Legal Admissibility of Neurologic Lie Detection Evidence

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The Pandora Myth

- Zeus created Pandora ("all gifted") to torment man as payment for Prometheus's theft of fire from the gods.

- She opened her jar, not a box, and let loose evils on the world, and thus, the myth explains why evil exists in the world.

- Metaphorically, it warns us that technology or science can have unintended consequences.

Pandora's Box available at: http://www.fotothias.bloggar.com.br/Pandora's%box.jpg.
Why Does Deception Matter?

- Truth breeds trust, which is important in human relationships.
- Deception detection failures can destroy individual lives, governments, even civilizations.
- But deception can be politically or militarily useful, if performed successfully.
- Most civilized societies expend capital on methods that might detect deception.
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- Medieval Methodologies varied from simple trial-by-combat to torture machines.

- Modern technologies vary from the polygraph to sophisticated medical devices, such as fMRI scanners.
  - MRI scanner slide courtesy of Adam E. Flanders, MD; Department of Radiology; Division of Neuroradiology/ENT; Thomas Jefferson University Hospital; Philadelphia, PA 19107-5244.
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- Privacy Concerns

- Employee Rights (*See Employee Polygraph Protection Act of 1988, 29 USC §§ 2001 et seq.*).
  - (3) "The term 'lie detector' includes polygraph, deceptograph, voice stress analyzer, psychological stress evaluator, or any other similar device (whether mechanical or electrical) ... rendering a diagnostic opinion regarding the honesty or dishonesty of an individual."


- Novel Scientific Evidence in Civil and Criminal Matters.
  - *Frye* Test (States).
  - *Daubert* and its progeny (Federal and State Cases).
  - Combinations (States)
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- **What is currently out there?**
  - **No Lie MRI** [http://www.noliemri.com/products/ProductBenefits.htm](http://www.noliemri.com/products/ProductBenefits.htm)
    - Truth verification
    - Legal system: “... In legal cases, No Lie MRI will enable objective, scientific evidence regarding truth verification or lie detection to submitted in a similar manner to which DNA evidence is used.”
    - Business valuation: “... No Lie MRI increases value by reducing risk through mental verification. ...”
  - **Cephos Corporation** [http://www.cephoscorp.com/](http://www.cephoscorp.com/)
    - “To offer fMRI deception detection services in 2006 ... .”
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- **Novel Scientific Evidence is admissible in both civil and criminal matters.**
  - *Frye* Test survives in several state jurisdictions.
  - *Daubert* and its progeny rule in the overwhelming majority of our federal and state jurisdictions.
  - Combo States: A small number of states may employ a combination of *Frye* and *Daubert* and its progeny.
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- Preliminary Issues:
  - Rule 104: Conditional Relevancy or Competency is an issue.
    - Assures the Judge and jury decide preliminary questions of fact upon which admissibility of evidence depends.
    - Preliminary questions of fact must be resolved first.
    - Competency checks unreliability, confusion, and govt. error.
    - Questions of admissibility need not be bound by the Rules.
  - Rules 401 – 403: Prejudicial or not, that is a question!
    - Rule 403 is the “silver bullet”, where the probative value of proffered evidence is substantially outweighed by the prejudice, confusion, and delay it causes.
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- **Frye Test**
  - Requires the proponent of the scientific evidence to show that the theory and method used by the expert witness are generally accepted within the relevant scientific community.
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- **USCS Fed Rules Evid R 702**

- 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 by knowledge, skill, experience, training, or education, 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.

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- Who decides under *Daubert* and its progeny?
  - The Gatekeeper (District Court) decides if the expert has special skill, knowledge, or education that will aid the trier of fact.
  - Cross examination culls shaky evidence, not per se exclusion.

- What is the gatekeeper’s role?
  - Assure its minimal reliability.
  - Does not simply refer evidence to the trier as a question on weight.
  - Determines its validity by looking at nonexclusive, flexible set of factors that depend on whether technique or theory:
    - (1) Can they be or have they been tested?
    - (2) Are they subject to peer review and publication?
    - (3) Are their potential or known error rates ascertained?
    - (4) Are their existing and persistence of standards?
    - (5) Is it generally accepted? (*Frye* Test survives?)
What has the gatekeeper said, thus far:

- Polygraph: No, Maybe No or Yes!
- Brain Fingerprinting: No x 2!
- fMRI: No x 1!
- fMRI Lie Detection: No cases!
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- **Brain Fingerprinting:**
  - **Technology:**
    - Utilizes electroencephalographic recordings with computer analysis of the EEG brain wave patterns.
    - \( P_{300} \) wave and a memory-and-encoding-related-multifaceted-encephalographic response (MERMER) are the key EEG wave patterns recorded and analyzed.
    - Utilizes the “guilty knowledge test” which incorporates pictures, words, or sounds as target, irrelevant, or probe stimuli to elicit response from the subject.

- **Cases (Post conviction challenges):**
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  - Defendant claimed: (1) DNA evidence, (2) comparative bullet analysis, and (3) brain fingerprinting demonstrated that the defendant was factually innocent of first degree murder.
  - The District Court that the brain fingerprinting expert’s claim that the petitioner lacked knowledge was supported only by the expert’s bare affidavit.
    - Affidavit claimed petitioner’s brain responses to stimuli about salient details of the crime scene showed “information absent.”
    - Statistical confidence of not less than 99%.
    - Court noted the following:
      - Iowa lower court admitted evidence under non-*Daubert* circumstances
      - It did not factor into Iowa Supreme Court’s decision.
      - No evidence of extensive testing, presented or analyzed in peer review articles, has very low error rate, has objective standards to control its operation and/or is generally accepted within the relevant scientific community.
  - Does not support conclusion of factually innocent based solely on the MERMER effect.
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- MRI utilizes the principles of magnetic effects on hydrogen protons ($T_1$ and $T_2$ time constants key to anatomical images).

- For fMRI, Magnetic Field Strengths (Tesla), radiofrequency (rf), and $T_2^*$ gradient echo imaging (EPI) sequences are important.

- Statistical models are also important, especially statistical parametric mapping techniques.

- The Bold Oxygen Level Dependant (BOLD) effect is the key to fMRI lie detection, where neural activity is indirectly detected by imaging the changing concentrations of oxy- and deoxy-hemoglobin within flowing blood.

MRI image, available at http://www.ribnews.ir/newspic/04/11/30/Brain-scan_fal.jpg; See also fMRI image, available at http://www.rsnalink.com/.../thumbnails/Faro_Figure_10.jpg
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- **What happened when fMRI met a Gatekeeper?**
    - *Entm’t Software Ass’n.*, as the plaintiff, challenged The Illinois Violent Video Games Law and the Sexual Explicit Video Game Law as a violation of their First Amendment rights.
  - The State of Illinois, as the defendant, called an expert to deliver fMRI testimony to show that violent video games do cause effects in adolescent games.
    - Experiments consisted of subjects (behavior disorders) and controls performing a counting Stroop test.
    - Studied the ACC and DLPFC of the MFG and IFG because low or absence of activation led to violent behaviors.
    - Normals activate Anterior Cingulate Cortex and left Dorsolateral Frontal Cortex, but not Middle Frontal Gyrus.
    - Adolescents with behavior disorders and those exposed to violent video games activate the MFG of the DLPFC, but not the ACC, and controls with high exposure showed similar responses.
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- Plaintiff’s expert noted the following:
  - fMRI images were composite images of ALL the individuals in the study, and they appear to show activity in areas where no individual actually showed activity.
  - Questioned the applicability of the experimental design to the task being measured.
  - Questioned whether the conclusions drawn were correct.

- Ultimately, the expert’s testimony was not persuasive!
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What Might a Gatekeeper Wish to Know about fMRI Lie Detection?

- fMRI experiments have been performed on nearly 230 individuals.
- The overwhelming majority of studies are skewed toward young volunteers (18-50 years), and of those, over 70% are male participants (118/170).
- Nearly 8% of subjects (all females) were excluded due to their inability to keep still or their inability to lie!
- Over 85% of experiments use statistical parametric mapping techniques (11/13) to evaluate GROUP differences, not INDIVIDUAL differences.
- Thus far, the majority of studies compare group differences, and they create a composite image that is superimposed on an anatomical image of the brain.
- Although certain regions of the brain such as the frontal lobes (inhibition), limbic system, and temporal lobe (memory encoding and retrieval) are associated with deception, there is poor correlation with these areas when individual versus the group differences are analyzed.
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To Admit or Not to Admit: Is that the Question?


The Frye gatekeeper will admit it, if, and only if, it is "sufficiently established to gain acceptance within its relevant scientific community." Some courts parse the test into:

1. Who is the relevant scientific community for fMRI lie detection?
2. Is the theory underlying fMRI lie detection generally accepted?
3. Is this technique or technology generally accepted?
4. Has the technique or technology properly applied in the particular case?
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To Admit or Not to Admit: Is that the Question?

Gatekeepers following Daubert and its progeny may ask:

- Is the subject matter scientific knowledge?
- Is it (a) relevant, then is it (b) reliable (FRE 104 analysis)?
- Was its methodology applied correctly or reliably?
  - (1) Can they be or have they been tested?
  - (2) Are they subject to peer review and publication?
  - (3) Are their potential or known error rates ascertained?
  - (4) Are their existing and persistence of standards?
  - (5) Is it generally accepted? (Frye Test survives?)

- Are there "analytical gaps"?
What can we conclude?

- Modern societies often turn to technology to overcome human failings when it comes to detecting deception.

- Currently, gatekeepers have, at least in jurisdictions adhering to *Daubert* and its progeny, not accepted either brain fingerprinting or conventional fMRI evidence.

- Current fMRI lie detection experiments *indirectly* measure neural activity in regions of the brain associated with a process known as deception.

- The majority of fMRI deception detection images represent a composite image of a statistical average from a group, not individual events and thus, they are neural correlates.