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Neuroscience
in the courtroom

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The first in a series of Cambridge neuroscience and public policy discussions, this report addresses how policy makers might respond to the increasing use of scientific concepts and evidence in the legal system, addressing what is known and what questions should be asked about neuroscience in the courtroom

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Executive summary

A day workshop spent addressing the intellectual challenge of bringing law, philosophy and neuroscience together. Participants considered how neuroscience was currently being used in the courtroom, in civil and criminal cases; how developments in neuroscientific imaging and other research are increasing our knowledge of brain function; how the emerging discipline of neurocriminology seeks to address biological and contextual factors affecting criminal behaviour and how criminal justice policy makers might respond to advancing knowledge.

Research

- The impact on the legal framework and practice of bringing neuroscience concepts and paradigms could be incremental or fundamental; the challenge of 'reductive' neuroscience where mind is the brain.
- Neuroscience advancing, including through brain imaging, adding insight into the impact of brain damage including childhood trauma; how brain function varies across populations; understanding brain processing.
- Understanding the neurological basis for criminal behaviour and its impact on society

Practical Policy Issues

- Research from neurocriminology offers the prospect of more targeted, nuanced, informed and potentially cost-effective approaches to youth justice, intervention, sentencing and rehabilitation.
- How to ensure the best use of scientific evidence in the courtroom; testing reliability of evidence, education and training for lawyers and scientists.
- Insight from this area informs the broader question of how policy makers and legal practitioners respond to scientific data and approaches.

Key Questions

- What do policy makers need to know about neuroscience?
- What insight does neuroscience offer criminal justice policy?
- What are the key methods that neuroscience brings?
- What are the challenges and risks of bringing neuroscience into the courtroom?

Different types of neuroscientific evidence in courts:

- **Brain imaging**
  - Truth telling; age of criminal responsibility; nature of pain; mental condition (criminal responsibility); personality change due to brain damage; mitigation due to brain abnormality
- **Neuroscientific information**
  - Risk assessment; memory
- **Behavioural science**
  - Truth telling (e.g. in child abuse cases)
- **Empirical research on the use of neuroscience in appeal cases, approx. 25 per annum, likely to increase (Claydon and Catley)**
- **Appelbaum (2014) concludes courts in period of 'exploration' regarding use of evidence; in criminal cases and civil cases**

Royal Society (2011) concluded that 'discoveries in neuroscience [. . .] will not completely revolutionise the theory and practice of law in the near future; but there are already some important practical implications of recent neuroscientific discoveries, which should impact on the law, and there will certainly be many more over the next few years'.

Challenges to overcome included: ensuring latest advice is available on use of scientific expertise in cases; respective undergraduate teaching in law and neuroscience; ongoing training and professional development for lawyers and judges; further research; regular organised meetings between scientists and legal experts.

Where are we heading?

Neuroscience could tell us more about the following – Was the individual competent? Did they know what they were doing? Could they control their actions?

These questions are relevant to our understanding of the law. Neuroscience cannot do this now, but is beginning to do so, and is likely to be able to in the future.

Increased understanding may lead to a broader concept of responsibility in the future (Glenn and Raine (2014).

Discussion focused around critique of concepts and methods regarding neuroscience in court. Practical, pragmatic response was emphasized, focusing on how evidence is used practically in the courtroom. Several participants had been involved in practical legal cases, and discussion drew on insights from these experiences. In criminal cases neuroscience evidence was used to argue defence due to trauma, brain injury and evidence of behaviour change. The process for selecting and presenting scientific evidence in court was discussed along with legal tests for validity.

Chapter 2: How neuroscience challenges legal concepts

Professor Dennis Patterson presented the conceptual challenges that arise when bringing neuroscience into the legal 'arena'. Legal practices and the conceptual framework underpinning those practices are drawn from a different base to neuroscience, and have evolved in a different way. Professor Patterson argued that in what is referred to as a 'neurolaw' framework, a unitary, physical explanation is offered to explain mental state. In contrast, legal frameworks and behaviour and mental states are judged with more elements and are dependent on the context or situation in which they take place. We should be cautious about applying new thinking on established legal concepts such as responsibility, behaviour and risk.

Conceptual Issues

- Defining concepts differently: behaviour and action explained from brain activity challenges more complex understanding which includes context and situation.
  - Group to individual: scientific study makes inferences from the particular to the general group whereas law determines on an individual in court.
    - "Science's generalized, population-level knowledge of a phenomenon may not provide an appropriate empirical foundation for making inferences about individuals." (Patterson)

Methodological Challenges

- Brain-based lie-detection (EEG) is based on controlled test conditions and validity and reliability could be questioned when applied to more complex real world situations.
- Inconsistencies among empirical studies of fMRI (image-based lie detection).
- Inference of brain activity (or brain state) and associated tests to measure lies, deception can be questioned.

Challenge from Professor Patterson – can you move from a brain scan to the question of responsibility for a crime in court?

Chapter 3: Insights from neurosurgery

Evidence summary

- Neuroscience and neurosurgery provides insights from individual medical case research
- Research shows effect of brain injury and long-term results of brain damage
- Research shows how populations vary according to brain function
- Imaging techniques are becoming more sophisticated in what they can show in terms of brain activity
- Neuroscience produces evidence that criminal behaviour can be understood as a medical condition

Policy Issues

- Brain science is giving us insight into variability across populations in terms of how people function, according to empathy, intelligence, impulse control or aggression, which has implications for the law which treats all individuals equally. This may lead towards a 'scientifically informed approach' to sentencing which may mean sentencing and rehabilitation tailored to the individual (Eagleman, 2011).
- How can best use be made of scientific evidence in legal systems and court? What systems and processes need to be in place in order to do this?
- How do we make best use of science and particularly neuroscience adding to our knowledge regarding criminal behaviour?

"As brain science improves, we will better understand that people exist along continua of capabilities, rather than simplistic categories. And we will be better able to tailor sentencing and rehabilitation for the individual …" (Eagleman, 2011)

Professor John Pickard from the Department of Clinical Neurosciences took participants through latest developments in imaging techniques and neurosurgery, showing how neuroscience is advancing in this area through examination of medical cases and scientific studies using brain imaging techniques. Neuroscience can show effects on the brain of: brain damage including childhood trauma, brain processing, and how brain function varies across populations.

Chapter 4: Neuroscience in the wider criminal justice system

There is increasing understanding that neurobiological influences partly predispose an individual to offending. Research from the new field of neurocriminology offers the prospect of more effective policy in the criminal justice system, by building up research on the connection between biological, neural processes and the context or environment. It is not yet known how biological and environmental factors are processed and impact on behaviour but a key focus of developing empirical research is how the relationship differs for individuals, and what policy interventions may be successful in preventing criminal behaviour.

Evidence Summary

- A number of studies provide evidence on the biological basis to criminal behaviour:
  - Epigenetics studies show that the environment can influence how genes are functionally expressed in an individual, and even in brain areas.
    - Longitudinal research from Sweden showed incurring brain damage increases the risk of criminal behaviour.
      - Finnish study showed that traumatic brain injury during childhood and adolescence was associated with an increase in crime in adulthood (Glenn and Raine, 2014)
  - Research in neurocriminology suggests if we look at individuals and context we can make changes to individuals and settings and make change to these interactions; for example, focus on family, school settings.

Policy Issues

- If we have scientific information (such as brain injury) that an individual is more likely to commit a crime how should we intervene to reduce the risk to society?
- What impact does knowledge in this area have on the moral responsibility of a defendant? Should they face the same sentence or should they have tailored rehabilitation?
- Focus for neurocriminology is in early intervention where it can help inform potential towards criminal behaviour, for example identify characteristics of people more likely to commit crime and targeted early interventions.

Neurocriminology: "Knowing more about the brain. Knowing more about the environment." **Kyle Treiber,** University Lecturer in Neurocriminology

FURTHER RESEARCH: what might be particular risks or 'trigger points' in terms of criminal behavior?

Chapter 5: Policy issues

Bringing neuroscience in to Courtroom

- How can the legal system make best use of neuroscientific information as that information increases over time?
- What is the function of punishment and could neuroscience test this?
- What is the relationship between individual and population in developing research into biological factors in crime?
- Policies around prediction and prevention – ethical issues about collecting data from prison population

Using science in policy process

- How much do lawyers and policy makers need to know about neuroscience in order to make sense of its contribution?
- What are the risks and rewards of bringing neuroscience into the courtroom?
- Accuracy and prediction are a key test for applying evidence to policy
- Likely to result in more measured, incremental impact of increasing knowledge regarding criminal behaviour and brain function.

RELEVANT AREAS FOR FURTHER DISCUSSION: neuroscience in addiction; behavioural insights (e.g. impact of virtual courts); insanity; risk and prediction; punishment; developmental neuroscience and developmental psychology; provocation; diminished responsibility.

The potential for bringing neuroscience in to the courtroom is increasing. Whilst participants were cautious and keen not to overstate the inroads neuroscience has so far made, empirical evidence of its application is developing. It raises conceptual questions about the validity of scientific concepts to the legal framework but also very practical issues about how scientific data is presented in court and tested legally.

Overall, participants were pragmatic, mindful that advances in science are taking place, open to the potential for new insights, cautious about overstating the benefits of scientific tests in legal cases.

List of participants

Professor Simon Deakin, Faculty of Law, University of Cambridge

Mr David Howarth, Land Economy and Department of Politics and International Studies, University of Cambridge

Professor Dennis Patterson, Philosophy and Law, European University Institute

Professor John Pickard, Department of Clinical Neurosciences, University of Cambridge

Professor John Spencer, Faculty of Law, University of Cambridge

Dr Kathy Liddell, Faculty of Law, University of Cambridge

Dr John Barker, Lauterpacht Centre for International Law, University of Cambridge

Dr Kyle Treiber, Lecturer in Neurocriminology, University of Cambridge

Professor Michael Lamb, Psychology and Law, University of Cambridge

Tor Tarantola, Behavioural Science, University of Cambridge

Dr Lisa Claydon, Senior Lecturer in Law, the Open University

Paul Catley, Senior Lecturer in Law, Open University Business School

Stephen Muers, Sentencing and Rehabilitation, Ministry of Justice

Jonathan Childs, Youth Justice, Ministry of Justice

Alana Diamond, Analytical Services, Ministry of Justice

Dr Liz Ward, Analytical Services, Ministry of Justice

Dr Brian Burton, Analytical Services, Ministry of Justice

Dr Alec Buchanan, Psychiatry, Yale School of Medicine

Dr Charlotte Sausman, Coordinator, Public Policy Strategic Research Initiative

Dr Dervila Glynn, Coordinator, Neuroscience Strategic Research Initiative

References and further reading

Michael S. Pardo and Dennis Patterson: *Minds, Brains and Law. The Conceptual Foundations of Law and Neuroscience.* (Oxford University Press, 2013)

Appelbaum, P. S. 2014: *The double helix takes the witness stand: behavioural and neuropsychiatric genetics in court.* (Neuron, 82, June 4, 946-949)

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Seymour, B. and Vlaev, I. 2012: *Can, and should, behavioural neuroscience influence public policy?* (Trends in Cognitive Sciences, 16, 9, 449-451)

Glenn, A. L. and Raine, A. 2014: *Neurocriminology: implications for the punishment, prediction and prevention of criminal behaviour.* (Nature Reviews Neuroscience, 15, 54-63)

Eagleman, D. 2011: *The brain on trial.* (The Atlantic Magazine www.theatlantic.com/magazine/archive/2011/07/the-brain-on-trial/308520/)

Also the reports of the Royal Society Brain Waves project on Neuroscience including *Module 4: Neuroscience and the Law*, available at: https://royalsociety.org/policy/projects/brain-waves/

Notes

The Cambridge Public Policy Strategic Research Initiative (SRI) aims to support public policy research across Cambridge University, working with colleagues in science, social science, the arts and humanities, to apply new thinking to public policy problems and promote research and analysis into the public policy process.

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