has been tested;
- (2) Whether the theory or technique has been subjected to peer review and publication;
- (3) The known or potential rate of error of the method used and the existence and maintenance of standards controlling the technique’s operation; and
- (4) Whether the theory or method has been generally accepted by the scientific community.³⁴

Judge Pham found that neuroscientific lie-detection passed the testing and peer review qualifications. However, on the third point the Judge highlighted that lie-detection testing had been contained to a small sample size and accordingly error rates were specific to laboratory testing; ‘real-life’ error rates remain unknown. This issue, amongst others, was highlighted by the literature examined by the Judge.

²⁹ *United States Of America v Lorne Allan Semrau*, (31 May 2010), No. 07-10074, Report and Recommendations, J Pham.

³⁰ *Daubert v Merrell Dow Pharmaceuticals Inc [1993] USSC 114*; 509 US 579 (1993), pp. 12–15. This is made under Rule 104 of *The Federal Rules of Evidence 1975* (US).

³¹ Federal Evidence Rule 702, *The Federal Rules of Evidence 1975* (US).

³² *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125L. Ed. 2d 469, 113 S. Ct. 2786. In this the court held that this rule superseded the “general acceptance” test set out in *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

³³ *United States v. Bonds*, 12 F.3d 540, 555-56 (6th Cir. 1993).

³⁴ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125L. Ed. 2d 469, 113 S. Ct. 2786 at 593–594.

While Dr Laken testified to his own standards, scholarly consensus that lie-detection was not ready for real-life application meant the court could not “adequately evaluate the reliability of a particular lie-detection examination”.³⁵ In considering the fourth point, the Court found that the majority of literature held that lie-detection is not reliable enough for use in court.³⁶ On these bases, the court found the evidence to be inadmissible.

Given that Australia takes *Daubert*'s formulation of “knowledge”, it is likely that fMRI lie-detection would be found inadmissible in Australia on similar grounds.³⁷ Furthermore, *Tang* shows the caution with which Australian courts treat new technologies. Chief-Justice Spigelman quoted *R v Gray*³⁸ which held:

There is no means of determining objectively whether or not such an opinion is justified. Consequently, unless and until a national database or agreed formula or some other such objective measure is established, this court doubts whether such opinions should ever be expressed by... mapping witnesses.

It is likely that fMRI lie-detection would be subject to the same standards of scrutiny. Various Australian academics have supported such caution by courts as combined with the current rationalistic mindset, hasty inclusion could easily lead to “the contamination of criminal trials with unreliable incriminating expert opinion evidence”.³⁹

3 The Impact of fMRI Lie-Detection on the Legal System

For the purpose of investigating the impact of fMRI lie-detection on the Australian legal system, one is required to look forward to a day when such evidence could meet the rigorous admissibility standards in place. Any employment of neuroscience would require legislated regulation to mitigate the complex concerns over unfair prejudice, such as the number of expert opinions able to interpret a scan, requirements that both parties participate in determining questions used in the scan, and the balance of power between scientists and lawyers in treatment of the data.

Therefore, the first frontier of impact requires consideration of the relationship between science and law, and the conceptual limitations of using fMRI data.

Even after settling these questions, and introducing legislation there would be consequences for many central tenets of justice in the legal system; especially the jury system, the right to silence and personal privacy.

³⁵ *United States Of America v Lorne Allan Semrau*, (31 May 2010), No. 07-10074, Report and Recommendations, J Pham, at p. 31.

³⁶ The court looked at articles including: Simpson (2008) and Chen (2009).

³⁷ As set out in *R v Tang* (2006) 65 NSWLR 681 (CCA) CJ Spigelman at 138.

³⁸ *R v Gray* [2003] EWCA Crim 1001.

³⁹ Edmond et al. (2008), *University of New South Wales, University of Technology, Sydney, Australian Research Council and University of Western Sydney*.

4 The Conceptual Boundaries of the Use of fMRI Lie-Detection Data

The introduction of fMRI lie-detection into criminal cases would be accompanied by increased participation by scientists in court processes. If fMRI lie-detection was treated as conclusive evidence, the role of legal practitioners would inevitably be relegated to one of simple deference to scientific expertise.

However, it is important to recognise that scientific research looks only to the empirical correlations between deceptive behaviour and brain activity. While eventually strong correlative patterns may be found, these cannot definitively state whether a person is lying or not, as deception is behaviour of the whole person, rather than simply an operation of the brain.

Therefore, the inductive evidence provided by neuroscience, though appropriately given weight, must still be grounded in sound evidentiary and general legal analysis. Even if certain mental states were shown to be necessary for deception – they could not be said to be sufficient, as deception must involve the *subjective* criteria of intention. Therefore, while fMRI may provide inductive evidence about a subject's brain activity, the limitations on the meaning of this information only allow one to evaluate whether scans are more similar or less similar to functioning patterns associated with deception at a group and individual level. Functional MRI cannot offer testimony about lies being 'produced' or 'happening' in the brain, but is limited to heightening or lessening the probability that one was engaged in deceptive behaviour at the time of the scan.

This limitation on the use of brain scans in lie-detection would protect innocent persons who happen to have incriminating states of mind, or those who conceived the intention to lie but did not carry out the act. It ensures that where there is strong circumstantial evidence to the contrary, lie-detection would not be given undue weight; lawyers would be responsible for moderating this. Furthermore, requiring behavioural evidence and an analysis of the subjective and criterial bases of deception would ensure the protection of the right to a fair trial. While the role of lawyers would continue to be a crucial one, whether jurors, would be sufficiently capable to make and hold the necessary distinctions in dealing with fMRI evidence remains to be seen.

5 The Impact of fMRI Lie-Detection for the Jury

On the premise that a highly effective lie-detector exists, which meets the standards of *R v Tang*,⁴⁰ courts would still need to consider the impact on the role and function of the jury to "hear evidence and make decisions about facts with the guidance on

⁴⁰ *R v Tang* (2006) 65 NSWLR 681 (CCA).

the law from a judge”.⁴¹ With an accurate and efficient lie-detector, the traditional role of juries as “fact finders” (as affirmed in Australia and elsewhere⁴²) would be reduced to a mere rubber-stamping on the work of courtroom scientists. Already, American courts have proven reluctant to admit fMRI evidence that intrudes on this central function of the jury. This intrusion would, in many respects, be analogous to the impact of DNA evidence. Finally, in cases where jury’s did not follow the verdicts of lie-detection science, their currently implicit ‘powers of nullification’ would become explicit. Should this ‘power of nullification’ be elevated to an explicit and central function of the jury, this would prompt questions about the legitimacy of the jury in its current form.

Historically, the role of the jury has been fiercely protected. Juries have been entrusted with the evaluation of evidence; with legitimacy being derived from public trust in the system to do this fairly and accurately. Consequently, judges have taken a cautious approach for admitting evidence based on new fields of investigation, especially those which purportedly answer questions of fact.

Unlike DNA evidence (which connects a person’s DNA with the event in question), fMRI lie-detection goes directly to the question of witness credibility or the credibility of the accused; informing the jury that a testimony was given with brain activity that correlates with deception or honesty. The problem this poses for courts in allowing juries the freedom to decide the credibility of a witness was seen in the first consideration of lie-detection technologies by an American court, in *Corestaff v Wilson*.⁴³ In that case, the plaintiff and defendant disagreed in their testimony about what the defendant did or did not tell a witness. The Judge identified that a crucial question in admitting the evidence was whether the assessment of the witness’ credibility was “within the ken of the juror”⁴⁴; as this is always a key function of the jury, it was found to be so. The Judge declined the motion for a ‘Frye-hearing’,⁴⁵ on the basis that American common law excludes expert evidence, which bolsters the credibility of a witness as it improperly intrudes on the “province of the jury”.⁴⁶ In a similar way evidence from polygraphs has been consistently excluded, as judges have recognised that it poses an unwarranted threat

⁴¹ Jury Service, ‘The Role of Juries’, *Justice and Attorney-General*, NSW Government, 31 July 2007.

⁴² *Brownlee v The Queen* [2001] HCA 36; (2001) 75 ALJR 1180. or in America: *United States v. Scheffer*, 523 U.S. 303, 312–13 (1998).

⁴³ *Wilson v. Corestaff Services*, (14 May 2010), Supreme Court, Kings County, New York State Law Reporting Bureau.

⁴⁴ *Wilson v. Corestaff Services*, (14 May 2010), Supreme Court, Kings County, New York State Law Reporting Bureau, 2.

⁴⁵ *Frye v. United States*, 293 F. 1013 [DC 1923], remains the authoritative case in NY District Court’s jurisdiction.

⁴⁶ *Wilson v. Corestaff Services*, (14 May 2010), Supreme Court, Kings County, New York State Law Reporting Bureau, p. 3.

to the jury's role of determining witness credibility.⁴⁷ American law has greatly influenced Australian thinking on the jury.⁴⁸ In *The Queen v Murdoch*,⁴⁹ where expert evidence was offered for assessing witness credibility, it was noted that a witness should "possess scientific knowledge, expertise and experience outside the ordinary knowledge, expertise and experience of the jury".⁵⁰ The high barriers of admissibility for expert evidence protect the role of the jury in assessing credibility and would therefore be a significant barrier to the incorporation of fMRI lie-detection technology.

However, historically, the law's acceptance of new technology has been based on the reliability of that technology.⁵¹ Even the way in which the jury system came about in the middle ages when trial by ordeal was rejected, reflects the fact that while change may be resisted, when presented with a more accurate fact-finder, the public legitimacy of the legal system will depend upon acceptance of it.⁵² More recently, this has been evident in the treatment of DNA evidence, where following exonerations on the basis of new scientific evidence, convictions were quashed and the authority of the jury was questioned. If and when an accurate system of lie-detection became available, the current role of the jury will be called into question. A modified role has been posited of evaluating the subjective truth of lay witness testimonies or evaluating scientific evidence within the wider body of evidence.⁵³ Finally, an implicit operation of juries is the quasi-legislative capacity of adjudging whether the law befits the facts. While the first of these is arguably within the traditional scope of the juror's role, it may disappear as technologies are refined.

A second remaining function of the jury would be to examine the credibility of scientific evidence within the body of evidence, in a way similar to the jury's current assessment of DNA evidence. Since 1989, the use of DNA evidence in Australia has increased rapidly,⁵⁴ and defence challenges to this evidence have passed. Recent Australian research has identified⁵⁵ that juries are 23 times more likely to convict in homicide and 33 times more likely to convict in sexual assault cases when presented with DNA evidence.⁵⁶ Furthermore, jurors find statistical evidence difficult to understand; they may be 'overawed by the scientific garb in which the evidence is presented and attach greater weight to it than it is capable of

⁴⁷ Seaman (2009), p. 461.

⁴⁸ *Brownlee v The Queen* [2001] HCA 36; (2001) 75 ALJR 1180 at 21: see *Williams v Florida* [1970] USSC 155; 399 US 78 (1970) at 100.

⁴⁹ *The Queen v Murdoch* [2005] NTSC 78.

⁵⁰ *The Queen v Murdoch* [2005] NTSC 78 CJ Martin at 108.

⁵¹ Caudill (2010).

⁵² Shapiro (1986).

⁵³ Seaman (2009), p. 475.

⁵⁴ Eastale and Eastale (1990).

⁵⁵ Goodman-Delahunty and Hewson (2010), p. 1.

⁵⁶ Briody (2004).

bearing'.⁵⁷ In keeping with the high place science holds in the community, jurors place a high level of trust in expert witnesses. A recent Victorian case in which a man was erroneously convicted of sexual assault based on contaminated DNA evidence despite overwhelming evidence showing him to be innocent inspires little faith in the ability of juries to assess scientific evidence in light of other evidence proffered in a case.⁵⁸ This complete, unquestioning trust in the science of DNA evidence would likely follow scientifically approved fMRI lie-detection evidence in the courtroom.

A blind and unregulated acceptance of fMRI lie-detection would threaten jury secrecy; the legislative⁵⁹ and common law⁶⁰ principle that ensures free and honest jury room discussion. More certainty about the jury's belief of the factual guilt or innocence of the accused would unmask the basis on which a jury acquitted or convicted them.⁶¹ At present, the secrecy of jury deliberations also affords juries the right to convict or acquit not purely on the facts of the case, but also in the belief that a law is unjust or unfitting. In this way, the jury would be in effect exercising a quasi-legislative authority of determining what should and should not be law. The existence of their right to do this was initially recognised in *R. v. Kirkman*⁶² and then in *R v Abbott*⁶³ where it was held, "sometimes it appears to a jury that although a number of counts have been alleged against an accused person and have been technically proved, justice is sufficiently met by convicting him of less than the full number".⁶⁴ If clear evidence, in the form of fMRI lie-detection became available to courts, a jury's disagreement on the verdict would most likely point to, not a disagreement over facts, but an assessment of the appropriateness whether the law should apply at all.

This right of juries has been implicitly recognised on various occasions by both the courts and in the public arena.⁶⁵ The power of nullification provides in "an unusual arrangement of checks and balances, [a] way of building discretion, equity, and flexibility into the legal system"⁶⁶; therefore, reinforcing the importance of democratic consensus at the level of the court system.

⁵⁷ *R v Duke* 1979 22 SASSR 46, King CJ at 48.

⁵⁸ Hagan (2009).

⁵⁹ *Jury Act 1977* (NSW).

⁶⁰ *Ng v R* [2003] HCA 20; 217 CLR 521; 197 ALR 10; 77 ALJR 967 (10 April 2003).

⁶¹ Seaman (2009), p. 427.

⁶² *R. v. Kirkman* (1987) 44 S.A.S.R. 591.

⁶³ *R v Abbott* [2006] VSCA 100 (4 May 2006).

⁶⁴ *R. v. Kirkman* (1987) 44 S.A.S.R. 591 at 593.

⁶⁵ An example of this can be seen in the recent decision by a jury, acquitting a Queensland couple who were being tried under s225 of their Criminal Code for illegally procuring an abortion, while it is not possible to know for sure that this was a case of jury nullification, it does present a persuasive example of where the jury arguably returned a merciful verdict in application of the law: see, Wainer (2010).

⁶⁶ Kalver and Zeisel (1966).

However, the public unveiling of this right would entail various problems. It could likely increase its usage,⁶⁷ and given the variety of existing views about the appropriateness of certain laws, increase the instances of hung juries and controversial decisions by juries swayed more by emotion than fact.

Furthermore, in *R v Abbott* it was held that the trial judge was not at liberty to instruct a jury of this implicit right as it would have, inappropriately, bestowed on him the power to instruct juries to “determine which of the laws of the land are to be enforced”.⁶⁸ Finally, scholars have remarked that any open understanding of jury deliberations might cause the public to reject their verdicts.⁶⁹ Legitimacy of the jury system in the eyes of the public is based on whether it is able to fulfil its assigned role; given the problematic effects associated with promoting this remaining quasi-legislative role to a central function of the jury, the constitutional right of trial by jury might come into question. For all the shortcomings or occasional failings of the current jury system, the inclusion of fMRI evidence in this way would not prove an opportunity for reform, but rather pose a threat to its continued existence by undermining public legitimacy.

Any introduction of fMRI evidence would have stark ramifications for traditional conceptions of the jury’s role and function. Embracing a system in which “fact-finding” is the domain of science would likely spark debate about the jury’s continued legitimacy. Given such dramatic consequences, any introduction of fMRI lie-detection would likely be met with hesitation by courts.

6 The Right to Silence and the Right to Privacy

A further remaining task of the jury, should fMRI lie-detection become a significant part of the legal system, will likely be determining guilt where accused persons choose not to undergo lie-detection. The accused is entitled, both by common law and statute to the “right to silence” at various stages of the trial process.⁷⁰ It is accordingly unlikely that an accused could be compelled to undergo a lie-detection scan in a trial.

Many scholars have commented on the erosion of the right of the accused to silence,⁷¹ given the adverse inferences commonly drawn by juries in the absence of a testimony. Should lie-detection evidence become commonplace in criminal trials,

⁶⁷ Seaman (2009), p. 484.

⁶⁸ *R v Abbott* [2006] VSCA 100 (4 May 2006) per JA Buchanan at 18.

⁶⁹ Ruprecht (1997), p. 217.

⁷⁰ S17(3) *Evidence Act 1995* (NSW).

⁷¹ Hocking and Manville (2001).

any negative consequences for an accused, would likely be exacerbated, given the significant weight of such evidence.

The way in which judges could comment on any failure to undergo fMRI lie-detection might mirror legislative boundaries given in section 20(2) of the Acts; permitting comment, but requiring the comment “must not suggest that the defendant failed to give evidence because the defendant was, or believed that he or she was, guilty of the offence concerned”.⁷² Given the weight lie-detection tests would inevitably hold in the eyes of the jury, even if a judge’s directions were aimed at tempering that weight, it is likely the average juror would be unable to “shut their eyes to the consequences of exercising the [right to silence]”.⁷³

*Weissensteiner v The Queen*⁷⁴ dealt with the failure to explain where facts “peculiar” to the defendant.⁷⁵ In lie-detection, it is likely that facts about the credibility of an accused’s testimony will belong peculiarly to the defendant. In breaking from steps aimed to further protect the accused’s right to silence, accepting fMRI lie-detection evidence would inevitably further threaten the right to silence.

At stake in this are significant privacy concerns, with highly sensitive information about one’s inner brain functioning in question. Some authors have rejected including lie-detectors entirely because of the coercion that could occur, and the dangers where the information gained is about one’s cognitive abilities.⁷⁶ Although privacy laws have not anticipated that the inner workings of the brain might one day constitute sensitive, available information,⁷⁷ balancing this right with the interests of justice would be a significant concern for the legislature and the courts. Indeed, it is likely that although not legally compellable, the desire of an accused to be acquitted would lead to their wavering of privacy rights in many instances, where fMRI lie-detection was admitted. This would in turn lead to concerns about the resulting prejudice for those who do not waive their privacy rights. The very real concern of highly sensitive information and unavoidable pressure to testify as an accused would need to be accounted for by legislation.

⁷² S20 (2) *Evidence Act 1995* (Cth), (NSW).

⁷³ *Weissensteiner v The Queen* [1993] HCA 65; (1993) 178 CLR 217, per Mason CJ, Deane And Dawson JJ at 33.

⁷⁴ *Weissensteiner v The Queen* [1993] HCA 65; (1993) 178 CLR 217, per Mason CJ, Deane And Dawson JJ at 33 and *Azzopardi v R* [2001] HCA 25; 205 CLR 50; 179 ALR 349; 75 ALJR 931 (3 May 2001).

⁷⁵ *Weissensteiner v The Queen* [1993] HCA 65; (1993) 178 CLR 217 per JJ Gaudron and McHugh at 4.

⁷⁶ White (2010), p. 258.

⁷⁷ *Privacy and Personal Information Protection Act 1998*, (NSW), found at the Office of the NSW Privacy Commissioner.

7 Admissibility Under General Exclusionary Clauses and the Regulation of fMRI Lie-Detection

What becomes clear upon reflection is just how dramatic the impact of advances in neuroscience may be in criminal cases: at stake is the constitutional right to trial by jury.⁷⁸ Indeed, the difficulties for juries in dealing with the amount of scientific evidence in making verdicts may already prove grounds for reform of its current operation.⁷⁹ Jury panels might be reconstituted as an expert witness panel, including neurologists and others more equipped to assess scientific evidence. The secondary role of the jury, as an impartial arbiter of laws, moderating them in accordance with societal standards would be the primary remaining role of a lay-person jury. If this quasi-legislative function was revealed, the legal system would face the problem of having two appliers of the law (judge and jury); a host of difficulties in facilitating this capacity would endanger the enduring role of the jury. A regulated approach to fMRI lie-detection is further warranted, considering the erosion of the accused's right to silence that would likely occur.

A final hurdle of admissibility for a scientifically viable fMRI lie-detector would be the general exclusionary clauses found in sections 135, 136 and 137 of the Acts⁸⁰; which allow courts to exclude (or limit use of) evidence that may be unfairly prejudicial, misleading or confusing or exclude evidence resulting in an undue waste of time. Section 137 requires the court to refuse evidence "adduced by the prosecutor if its probative value is outweighed by the danger of unfair prejudice to the defendant"⁸¹.

The issue of unfair prejudice in relation to fMRI lie-detection evidence was discussed in *Semrau*, where the court turned to the comparable discretionary section, section 403,⁸² whereby: "if the unfair prejudice substantially outweighs the probative value of the evidence, the evidence is inadmissible".⁸³ Judge Pham followed the line of argument put forward in *United States v. Sherlin*⁸⁴ where the probative value of results from a polygraph test were held to be substantially lessened by the fact that the defendant risked nothing in obtaining the test unilaterally, that is, without the "knowledge or acquiesce of the government" (who had no chance to amend or submit questions). The danger of unfair prejudice outweighed any probative value, particularly as it was being used to bolster witness credibility.

⁷⁸ Section 80, *The Australian Constitution 1900* (Cth).

⁷⁹ Goodman-Delahunty and Hewson (2010).

⁸⁰ S135, s136, s137 in *Evidence Act 1995* (Cth) (NSW).

⁸¹ S135, s136, s137 in *Evidence Act 1995* (Cth) (NSW) at s137, this is the main general discretionary clause used in evidence: *R v Keenan Mundine* [2008] NSWCCA 55 (18 March 2008).

⁸² *United States Of America v Lorne Allan Semrau*, (31 May 2010), No. 07-10074, Report and Recommendations, at p. 33.

⁸³ *United States v. Thomas*, 167 F.3d 299, 308-09 (6th Cir. 1999).

⁸⁴ *United States v. Sherlin*, 67 F.3d 1208, 1217 (6th Cir. 1995).

The judge also considered *United States v. Thomas*,⁸⁵ which held, where there is no chance of the evidence holding negative consequences for the defendant, the probative value is outweighed by prejudice. The court also considered that a lapse in time between the crime and tests might lead to unfair prejudice. For all these reasons, Judge Pham found the lie-detection evidence was not admissible under Evidence Rule 403. While not precedent, it is likely that these remarks would be persuasive in Australian courts and therefore, Australian courts might choose to exclude fMRI evidence on the basis of unfair prejudice, under section 135 or 137.

Similarly courts may exclude fMRI lie-detection evidence, finding the volume of complicated data may confuse or mislead the jury, and lead them to attach more weight to scientific evidence than should be. Consequently, fMRI data would unjustly encroach on the “province of the jury” as referred to in *Corestaff v Wilson*⁸⁶; that is the finding of fact. Furthermore, without appropriate regulation, the likelihood of different scientists asserting multiple conclusions from the same evidence might preclude evidence (or limit its use) on the basis of an onerous burden on the court or a waste of court’s time.

The term “probative value” in section 137⁸⁷ has been interpreted in a number of different ways. In *Papakosmas v The Queen*⁸⁸ Justice McHugh distinguished between relevance and probative value; relevance not being concerned with reliability, whereas probative value is. This was contradicted by *Adams v The Queen*⁸⁹ where Justice Gaudron defined “probative value” only in relation to the relevance of the evidence. This reading was confirmed by Justice Simpson in *R v Keenan Mundine*⁹⁰ where he noted,

Although contrary views have been expressed... it is not open to a trial judge, in assessing... the probative value of any piece of evidence, to take into account ... its reliability or ...the credibility of the witness through whom it is tendered.⁹¹

This was held by Justice Simpson on the basis that doing so “would be to attempt to anticipate the weight the jury would attach to it”.⁹² Given the difficulty in assessing the credibility of fMRI lie-detection and considering the undue weight that juries will attach to the evidence, a return to *Papakosmas* is necessary in the case of the inclusion of fMRI evidence. *Papakosmas* held that evidence becomes

⁸⁵ *United States v. Thomas*, 167 F.3d 299,308-09 (6th Cir. 1999).

⁸⁶ *Wilson v. Corestaff Services*, (14 May 2010), SC, Kings County, New York State Law Reporting Bureau, pp. 1–2.

⁸⁷ S137, *Evidence Act 1995* (NSW).

⁸⁸ *Papakosmas v R* [1999] HCA 37; 196 CLR 297; 164 ALR 548; 73 ALJR 1274 (12 August 1999).

⁸⁹ *Adam v R* [2001] HCA 57; 207 CLR 96; 183 ALR 625; 75 ALJR 1537 (11 October 2001).

⁹⁰ *R v Keenan Mundine* [2008] NSWCCA 55 (18 March 2008).

⁹¹ *R v Keenan Mundine* [2008] NSWCCA 55 (18 March 2008) per J Simpson, at 33.

⁹² *R v Keenan Mundine* [2008] NSWCCA 55 (18 March 2008) per J Simpson, at 33.

“prejudicial” where it is used in an “improper . . . emotional or illogical way”.⁹³ In the case of scientific evidence, as has been shown with DNA evidence, prohibiting an improper portrayal of fMRI as conclusive evidence would be difficult to maintain without Justice McHugh’s interpretation in *Papakosmas*.

The assessment of probative value would need include reviewing the credibility of fMRI scans, including reliability, the possible prejudicial circumstances in which it was attained and difficulties that the jury may have in attaching a proper weight to it. While this might seem to lead to the exclusion of fMRI evidence under the general exclusionary clauses, historically, reliable lie-detectors have not been able to be excluded from the legal system. To maintain public faith in the legal system, courts must seek out the most accurate determiner of fact to ensure justice and fairness. The introduction of such evidence, however, must not be done haphazardly, without careful consideration of the significant consequences upon the function and role of the jury, and the right of the accused to silence.

8 Capacity, Responsibility and the Impact of Neuroscience

8.1 Can fMRI Provide New Insights into Criminal Responsibility?

As fMRI improves understanding about brain functioning, it is hoped that it may provide new insights into the concept of legal responsibility and doctrines such as voluntariness⁹⁴ and *mens rea*.⁹⁵ While neuroscience has already had an impact in these areas by providing structural images in cases involving the defence of substantial impairment,⁹⁶ fMRI capabilities present the possibility of showing *functional* aberrations which may mitigate criminal responsibility.

Experiments utilising fMRI for the purposes of criminal responsibility have investigated the association between neuronal activity and various functional capacities necessary for behaving responsibly. Scientists have tested a range of sensory, motor, affective, and cognitive processes within the brain⁹⁷ to explore the effects of peer pressure, the impact of stress, the process of evaluating risks and

⁹³ *Papakosmas v The Queen* [1999] HCA 37; 196 CLR 297; 164 ALR 548; 73 ALJR 1274 (12 August 1999) per j McHugh at 92.

⁹⁴ The question of volition, or voluntariness forms traditionally forms part of the *actus reus* inquiry and looks at whether the criminal action was freely done, following principles laid out in *Woolmington v DPP* [1935] AC 462.

⁹⁵ ‘*Mens Rea*’ looks at the mental state of the accused, requiring that the crime was done with a “guilty mind”. “The mens rea requirement stems from the common law notion of reserving punishment for those behaving wickedly.” Brown and Murphy (2010), p. 1119, 1128.

⁹⁶ The full name of this defence is “Substantial impairment by abnormality of mind”, found at s23A of the *Crimes Act 1900* (NSW).

⁹⁷ Freund (2002).

rewards and the exercise of deliberation on neuronal activity.⁹⁸ In a similar way to structural imaging, analysing fMRI results may assist scientists in developing an understanding of ‘normal’ brain functioning, and enable the establishment of criteria, against which ‘deviations’ may be identified.

More specifically, investigations are being carried out to assess the impact of certain brain lesions⁹⁹ on function and corollaries with behavioural traits.¹⁰⁰ Likewise, scientists are beginning to determine the specific brain aberrations associated with psychopathic behaviour¹⁰¹ or susceptibility to drug addiction¹⁰²; which may, in time, pose significant and specific legal quandaries.¹⁰³

Importantly, alongside this evidence linking functional capacities and known behavioural conditions is increasing support for the idea that the brain has a degree of ‘plasticity’; that different regions can function in various ways, and even learn to perform new functions.¹⁰⁴

As with lie-detection, it is still early in determining how neuroscience may impact on our understanding of criminal responsibility. Similarly, many of the studies have reported group level analysis (and therefore may have limited validity in individual cases).¹⁰⁵ Even despite these and other limitations in the studies, this area may eventually provide strong empirical evidence for conclusions relating to functional capacity and, consequently, personal responsibility.

9 The Legal Admissibility of fMRI Evidence

Expert evidence regarding responsibility and capacity would be met with the same strict scrutiny as fMRI lie-detection evidence. The admissibility under section 79 of the Acts¹⁰⁶ would require “specialised knowledge”, and methods resting on “more than unsupported speculation or subjective belief”.¹⁰⁷ Again, in characterising this, the four points expounded in *Daubert*¹⁰⁸ provide a useful measure of admissibility.

⁹⁸ Mayberg (2010), p. 37, 51.

⁹⁹ Such as those from invasive tumours, infection processes and neurodegenerative disorders, Mayberg (2010).

¹⁰⁰ Batts (2009); Müller et al. (2008).

¹⁰¹ Yang and Raine (2009).

¹⁰² Bloom (2010).

¹⁰³ Kiehl (2010).

¹⁰⁴ Wandell and Smirnakis (2009).

¹⁰⁵ Mayberg (2010), p. 37, 40.

¹⁰⁶ *Evidence Act 1995* (Cth),(NSW).

¹⁰⁷ *R v Tang* (2006) 65 NSWLR 681 (CCA) CJ Spigelman at 138.

¹⁰⁸ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125L. Ed. 2d 469, 113 S. Ct. 2786 at 593–594.

The first two points regarding testing and peer review might be met by a qualified individual. However, in considering the rate of error, the professional standards in this field and whether the “*theory... has been generally accepted by the scientific community*” the literature reveals that the general consensus amongst leading neurologists is that fMRI is not yet ready for court.¹⁰⁹ A detailed knowledge of error rates for many specific behavioural disorders is yet unknown,¹¹⁰ and debate surrounding the appropriate use of fMRI data¹¹¹ suggests that the cautionary approach of the courts is appropriate.

Given that fMRI evidence about functional capacity would mirror the way psychological or structural brain image evidence operates, the admission of this evidence, if it met the criteria of *Daubert*, would take place on analogous grounds. Provided scientists and lawyers adhered to the conceptual limitations of using fMRI data, it is unlikely courts would need to exclude the evidence on any of the grounds found in the general discretionary clauses of sections 135–137 of the Acts.¹¹² Aside from significant alterations in views about sentencing and punishment, the impacts of fMRI evidence for criminal responsibility would be less dramatic than those of lie-detection evidence; it follows that this evidence may be sooner admitted for use in courts.

10 The Conceptual Limitations of fMRI Data

If fMRI data is able to contribute valuable empirical data, interpretation of the images would face inevitable conceptual limitations. As aforementioned, correlation is not causation.¹¹³ The empirical data correlating BOLD responses with human functioning cannot identify that the existence of particular mental states or certain behaviour; but rather provide a measurement of activity in highlighted regions of the brain. While this brain activity may be shown to consistently accompany certain behaviour, fMRI evidence remains *inductive* proof of accompanying behaviour, rather than *deductive* proof and therefore provides strong but not definitive evidence about the accompanying behaviour. Similarly, a lack of neuronal activity in relevant regions does not conclusively determine a lack of associated abilities; although particularly alongside behavioural evidence, this may be indicative of functional impairment. In looking at subjective mental states, often involved in responsibility questions, the problem of equating empirical data with criterial data becomes particularly evident. Sensitivity to this limitation when

¹⁰⁹ Mayberg (2010), p. 37, 51.

¹¹⁰ Mayberg (2010), p. 41.

¹¹¹ Vincent (2010), in discussion of Reimer (2008).

¹¹² Ss 135, 136, 137 of the Acts.

¹¹³ Aldrich (1995), 1.

considering what constitutes ‘normal’ brain functioning is therefore crucial to any legitimate application of fMRI data in determining responsibility.

A second, perhaps more obvious limitation exists in applying this scientific data where there is inevitably a lapse in time between a trial and the relevant event. Although investigation into capacity and responsibility may appear to provide objective criteria for determining criminal states of mind, it faces the insurmountable difficulty of not being able to examine the brain in the moment and circumstances of the crime; meaning, for example, that it is unable to be used as evidence of intention within *mens rea*.

Neuroscience therefore should not affect the law in a vacuum; rather, the joint efforts of scientists, psychologists, philosophers and legal and judicial experts are necessary for any well-founded development of law in this area.

11 The Overarching Concept of Responsibility

The criminal justice system is underpinned by the idea that people can and should be held accountable for their actions; agent responsibility, to some degree, is required for the legal system to make sense at all.¹¹⁴ While “responsibility” is raised at various points throughout a criminal trial, the term “responsible” has various uses.

One meaning of “responsibility” simply attaches a person to a consequence by reason of voluntary engagement in action. For example, the statement “X is responsible for a hole in the wall” attaches X to the “hole in the wall”. Usage in this way does not necessarily imply moral guilt, as the hole in the wall may have been made accidentally, but does suggest that X was free in their actions and therefore may be properly attached to the consequential hole. If, on the other hand, X had been forced to put the hole in the wall, it would follow that *the force* would be “responsible” and thus attached to the hole. This notion of responsibility may be called “attachment responsibility”.

A second usage of “responsibility” denotes the ability to be held accountable; such as where an adult is responsible for their actions but a child is not. Here, “responsibility” is dependent upon the capacity for reasonable judgement in their actions. Capacity means they are legitimately considered a moral agent whose actions may be attributed to them. In contrast, a person without the complete capacities required for deliberation on how to act, or without the capacity to act in certain ways at all, is unable to provide a reasoned account of these actions, and cannot therefore be held accountable. Such meaning not only applies to general capacities, but also in specific cases where one may not be specifically qualified to

¹¹⁴ Mobbs et al. (2007).

make decisions, such as a doctor giving legal advice. This usage has been labelled by at least one theorist as “capacity responsibility”.¹¹⁵

A third way of applying “responsible” is as a description of virtuous action; one is responsible when one’s actions in a specific context are just or appropriate. For instance, a child may not have the *capacity* to be responsible, but may have acted ‘responsibly’.¹¹⁶ This meaning has been labelled “virtue responsibility”.¹¹⁷

These various concepts of responsibility appear at different times in the criminal trial process. Generally, “attachment responsibility” looks at the question of voluntariness and, the latter two meanings are used in assessing the element of *mens rea* and sentencing, respectively.

12 Voluntariness

Attribution of criminal action requires an agent, who is free and therefore can be held responsible; as established in *Woolmington v DPP* in which it was stated, “the Crown must prove [the offence]... as the result of a voluntary act of the accused”.¹¹⁸ It is often assumed that fMRI data will remove the possibility of truly voluntary action at all. Such challenges to ‘free will’ stem from materialist readings of the data, and hold to deterministic views of human nature.¹¹⁹

The roots of causal determinism are found in Hume’s philosophy of causality, which purports that everything is caused¹²⁰ and cannot therefore be freely willed. His treatise has been dubbed “the founding document of cognitive science”¹²¹ by subsequent philosophers and scientists. Modern fMRI investigations aim at showing the way in which brain activity may be held responsible for all human action. Perhaps, the most famous of these is Libet’s experiments into consciousness,¹²² where people were asked to move their hand, while the electrical activity in their brain, known as their “readiness potential” was monitored. He found that this electrical current preceded the conscious decisions of subjects to move their hands by up to half a second.¹²³

Although much has been said about the implications of these experiments regarding conscious experience, they have also been used as evidence that action

¹¹⁵ Vincent (2010), p. 17.

¹¹⁶ Vincent (2010), p. 18.

¹¹⁷ Vincent (2010), p. 17.

¹¹⁸ *Woolmington v DPP* [1935] AC 462.

¹¹⁹ Robert M. Sapolsky (2004).

¹²⁰ Russell (2007).

¹²¹ Fodor (2003), p. 134.

¹²² Libet (1999).

¹²³ Marchetti (2005).

is determined rather than voluntary.¹²⁴ Functional MRI scanning has already been recognised as a way of observing such determined movement more conclusively. Such evidence might arguably be used to exculpate people, on the basis that they were not truly free and were therefore were not acting voluntarily.

The doctrine of *compatibilism*,¹²⁵ which holds that free will and determinism may be held compatibly as beliefs, has provided determinists with a way of defending legal understanding of agency and attributing responsibility.¹²⁶ However, future research of fMRI, if interpreted to show that certain brain activity preceded experience of choosing, might undermine the availability of such a premise.¹²⁷ If the *experience* of voluntariness is shown to be “a mental mechanism that gives rise to a sense of conscious will and the agent self in the person”¹²⁸ then this might provide grounds for a defence, similar to automatism, which could show that although intention and action were present, they were beyond the control of the accused.¹²⁹

The scientific application of brain activity imaging in the area of personal responsibility in this way would exceed the conceptual limitations of fMRI data. Brain activity would be used as the measure of free will, rather than the behavioural, criterial data pertaining to free will. Monitoring brain activity during the process of decision-making provides a measurement of functioning, but does not show “choosing” as a function itself. A materialist belief that reduces subjective, conscious human experience to the physical processes that *accompany* it cannot result in a logical framework for law. In fact, the necessity of voluntary agency and free will and the associated difficulties in their abandonment may guide scientists in their application of fMRI to legal questions of voluntariness.

Functional MRI data may provide legitimate insights into the factual presumption of voluntariness,¹³⁰ where people can be seen to have conditions affecting their consciousness and awareness in action. Beyond showing actions as being performed by agents suffering from a persistent impairment in consciousness, application of this research would be limited by the fact that research into mental states of the accused would not be contemporaneous to the crime. The problems of leaving the weighing of such complex evidence in the hands of the jury are similar to those discussed previously.

¹²⁴ Libet (1999).

¹²⁵ McKenna (2009).

¹²⁶ Morse (2008), p. 19, and Greene and Cohen (2004), p. 1775, 1778, come to different conclusions about how this understanding may impact on legal justice.

¹²⁷ Hodgson (2000).

¹²⁸ Wegner (2005).

¹²⁹ Sapolsky (2004), p. 1794.

¹³⁰ *R v Falconer* (1990) 171 CLR 30.

13 The Element of *Mens Rea*

The *mens rea* element of criminal investigation looks to whether one has the requisite mental state of a ‘guilty mind’, which is established by demonstrating that the accused performed the crime with intent, knowledge, recklessness or even mere negligence. This usually involves a subjective determination of the belief or intent of the accused, as well as an objective assessment of the reasonableness of their action in light of that belief.¹³¹

In addition to providing one of the bases for justification of punishment, *mens rea* “establishes a legal requirement that cannot be concretely measured”.¹³² Since fMRI scans test the brain activity that accompanies certain behaviours, it is thought, by some, that they may also reveal patterns relating to specific ‘intention’ within human brains. Cognitive behaviours (given the physical restrictions of fMRI scanners), such as conjuring up criminal intentions, are dependent on the individual’s own perspective. The task is objectively understood in terms of what constitutes intention, such as purpose or foreseeing an outcome; however, it exists within the subjective experience of an individual.¹³³ Therefore, scholars have identified that any progress made relating to *mens rea* will require the expansion of the library of understanding generated from subjective behavioural reporting and recording contingent brain activity.¹³⁴ Given that subjective feelings inevitably vary from person to person, based on the complex interaction of circumstances, memories, openness to emotion and other personalised traits, mapping these seem beyond the technical possibilities of fMRI. Indeed, even judges using universally shared language have not been able to encapsulate the essence of intention.¹³⁵ It seems even with a far advanced understanding of the contingency of brain states and mental states, the unique *experience* of neuronal activity in an individual (relating to intention) will not be overcome with fMRI technology.

Yet again, the requirement that the assessment of mental states be contemporaneous to the criminal act in *mens rea* would also limit the possibilities of neuroscience.

¹³¹ ANU Law Department (2010).

¹³² Brown and Murphy (2010), p. 1119, 1130.

¹³³ Nagel (1974).

¹³⁴ Brown and Murphy (2010), p. 1119, 1129.

¹³⁵ See: ‘Intention: Multiple Meanings’, in ANU Law Department (2010).

14 Criminal Defences

Neuroscientific understandings, gained through fMRI scanning, may make inroads into legal concepts of criminal responsibility in the area of functional capacity and relevant defences. The “veil”¹³⁶ separating defences such as insanity from the positive test of *mens rea* is based on how responsibility is afforded, once *actus reus* requirements are satisfied. Capacity responsibility, which determines how one is to be held accountable, implies a similar subjective experience of intention, as it requires the capacity to deliberate and choose a certain action. Insanity or substantial impairment denies the proper capacity for the deliberation required; it is a “defence to criminal responsibility by reason of absence of *mens rea*”.¹³⁷

The case law looking at the defences of insanity and substantial impairment by abnormality of mind¹³⁸ has confirmed that “as an excuse, [insanity] reflects the fundamental moral principle ‘that a person is not to be blamed for what he has done if he could not help doing it’.”¹³⁹ In her capacitarian model of responsibility, Vincent sets out the factors required; culpability depends upon one’s duties, these duties arise out of what one can or cannot do, and what one can and cannot do relies in part (at least) on one’s mental capacities.¹⁴⁰ If brain scans provided compelling evidence of mental capacities, their integration into this capacitarian understanding of responsibility would appear straightforward.

Mental capacities range from those which carry a sense of ambiguity (particularly regarding behavioural manifestation), such as reasoning, to those which can more clearly be identified with behavioural indicators, such as one’s ability to foresee likely outcomes of certain behaviour (as is assumed in recklessness). Functional MRI research has been used to identify aberrations appearing consistently alongside certain well-known dysfunctional behavioural syndromes, such as antisocial personality disorders or more serious forms of depression.¹⁴¹ Neuroscience, in the same way, may, by determining areas of the brain consistently active when making moral judgements, elucidate the areas required for this functioning.

The doctrine of insanity, was set down in *M’Naghten’s case*¹⁴²; requiring,

¹³⁶ Brown and Murphy 2010, p. 1119, 1129.

¹³⁷ *R v S* [1979] 2 NSWLR 1 as discussed *Hunter Area Health Service & v Presland* [2005] NSWCA 33 (21 April 2005) per JA Santow at 312, accessed at <http://www.austlii.edu.au/cgi-bin/sinodisp/au/cases/nsw/NSWCA/2005/33.html?stem=0&synonyms=0&query=insanity>.

¹³⁸ s23, *Crimes Act 1900* (NSW).

¹³⁹ H.L.A. Hart, *Punishment and the Elimination of Responsibility*, (1962), Athlone Press at 20, as discussed *Hunter Area Health Service & v Presland* [2005] NSWCA 33 (21 April 2005) per JA Santow at 312.

¹⁴⁰ This is made clear in any discussion of omission – we cannot be held accountable for those things we could not have done: Vincent (2010).

¹⁴¹ Mayberg (2010), p. 37, 38.

¹⁴² *M’Naghten’s case* [1843] UKHL J16 (19 June 1843).

to establish a defence of insanity, it must be clearly proved that, at the time of committing the act, the party accused was labouring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing; or, if he did know it, that he did not know he was doing what was wrong.

The first premise, the time of the act, presents another problem for neuroscientists. Introducing fMRI into insanity defences requires specificity about the time of “disease of mind” being examined, as brain functioning capacity may be affected by static (i.e. stable, long-term, fixed aberrations), episodic (e.g. epilepsy or bipolar manic depression) or progressive (such as dementia) aberrations.¹⁴³ While in the first of these instances, scans may hold significant weight, and be able to show a persistent abnormality; in the second two instances, fMRI would be persuasive in assessing certain functional impairment, only alongside other contemporaneous evidence.

The second premise of “defect of reason” from “disease of mind” refers to concepts upon which brain imaging shines limited light. Even with a wealth of understanding of the brain activity accompanying the behavioural conditions of reason, reason is not a static capacity, but rather subjective in the way that people exercise it with different capability and qualification. Even beyond reaching the ‘age of reason’, education in ‘thinking’ greatly affects the exercise of one’s reason, or ability to understand. These functions of reasoning and understanding cannot be fully grasped by fMRI, as the brain processes associated with these functions cannot elucidate the subjective aspect present in attaching meaning to this data. However, if someone was severely lacking brain function in areas commonly associated with the behaviour of ‘reasoning’, they might argue that this amounted to a “disease of the mind”, as brain capacities are necessary for exercising powers of the mind. Therefore, in some limited cases, where it is likely that mere examination of behaviour would reveal insanity anyway, fMRI would provide compelling evidence to support this severely reduced functioning.

The statutory defence of substantial impairment by abnormality of mind, which lessens a sentence of murder to manslaughter, requires the accused to show that:

at the time of the acts or omissions causing the death concerned, the person’s capacity to understand events, or to judge whether the person’s actions were right or wrong, or to control himself or herself, was substantially impaired by an abnormality of mind arising from an underlying condition. . .¹⁴⁴

In *R v Dusan Maric*,¹⁴⁵ in an attempt to define the meaning of “substantial” it was held that, “although the impairment may be less than total it must be more than trivial”.¹⁴⁶ The difficulty in defining “substantial” is further exacerbated by section 23 (2)’s prohibition of opinion evidence. Functional MRI may develop an objective

¹⁴³ Mayberg (2010), p. 37, 40.

¹⁴⁴ S23A (1) (a) of *Crimes Act 1900* (NSW).

¹⁴⁵ *R v Dusan Maric* [2009] NSWSC 346 (1 May 2009).

¹⁴⁶ *R v Dusan Maric* [2009] NSWSC 346 (1 May 2009), as per Harrison J at 35.

measurement of impairment, by testing the actual capacity of those parts of the brain, which would usually be active during the behaviour of making moral judgements. While psychological analysis is commonly accepted, accused persons face difficulties where they have not previously sought psychological help and cannot provide weighty evidence on the continuity of any condition. Functional MRI is on the path to being able to give significantly accurate answers to the status of mental conditions, that is, whether something is “underlying” as opposed to “transitory”,¹⁴⁷ and thus may assist in these cases.

The introduction of neuroscientific evidence regarding mental capacities may, however, invite an alternative approach to responsibility than held by Australian courts. In cases where conditions of insanity, such as hallucinations or delusions are not present, and fMRI evidence instead reveals a deficiency in functioning associated with moral understanding, such as in the case of psychopaths, it has been argued that these people are fundamentally bad, rather than mad and therefore should not be excused on this basis. Maibom, has argued for this approach, saying “to excuse psychopaths from moral blame is tantamount to excusing them for being bad. . . presumably, we do not intend with our system of law to exculpate those whose disorder primarily consists in being bad”.¹⁴⁸ While opening the courts to fMRI would open this use of scans to a prosecution, responses to this approach point out that this confuses “capacity responsibility” with “virtue responsibility” (a description of how one has acted based on fMRI evidence) and thus deals with elements of the sentencing process, rather than the guilt assessment process.¹⁴⁹

It is important that the scientific evidence is not regarded as an objective measure of a capacity, but rather as an objective measurement of brain functioning associated with certain cognitive moral capacities. Given that generally, the capacitarian view of assigning responsibility is facilitated by allowing for mitigation of responsibility where impairment exists, the increased clarity offered by fMRI may see statutory or common law defences for other criminal actions be established. For example, if strong empirical evidence suggested an association between lesions in the frontal cortex with violent behaviour, this might form a basis for a defence against assault as an “underlying condition” and decreases in one’s ability to “control” physical responses might be identified. Furthermore, research into more subtle reactions of persons may eventually lead to empirical evidence suggestive of one’s propensity to be “provoked” to the point of losing self-control. Such application of fMRI would require a sophisticated level of understanding by juries, to ensure scientific evidence was duly scrutinised.

If these developments had the effect of somehow reducing all criminal activity to brain defects, this would set the legal system on a path to a watered-down determinism of sorts. Such impacts would undoubtedly demand a review of the

¹⁴⁷ s23 (8) of *Crimes Act 1900* (NSW).

¹⁴⁸ Maibom (2008).

¹⁴⁹ Vincent (2010), p. 17.

sentencing of criminals, which would need to balance these concerns in light of the interests of justice.

15 Non Determinism, Sentencing and the Importance of Moral Education

If abnormalities in functioning were able to be effectively equated with any criminal peculiarity, moral responsibility might be framed in terms of mental defects rather than moral culpability.¹⁵⁰ However, while fMRI may impact on sentencing, neuroscientific evidence of non-determinism ensures that the fundamental concept of responsibility could not be laid aside entirely. In the face of criminal behaviour, the need for reparation for both victims and society hails from the innate desire for justice, upon which the legal system gains its force. While courts need to examine a criminal's "virtue responsibility" and retain punitive measures, a deeper understanding of the brain may eventuate in opportunities to implement philosophies of restorative or transformative justice.

The call to embrace treatment-based programs of justice, rather than traditional punitive ones, is a strong one. Jessel and Moir write,

...with the growing knowledge that crime is ... a function of biology... Evil may be...no more sinister than a matter of loose connections... Is it practically possible to discard the traditional concept of justice based on guilt and punishment and replace it with a 'medical model' based on prevention, diagnosis and treatment?¹⁵¹

This view is held by many who conclude that if brain lesions can be associated with criminal behaviour, then knowledge of capacity and responsibility should lead to the treatment of crime as an illness, and therefore medicate, rather than punish offenders. In fact, if a sense of "biological determinism"¹⁵² could be shown to exist, retributive punishment for offences committed outside of one's control would make little sense.¹⁵³

While fMRI revealing impaired capacities may affect the assessment of one's "capacity responsibility", this model of medical treatment reflects a view of determinism, which requires the legal system to abdicate the concept of free will, and thus abandon agency with responsibility. Applying this in the extreme, mandatory fMRI scanning, and locking up those with brain abnormalities, in a pre-emptive movement against crime, would seem reasonable.

However, what the current, though incomplete, understanding of brain capacities and their impact on behaviour, from fMRI, assures one of is that abnormalities are

¹⁵⁰ Calls for a therapeutic approach are discussed in: Hodgson (2000).

¹⁵¹ Moir and Jessel (1995).

¹⁵² Sapolsky (2004), p. 1795.

¹⁵³ Norrie (1991).

not determinative. In a review of findings from various studies looking at common behavioural brain lesions, Mayberg writes, “Interestingly, most patients with these types of lesions do not display antisocial or criminal behaviour and not all criminals show such brain abnormalities. . .”¹⁵⁴ Similarly, neuroscientific research looking into drug addiction has found that neurotransmitter systems play a significant part in specific addictive patterns, however, “biological vulnerabilities do not exonerate the person for responsibility for their addictive state since it is their choice to use the drugs, once or multiple times”.¹⁵⁵

That brain abnormalities may or may not be a characteristic of criminals convicted of the same crime or, likewise, that certain brain lesions may be present in both the offender and the ‘just citizen’ proves that at a level human agency plays a crucial part in the determination of human behaviour. This is not to disregard the recognition of disadvantage or the reduced responsibility that may eventuate from understanding of impairments of the mind. Indeed, there are many positive impacts such knowledge may have on the legal system.¹⁵⁶

A legitimate reading of Jessel, Moir and others, who would adopt a therapeutic system of justice, might see their concerns as stemming from the notion that justice should be about responding to the needs of offenders and transforming society into a better place in the process. Such aims might have to reject the common appeal to view the system *consequentially*,¹⁵⁷ and enforce practices based merely on the merit of their outcomes: deterrence, prevention and rehabilitation. Rather, responding in this way has often been labelled “restorative justice” or “transformative justice”.¹⁵⁸ Neuroscience, in revealing that abnormalities are not determinative of criminal behaviour, has shown that there is a level at which moral education about decision-making is increasingly important; a strengthening of the just character in citizens. As Moir and Jessel write, “identifying the cause. . .loads us with the responsibility of doing something about it – treating the offender”.¹⁵⁹ To the extent that wider society may be blamed for ‘producing’ criminals, a response is demanded in the form of wider moral education, particularly for those marginalised and disadvantaged, which might include programs focusing on the value of thinking reasonably, opportunities to be inspired to foster ambitions, and general encouragement to develop a sense of justice.

Furthermore, recent developments in neuroscience reveal the potential of the brain for ‘plasticity’; the ability to change structurally and functionally.¹⁶⁰ While there are limitations, and prerequisites – such as healthy brain tissue and the

¹⁵⁴ Mayberg (2010), p. 37, 39.

¹⁵⁵ Bloom (2010), p. 44.

¹⁵⁶ Doidge (2009).

¹⁵⁷ Sapolsky (2004), p. 1795

¹⁵⁸ Ashworth (2002), also see: Mertus (1999).

¹⁵⁹ Moir and Jessel (1995).

¹⁶⁰ Schaechter et al. (2006).

capacity for motivation and focus, this means that some functions lost due to abnormalities in certain regions of the brain may be regained.

Where neuroscience further develops and gives scientists, working with psychologists, a deeper understanding of brain plasticity, those who are viable candidates but who lack certain helpful capacities required for moral decision-making might further benefit from neurological exercises aimed at restoring these.

There would of course be opposition to such change, and significant difficulties in deciding upon *which* moral code should be adopted. However, any therapeutic system would bring similar questions, given the diversity of brain structures and the diversity of functioning patterns. Moreover, there are inherent dangers posed in preferring certain brain functional structures, if science was given domain to ‘fix’ abnormalities. The diversity and creativity that may be intrinsically reliant on what may appear as ‘abnormalities’ lead one to reject therapeutic modification of the human brain.

Finally, not all sense of “punishment” could be done away with, even in a system of restorative justice, which aims at rehabilitating offenders. The non-determinism of brain structure and function requires that notions of free will, intention and fundamental choice in action remain. Not only does some form of punishment respond to the needs of victims, being a form of recompense, but it is required to affirm the fundamental tenets of the legal system and enforce the sense of ‘justice’ or giving of someone’s ‘due’. This would further deter a number of malicious abuses that might come out of a purely therapeutic system. Ultimately, the legal system recognises the inherent value of self-determinism, the great dignity attached with being “master of one’s destiny”, by punishing where one removes that ability from another, and upholding the fact that there are boundaries to the exercise of freedom.

In this way, the advances of neuroscience would act to further confirm principles held dear to the functioning of the legal system, while enhancing the benefits for society that may be achieved through the justice system. A deeper understanding of human agency will better enable legislators and the juridical system to respond to the needs of their community, and encourage a sense of justice that fosters law-abiding citizens.

16 Conclusion

In Australia, the legal system is currently reluctant to accept neuroscientific techniques such as fMRI, EEG and brainfingerprinting evidence. This may change in the future.

Professor Henry Greely’s words support the Australian perspective too¹⁶¹:

¹⁶¹ Professor Henry Greely (Stanford Law School), “Can MRIs Help Solve Crimes” National Public Radio interview, May 14, 2010 with Paul Raeburn.

Well, I think, certainly our ability to read minds, and it's a strong term, but I think it's an accurate one here, through fMRI and other neuroimaging, is going to get better and better, both from technical advances and through statistical advances. Whether it will ever be good enough to be used in a courtroom remains to be seen.

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