

Neuroscience and Law: Blind Justice or Blind Faith?

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Last year two companies operating out of the USA began marketing a functional magnetic resonance imaging (fMRI) scanner as a commercial lie-detector. This sparked debate amongst ethicists, scientists and lawyers who fear that intrusive and unreliable technologies developed for academic neuroscience will be fast-tracked into widespread use without a complete analysis of the potential risks and benefits to both individuals and to society.

It is thought that lying involves activation of a number of unique brain areas required for suppressing the truthful response and generating a false response. Researchers claim to be able to identify a lie using fMRI by looking at blood flow to these unique brain areas while subjects respond to questions. The idea is that lying raises the activity of neurons in these areas, resulting in a local increase in blood flow, which is then detected by the fMRI machine. Currently accuracy is estimated to be between 78% and 90% (1). One of the companies, Cephos Corp, predicts that once development of the product is complete they will be able to detect lies with 95% accuracy. These modernized lie-detectors are intended for use by both private businesses and courts, with the claim they will: "Protect the innocent and convict the guilty" (2).

Attempts to identify liars objectively are by no means a modern phenomenon. In the past in West Africa, suspects were traditionally made to pass a bird's egg from one to another. He who broke the egg was assumed to be the most nervous and hence the liar. Similarly, in ancient China the suspect was required to hold a handful of rice in his mouth while the prosecutor made his accusation. Under the assumption that anxiety reduces salivation, the suspect was found guilty if the rice remained dry at the end of the speech. Modern polygraph machines work on perhaps surprisingly similar principles. Lying is assumed to cause anxiety, which activates automatic physiological responses such as increased heart rate, breathing, sweating, and blood pressure. By monitoring these changes, operators of the polygraph claim to be able to detect when an individual is lying with an accuracy of 80-90%, although the reliability of these reports has been the subject of significant debate (3).

Currently, polygraph lie-detector machines are not widely used in criminal justice systems. In the USA, the Supreme Court ruled that it is up to individual jurisdictions to decide whether polygraph questioning can be submitted as evidence, with most state courts refusing to allow this. Individuals cannot be forced to undergo polygraph testing. However, lie-detector tests are used by prosecutors and defence counsel during pre-formal and sentencing phases of trials; by security agencies during criminal and intelligence investigations; and in some states to assess probation and parole (4). In the United Kingdom, polygraph evidence is not used in court cases, nor is its use reported by the police.

In contrast to polygraph machines, which subjects may

deceive by controlling their physical responses to anxiety, fMRI lie-detectors are allegedly impossible to fool, as it is not possible to learn to control blood flow in the brain as areas become activated by a task such as lying. The companies marketing these machines are therefore making bolder assertions regarding the accuracy and sensitivity of their methods than had been made for polygraphs.

However, despite claims from proponents, there remain serious barriers that render the commonplace introduction of fMRI into law courts in the near future very unlikely. The fMRI scanner is large and requires an enormously powerful magnetic field. This makes it impossible for testing to take place outside the confines of dedicated laboratories. Given the power of the magnetic field, people who have metal inside their bodies (including pacemakers, artificial joints, metal fragments following accidents, etc) cannot be tested. More problematically, if a subject moves or refuses to answer a question during the scanning procedure then the results are meaningless, making it impossible to test a person who is not absolutely consenting. In practical terms this means that such devices are only likely to be successfully employed by defence lawyers.

In addition to these practical issues, there are a number of theoretical problems with the use of fMRI for lie-detecting in courts. For example, there is significant debate about the correct design and interpretation of any study that uses fMRI, a debate that operates at a level of complexity beyond the interests and abilities of the courts (5). Furthermore, it is not clear whether the models developed for detecting lies under laboratory conditions – in which subjects are asked to lie under very specific circumstance – will be applicable in court conditions where the stakes are considerably higher. Similarly, if the individual being tested is psychotic, deluded or a pathological liar, then the models developed in studies using 'normal' participants may not be applicable. When these considerations are taken together with the predicted cost – one of the companies, No Lie MRI, charges \$30 per minute of scanning, which may take an hour to complete, in addition to fees for legal assistance and analysis – fMRI lie-detectors appear practically unrealistic.

Assuming these issues could be resolved, there remains the ethical question of whether it is right to force people to submit themselves to intrusive and potentially flawed investigations with fMRI machines. Firstly, the complicated nature of interpreting results from fMRI investigations means that courts will be totally reliant on expert opinion. Since the world of academia cannot agree on how to interpret such results, it is unrealistic to expect courts to do so. Secondly, the scientists involved in developing these models for lie-detection own the patents to their use. This means that the academic world is excluded from freely testing their claims regarding accuracy. Thirdly, there is a considerable chain of assumptions leading from observation of a regional change in brain blood flow to a conclusion regarding a person's guilt or innocence. It is reasonable to expect a suspect to explain how their fingerprint came to be on a trigger, but may be less reasonable to expect a defendant to explain why the blood flow in his/her brain altered in response to a particular question.

Therefore, it seems unlikely that witnesses and defendants will very soon find themselves submitting to fMRI scanning in place of the traditional oath and jury. Until the technical, practical and ethical objections have been satisfied, the prospect of simply sliding a suspect into a scanner will remain science fiction. However, the example of fMRI lie detection illustrates a general trend, for there are further situations in which recent neuroscientific developments show the potential to influence decisions made within law courts. For example, evidence suggests that individuals known to display repetitive violent and aggressive behaviour (6), including those with murder convictions (7), tend to have less activity in the frontal cortex of their brain when compared to the average population.

These findings are significant for a number of reasons. Firstly, this region of the brain, identified as showing evidence of malfunction in significantly antisocial individuals, contains many of the same areas found to be involved when normal people lie. This raises serious doubts about the validity of using models of lying based on 'normal' participants, to assess the truth of statements from suspects whose brain



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structure and function may not be quite as 'normal'. The second and more serious concern is the possibility that evidence for similarly reduced activity in the frontal cortex of a suspect might be used to prove guilt; to establish the chances of re-offending; or even decide the probability that this person will commit a crime in the future. Such fears of pre-emptive conviction before any crime has been committed may seem far-fetched, but the UK government is currently pursuing new laws towards preventative detention of those deemed to have 'dangerous and severe personality disorder' and in the USA such detention of 'sexual predators' is allowed in many states (8). It is not unrealistic, therefore, to imagine that a brain scan for features common with those found in a population of hardened criminals might become part of the processes of both determining guilt and 'protecting' the public from future threat before a crime has been committed.

Aside from this ethical debate regarding pre-emptive conviction, what is the problem with using this technology to determine who committed a crime that has already taken place? The main issue is that the research indicating an association between frontal cortex under-activity and criminal behaviour is fraught with difficulties of interpretation. Two points can be made regarding the translation of these studies from laboratories to law courts. Firstly, establishing an association between two characteristics does not automatically imply a causal relationship. It may be true that people convicted of murder have reduced frontal

cortex activity compared to the average, but whether this reduced activity makes them murderers is not proven. A third trait, such as social or educational background, may be independently related to both the level of frontal activity and to the overall likelihood of committing a given crime. A second, related issue arises from difficulties people have in interpreting probabilities in relation to groups of people. If for example, a person belongs to a group (e.g. frontal cortex under-activity) which as a population has an X% chance of committing a murder; this is not the same as saying that a specific individual from that group has an X% chance of committing a murder. This is because the research that established the association was based on the entire population. Being a member of a population by no means endows an individual with all the characteristics shown by that population. Just because there is a roughly 50% frequency of women in the UK population does not mean that there is a 50% chance that a male individual in that population, would be a woman at any time. Juries and judges may not make this crucial distinction.

It therefore seems that neuroscience has less to offer law courts than might have originally been thought. There may be a few very limited cases in which a clinically well-understood injury or disease to particular brain regions is associated with increasingly violent behaviour in almost all people (8), but these should be treated as rare exceptions to a general rule that currently neuroscience should not be looked to for dealing justice. Perhaps in the future, when techniques are better honed and interpretations less equivocal, this position will change. This would mark an abandonment of the 'human' idea of justice, which is concerned with the fundamentally individual-oriented realms of intention, guilt and culpability.

References:

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