



James Allan Matte\*  
Matte Polygraph Service, Inc.  
Williamsville, New York  
USA

## fMRI Lie Detection Validity and Admissibility as Evidence in Court and Applicability of the Court's Ruling to Polygraph Testing

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### Background

On 18 June 2008, a federal grand jury returned an indictment against Dr. Lorne Allan Semrau, a clinical psychologist, and in a Second Superseding Indictment filed later that year charged him with sixty counts of healthcare fraud in violation of *18 U.S.C & 1347*, twelve counts of money laundering in violation of *18 U.S.C & 1956 and 1957*, and one count of criminal forfeiture. After a twelve-day jury trial Dr. Semrau was convicted of three counts of healthcare fraud, and was acquitted on the remaining counts. Dr. Semrau appealed his conviction in *United States Court of Appeals for the Sixth Circuit, U.S. v. Semrau, 693 F.3d 510 (6<sup>th</sup> Cir. 2012)*.

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\* jamesallanmatte@mattepolygraph.com

In Dr. Lorne Semrau's appeal of his conviction, he argues, on a matter of first impression in any jurisdiction in the country, that results from a functional magnetic resonance imaging (fMRI) lie detection test should have been admitted to prove the veracity of his denials of wrongdoing. Dr. Semrau's conviction was affirmed.

### Explanation of the Court's Decision:

The United States Court of Appeals concluded, after carefully reviewing the scientific and factual evidence, that the district court did not abuse its discretion in excluding the fMRI evidence under Federal Rule of Evidence 702 because the technology had not been fully examined in "real world" settings and the testing administered to Dr. Semrau was not consistent with tests done in research studies. The Court also ruled that the testimony was independently inadmissible under Rule 403 because the prosecution did not know about the test before it was conducted, constitutional concerns caution against admitting lie detection tests to bolster witness credibility, and the test results do not purport to indicate whether Dr. Semrau was truthful about any single statement.

Dr. Steven J. Laken, President and CEO of Cephos Corporation who administered the fMRI lie detection test to Dr. Semrau, testified at the *Daubert* hearing that to his knowledge, fMRI based lie detection testimony had only been presented in court on one prior occasion, a post-conviction relief case in South Carolina.

At the heart of Dr. Laken's lie detection method is fMRI imaging. An fMRI enables researchers to assess brain function "in a rapid, non-invasive manner with a high degree of both spatial and temporal accuracy." When undergoing an fMRI scan, a subject lies down on a bed that slides into the center of a donut-shaped magnet core. As the subject remains still, he is asked to perform a task while magnetic coils in the scanner receive electric current and the device gathers information about the subject's Blood Oxygen Level Dependent (BOLD) response. By comparing the subject's BOLD response signals with the control state, small changes in signal intensity are detectable and can provide information about brain activity.

Dr. Laken agreed during cross-examination that he had only conducted laboratory studies using mock scenarios and was not aware of any research in a "real life setting" in which people are accused of "real crimes." Dr. Laken

testified that fMRI lie detection has “a huge false positive problem” in which people who are telling the truth are deemed to be lying around sixty to seventy percent of the time. Dr. Laken conceded that his 2009 mock crime study was able to identify a “truthteller as a truth teller” just six percent of the time, meaning that about “nineteen out of twenty people that were telling the truth we would call liars.” Another study expressed concern that “accuracy rates drop by almost twenty-five percentage points when a person starts becoming fatigued.” Dr. Laken also explained that a person can become sufficiently fatigued during testing such that results are impacted after about two “scans” because “their brain starts kind of going to sleep.” Similarly, inadequate sleep the night before a test could cause such fatigue.

During his cross-examination, Dr. Laken agreed that the test results do not indicate whether Dr. Semrau responded truthfully as to any specific question but rather shows only whether he was generally truthful as to all of his answers collectively. Accordingly, Dr. Laken conceded that it is certainly possible that Dr. Semrau was lying on some of the particularly significant questions. Dr. Laken was unable to state the percentage of questions on which Dr. Semrau could have lied while still producing the same result.

The magistrate judge had determined that Dr. Semrau could not satisfy the rate of error and controlling standards factor. “While it is unclear from the testimony what the error rates are or how valid they may be in the laboratory setting, there are no known error rates for fMRI-based lie detection outside the laboratory setting, i.e., in the ‘real-world’ or ‘real-life’ setting.” *2010 U.S./Dist. LEXIS 143402. (WL) at \*11*. Also problematic was Dr. Semrau’s participation in a third study (test) after the first two yielded different results, a tactic that does not appear to have been followed in any of the studies performed or cited by Dr. Laken. As the magistrate judge observed, Dr. Laken’s “decision to conduct a third test begs the question whether a fourth scan would have revealed Dr. Semrau to be deceptive again.” *Semrau, 2010 U.S. Dist. LEXIS 143402, 2010 WL 6845092, at \*13*. The decision to conduct an fMRI “best two out of three re-test” as to the AIMS charges suggests testing on Dr. Semrau was itself part of Dr. Laken’s research to refine and better understand how the brain can reveal deception and truthfulness. Particularly troubling was Dr. Laken’s explanation of why the initial “deceptive” result was untrustworthy “the chances of calling a truth teller a truth teller was only roughly six percent” because this “huge false positive problem” could potentially justify continual re-testing on anyone until a “not deceptive” result is obtained.

## Decision of Supreme Court of New York on fMRI:

It should be noted that on 14 May 2010, the Court in *Wilson v. Corestaff Services*, 900 N.Y.S.2d 629 (2010) decided that the defendant's motion in limine to exclude the testimony of the fMRI expert Dr. Stephen Laken is granted and plaintiff's motion for a Frye hearing was denied. The court in *Wilson v. Corestaff* stated that the opinion to be offered by Dr. Laken is of a collateral matter, i.e. the credibility of a fact witness. Since credibility is a matter solely for the jury and is clearly within the ken of the jury, plaintiff has failed to meet this key prong of the *Frye* test and no other inquiry is required. However, even a cursory review of the scientific literature demonstrates that the plaintiff is unable to establish that the use of the fMRI test to determine truthfulness or deceit is accepted as reliable in the relevant scientific community. The scientific literature raises serious issues about the lack of acceptance of the fMRI test in the scientific community to show a person's past mental state or to gauge credibility.

## Other Studies and Conclusions on fMRI Lie Detection:

Dr. Nancy Kanwisher, a professor at the Massachusetts Institute of Technology (MIT) discusses papers that present supposedly direct evidence of the efficacy of detecting deceit with fMRI in Chapter 2, *The Use of fMRI in Lie Detection: What Has Been Shown and What Has Not*, but dismisses their conclusions. (Bizzi E, Hyuman SE, Raianchle ME, Kanwisher N, Phelps EA, Morse SN, Sinnot-Armstrong W, Rakoff JS, Greely HTG. (2009). Chapter 2 reflects "Kanwisher notes that there is an insurmountable problem with the experimental design of the studies she analyzes. She points out that by necessity the tested population in the studies consisted of volunteers, usually cooperative students who were asked to lie. For Kanwisher this experimental paradigm bears no relationship to the real-world situation of somebody brought to court and accused of a serious crime. Kanwisher's conclusions are shared by Elizabeth Phelps, a professor at New York University. Phelps points out that two cortical regions – the parahippocampal cortex and the fusiform gyrus – display different activity in relation to familiarity. The parahippocampal cortex shows more activity for less familiar faces, whereas the fusiform gyrus is more active for familiar faces. However these neat distinctions can unravel when imagined memories are generated by subjects involved in emotionally charged situations. Phelps points out that the brain regions important to memory do not differentiate between imagined memories and those based

on events in the real world. In addition, the perceptual details of memories are affected by emotional states.”

Professor Kanwisher stated “But there is a much more fundamental question. What does any of this have to do with real-world lie detection? Let’s consider how lie detection in the lab differs from any situation where you might want to use these methods in the real world. The first thing I want to point out is that making a false response when you are instructed to do so isn’t a lie, and it’s not deception. It’s simply doing what you are told. We could call it an ‘instructed falsehood.’ Second, the kind of situation where you can imagine wanting to use fMRI for lie detection differs in many respects from the lab paradigms that have been used in the published studies. For one thing, the stakes are incomparably higher. We are not talking about \$20.00 or \$50.00, we are talking about prison, or life, or life in prison. Further, the subject is suspected of a very serious crime, and they believe while they are being scanned that the scan may determine the outcome of their trial. All of this should be expected to produce extreme anxiety. Importantly, *it should be expected to produce extreme anxiety, whether the subject is guilty or not guilty of the crime.* The anxiety does not result from guilt per se, but rather simply from being a suspect.” (See Matte 2010 regarding Lab v. Field studies, and Matte 1998 and Matte, Reuss 1999 regarding the Directed-Lie Control Question.)

### Application of U.S. Court of Appeals Ruling on fMRI Lie Detection to Polygraph Tests:

The United States Court of Appeals for the Sixth Circuit in its rejection of the fMRI Lie Detection test placed particular emphasis on the fact that Dr. Laken’s fMRI lie detection test was based on laboratory studies using mock scenarios and the existing technology had not been fully examined in “real world” settings. This opinion raises serious questions regarding the use of laboratory studies to validate polygraph techniques. A lengthy discussion supported by published research studies regarding the value of laboratory versus field studies is found in “Guiding Principles and Benchmarks for the Conduct of Validity Studies of Psychophysiological Veracity Examinations Using the Polygraph” (Matte 2010). As stated in aforesaid Guiding Principles, “Laboratory studies which are based on *non-emotional orienting responses* definitely fail to replicate the field conditions that elicit *emotional defensive responses* where both the guilty and innocent examinee’s *primary emotion* is “fear” of the consequences if found deceptive, which in criminal cases could

result in the horror of imprisonment.” As stated by Iacono (2001); “These mock crime studies are too unlike real life to offer any realistic insight to how polygraph tests work in the field.”

The Court further stated that “There was simply no formal research presented at the *Daubert* hearing demonstrating how the brain might respond to fMRI lie detection testing examining potential deception about real world, long-term conduct occurring several years before testing in which the subject faces extremely dire consequences (such as prison sentence) if his answers are not believed. See Fed. R. Evid. 702(c) (requiring expert testimony to be the ‘product of reliable principles and methods.’)” The above statement by the Court raises the “Fear of Error” also known as the “Othello Error” issue mentioned in the NRC of the National Academies 2003 report on The Polygraph and Lie Detection. (Ekman 1985; Matte 1978, 1996, 2011; NRC 2003).

The Court also faulted the fMRI Lie Detection method for a lack of known error rates for fMRI-based lie detection outside the laboratory setting, i.e., in the ‘real-world’ or ‘real-life’ setting. Federal courts have long appreciated that certain kinds of analyses may have different rates of error depending on the setting because of the difficulties of simulating realistic conditions. See *United States v. Crisp*, 324 F.3d 261, 2870 (4th Cir. 2003) (Handwriting analysis); *United States v. Cordoba*, 194 F.3d 1053, 1059-60 (9th Cir. 1999) (polygraph testing). Hence, a polygraph technique that is not supported by published *field* studies showing an error rate may suffer the same fate as the fMRI Lie Detection method.

A list of validated “evidentiary” polygraph techniques and their supportive research studies with sample size and accuracy rates can be reviewed and downloaded at [www.mattepolygraph.com](http://www.mattepolygraph.com) under the heading of “List of Validated Polygraph Techniques with Accuracy Data.”

The Court found that Dr. Laken’s exclusion of the first scan that indicated Deception in favor of the second and third scan that indicated truthfulness was not scientifically and judicially acceptable. The court stated that Dr. Laken’s “decision to conduct a third test begs the question whether a fourth scan would have revealed Dr. Semrau to be deceptive again.” Dr. Laken’s explanation for the exclusion of the first scan was that the fMRI has a “Huge false Positive Problem” and the Court countered that this false positive problem could potentially justify continual re-testing on anyone until a “not deceptive” result is obtained. Analogous to polygraph testing, the exclusion of a scan or chart should not be permitted unless there is excessive artifact that

impedes the production of sufficient physiological data for analysis within the framework of the technique's protocol. Furthermore, the Court's concern regarding the continual re-testing until the desired result is obtained is reminiscent of polygraph techniques that use a fixed score threshold that permits the successive collection of additional charts to reach the fixed score threshold. Especially vulnerable to attack by opposing counsel and rejection by the Courts are those techniques with a low fixed score threshold below +/-6. (Matte 1996, 2000, 2011). Conversely, those polygraph techniques that employ an increasing score threshold with each chart collected are not vulnerable to such attack and rejection. (Matte 2013).

The failure of Dr. Laken's fMRI Lie Detection method to identify Dr. Semrau's truthfulness or deception to specific test questions further diminished the diagnostic value of the fMRI Lie Detection method. Dr. Laken could only generalize truthfulness to all of Dr. Semrau's answers collectively. This is analogous to multiple-issue polygraph screening tests which have a bias against truthful examinees and thus require the use of a successive hurdle approach with a validated single-issue test to address unresolved autonomic responses.

It becomes evident that fMRI Lie Detection suffers from a serious problem of false positives where the truthful examinee is erroneously found to be deceptive. This author believes that field research studies using real-life incidents with significant consequences must be done before fMRI Lie Detection can be accurately evaluated and perfected to the extent that it would be competitive with polygraph testing. The criticisms levied against the fMRI Lie Detection method by the Court of Appeals and cited scientists should serve notice to the polygraph profession as to what is expected and accepted as evidence in court.

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