

---

Tom Shay Post-Conviction Testing

---

fMRI Testing Report

---

Steven J. Laken, Ph.D.  
June 28, 2010

---

## Contents

Background Information.....	3
Testing Procedure .....	3
Testing Protocol.....	3
Question Development .....	4
Day of Testing .....	4
Question Presentation.....	4
Practice Outside of the Scanner.....	5
May 24, 2010 fMRI and MRI.....	5
fMRI Data Analysis.....	5
Results.....	6
Candidate for fMRI Testing .....	6
Structural Scan .....	6
May 24, 2010 fMRI Scans.....	6
June 3, 2010 fMRI Data Analysis .....	6
Conclusions.....	7
Appendix 1 –Questions Administered.....	8
May 24, 2010 – Control Ring or Watch Stolen.....	8
Neutral.....	8
Ring or Watch Questions.....	8
Control.....	9
May 24, 2010 – Did you have knowledge of a bomb?.....	11
Neutral.....	11
Control.....	11
Specific Incident Questions.....	12
May 24, 2010 – Did you purchase parts for a bomb from a Radio Shack?.....	13
Neutral.....	13
Control.....	13
Specific Incident Questions.....	14
Appendix 2 – Brain Images .....	15
Scan 1: Not Taking the Ring (Left) and Not Taking the Watch (Right) .....	15

## **Background Information**

Mr. Morrison Bonpasse, Bonpasse Exoneration Services, P.O. Box 390, Newcastle, ME 04553-0390 contacted Cephus and requested that Cephus perform a Functional Magnetic Resonance Imaging (fMRI) deception testing on his client, Mr. Thomas Shay having a date of birth of November 3, 1971.

Mr. Shay alleges the following:

1. He did not take part in bomb building, and
2. He did not purchase items to make a bomb from RadioShack.

On May 24, 2010, Mr. Shay was given a fMRI test using a control series of tasks and questions to determine if Mr. Shay would be a suitable candidate for fMRI testing. Immediately following the first two tests, Cephus performed two additional fMRI scans to determine the veracity of Mr. Shay's statements to the questions above. Mr. Shay has been diagnosed with pseudologia phantastica and Klinefelter's syndrome. The purpose of the first test is to determine if his brain reacts to lying as described in Cephus' publications. If his brain reacted appropriately to this task, then Cephus would analyze the second and third fMRI test regarding the questions above. Mr. Shay also received a high-resolution MRI to examine his brain for anomalies. fMRI scanning occurred at Shields MRI, 30 Cocichuate Road, Framingham, MA. Steven J. Laken, Ph.D., President and C.E.O. of Cephus Corporation performed the fMRI analysis at 74 Northeastern Ave. Unit 21B, Nashua, NH on June 3, 2010.

fMRI deception technology is peer reviewed [1-40], the brain is the source of lying [1-40], and the error rates are documented [14, 17, 34-45].

## **Testing Procedure**

### **Testing Protocol**

Testing was performed using Cephus' fMRI Testing Protocol version 1.10.

## **Question Development**

Dr. Steven Laken and Mr. Bonpasse developed the questions. The questions were reviewed with Mr. Shay on the day of the scan.

## **Day of Testing**

On the day of testing, Dr. Laken explained the fMRI testing procedure to Mr. Shay, and had Mr. Shay do the following:

- Sign a consent form.
- Provide a urine sample for drug screening.
- Fill out an Annette Handedness questionnaire.
- Complete an MRI safety form.

Dr. Laken did not interview Mr. Shay for psychological screening as this had been previously performed by other health care providers.

For the purposes of determining if Mr. Shay's brain responds similarly to our published data, we had Mr. Shay pretend to steal a ring or a watch from a drawer. He placed that in his locker and was instructed to answer as if he did not take either object and to not tell anyone what object he took. Mr. Shay was then told he would have to convince us he did not take an object to 'pass' the test. If he could not convince us, then we would not draw a conclusion for the specific incident scans.

## **Question Presentation**

Each fMRI scan consists of two epochs where Mr. Shay was visually instructed to 'Lie' or to tell the 'Truth' to the Specific Incident Questions (SIQ). He was told to always respond truthfully to the neutral and control questions. The question order, but not the questions themselves, was randomized by a computer when administered in the fMRI; therefore, the questions presented, but not the type of questions (e.g. neutral), differed between Lie and Truth epochs.

For the control fMRI test, Mr. Shay was instructed to answer to the 'Ring' or the 'Watch' questions as if he did not take either object. The neutral and control questions were identical to the neutral and control questions in the specific incident testing.

## **Practice Outside of the Scanner**

Mr. Shay practiced answering the questions in Appendix 1 on a laptop computer outside of the scanner while being observed by Dr. Laken. When Dr. Laken felt that Mr. Shay showed sufficient compliance with the instructions, responded to questions appropriately, and understood what he was to do in the scanner, Dr. Laken had Mr. Shay change into magnetic-resonance compatible clothing.

## **May 24, 2010 fMRI and MRI**

On May 24, 2010, Mr. Shay received three fMRI scans using Cephos' standard imaging protocol [39], and fMRI Testing Protocol, version 1.1. In addition, Mr. Shay received a high-resolution structural MRI scan so a radiologist could determine if there were any anomalies of the head or neck.

Dr. Laken and an MRI technologist escorted Mr. Shay into the MRI environment. They made Mr. Shay comfortable in the MRI and placed a display that would relay the random questions to Mr. Shay over Mr. Shay's head. They then aligned Mr. Shay's head in the MRI scanner and performed the fMRI testing procedures as established at the Medical University of South Carolina, the University of Texas Southwestern at Dallas, and Cephos Corporation [14, 34-40, 43, 44, 46]. The random questions prevented Mr. Shay from anticipating any question. Mr. Shay's response to each question was recorded.

## **fMRI Data Analysis**

Dr. Laken analyzed the functional MRI data using Statistical Parametric Mapping software (SPM 2, Wellcome Department of Cognitive Neurology, London, UK – using Matlab version 2006a). Individual activated t-maps were generated by defining the following contrasts: Lie-Truth, Truth-Lie, Lie-Neutral and Truth-Neutral. To provide statistical analysis of truth or falsehood, the number of significantly activated voxels ( $p \leq 0.05$ , uncorrected) for Lie-Neutral and Truth-Neutral was determined in three regions of interest (roughly the right orbitofrontal/inferior frontal, the right middle frontal, and the right anterior cingulate) that were previously defined [37]. A greater number of significantly activated voxels for the Lie-Neutral contrast versus the Truth-Neutral contrast indicated that Mr. Shay was being deceptive about the Lie questions. Conversely, a greater number of significantly activated voxels for the Truth-Neutral contrast versus the Lie-Neutral contrast indicated that Mr. Shay was being deceptive about the Truth questions. An equal number of significant voxels for the two contrasts yielded an indeterminate indication.

## Results

### Candidate for fMRI Testing

I, Dr. Steven Laken, met with Mr. Shay on May 24, 2010; between the approximate hours of 7:30 to 9:00 p.m. Prior to testing I reviewed Cephos' fMRI Consent Form with Mr. Shay. In addition, Mr. Shay provided a urine sample that was screened for drugs. The results of the screening was negative.

Based on the urine tests, I believe that Mr. Shay is a good candidate for fMRI pending a positive result for the mock ring and watch scenario testing.

### Structural Scan

A radiologist reviewed the high-resolution structural brain scan taken on May 24, 2010. The scan did not show any obvious abnormalities. Based on this information, I believe that Mr. Shay's fMRI scans are amenable to fMRI analysis.

### May 24, 2010 fMRI Scans

Mr. Shay tolerated the fMRI procedure well and I did not feel there was any reason to not use these scans.

### June 3, 2010 fMRI Data Analysis

On June 3, 2010, I reviewed and processed the first, control fMRI scan for the ring or watch taken on May 24, 2010. The 300+ scans [34-40] were analyzed using automated scripts and the fMRI Testing Protocol, version 1.1. Mr. Shay answered an appropriate number of questions, responded correctly, and had no excess movement. There were no imaging artifacts. The number of activated voxels for each condition was generated and a conclusion drawn.

On the first scan, Cephos' *a priori* cut-off concluded that Mr. Shay had taken the watch (see [Appendix 2](#)). In fact, Mr. Shay had taken the ring and he is not a good candidate for conclusions to be drawn on the specific incident questions. Therefore there will be no conclusions drawn for the second and third fMRI tests.

## Conclusions

In my professional opinion, I, Dr. Steven Laken, refrain from making any conclusions that Mr. Shay is, or is not, telling the truth in regards to the specific incident questions because the results of the control fMRI test was inconclusive.



---

Steven J. Laken, Ph.D.  
President and C.E.O.

## Appendix 1 – Questions Administered

*May 24, 2010 – Control Ring or Watch Stolen*

### Neutral

Do you like to swim-  
Do you like to read-  
Are you awake-  
Are you asleep-  
Are you under age 50-  
Are you over age 18-  
Do you like the beach-  
Do you live in the United States-  
Do you live in the United States-  
Do you live in Massachusetts-  
Do you like chocolate-  
Do you like to watch TV-  
Do you have a dog-  
Do you have a cat-  
Is it 2004-  
Do you like movies-  
Do you speak English-  
Is it October-  
Are you at Shields MRI-  
Are you in a MRI-  
Are you laying down-

### Ring or Watch Questions

Did you take the ring from the drawer-  
Did you take the watch from the drawer-  
Is the ring in your locker-  
Is the watch in your locker-  
Did you take the watch-  
Did you take the ring-  
Did you steal the ring-  
Did you steal the watch-



Was the watch stolen-  
Was the ring stolen-  
Did you hide the watch-  
Did you hide the ring-  
Did you steal a watch-  
Did you steal a ring-  
Is the ring with your possessions-  
Is the watch with your possessions-  
Is there a stolen ring in your locker-  
Is there a stolen watch in your locker-  
Did you take a ring that is not yours-  
Did you take a watch that is not yours-  
Did you put the ring in your locker-  
Did you put the watch in your locker-  
Did you hide the ring in your locker-  
Did you hide the watch in your locker-  
Did you remove a ring from the drawer-  
Did you remove a watch from the drawer-  
Did you steal a ring from the drawer-  
Did you steal a watch from the drawer-  
Did you place the ring in your locker-  
Did you place the watch in your locker-  
Did you keep the ring in the drawer-  
Did you keep the watch in the drawer-  
Did you leave the ring in the drawer-  
Did you leave the watch in the drawer-  
Did the watch stay in the drawer-  
Did the ring stay in the drawer-  
Was the ring moved from the drawer-  
Was the watch moved from the drawer-  
Is the ring in the drawer-  
Is the watch in the drawer-

### **Control**

Do you ever gossip-  
Have you ever done something illegal-  
Have you ever done something illegal-



Have you ever done something immoral-  
Have you used illegal drugs-  
Have you ever deceived a loved one-  
Have you ever made someone angry-  
Have you ever made someone angry-  
Have you ever committed a crime-  
Have you ever cheated on a test-  
Have you ever told a white lie-  
Do you obey every traffic law-  
Have you always told the truth-  
Have you ever cheated on your taxes-  
Do you curse-  
Have you ever faked an illness-  
Are you a law-abiding citizen-  
Have you ever forged a signature-  
Have you ever kept the truth from someone-  
Have you ever been arrested-  
Do you speed-  
Have you ever littered-



Have you ever done something immoral-  
Have you used illegal drugs-  
Have you ever deceived a loved one-  
Have you ever made someone angry-  
Have you ever made someone angry-  
Have you ever committed a crime-  
Have you ever cheated on a test-  
Have you ever told a white lie-  
Do you obey every traffic law-  
Have you always told the truth-  
Have you ever cheated on your taxes-  
Do you curse-  
Have you ever faked an illness-  
Are you a law-abiding citizen-  
Have you ever forged a signature-  
Have you ever kept the truth from someone-  
Have you ever been arrested-  
Do you speed-  
Have you ever littered-

*May 24, 2010 – Did you have knowledge of a bomb?*

### **Neutral**

Do you like to swim-  
Do you like to read-  
Are you awake-  
Are you asleep-  
Are you under age 50-  
Are you over age 18-  
Do you like the beach-  
Do you live in the United States-  
Do you live in the United States-  
Do you live in Massachusetts-  
Do you like chocolate-  
Do you like to watch TV-  
Do you have a dog-  
Do you have a cat-  
Is it 2004-  
Do you like movies-  
Do you speak English-  
Is it October-  
Are you at Shields MRI-  
Are you in a MRI-  
Are you laying down-

### **Control**

Do you ever gossip-  
Have you ever done something illegal-  
Have you ever done something illegal-  
Have you ever done something immoral-  
Have you used illegal drugs-  
Have you ever deceived a loved one-  
Have you ever made someone angry-  
Have you ever made someone angry-  
Have you ever committed a crime-

Have you ever cheated on a test-  
Have you ever told a white lie-  
Do you obey every traffic law-  
Have you always told the truth-  
Have you ever cheated on your taxes-  
Do you curse-  
Have you ever faked an illness-  
Are you a law-abiding citizen-  
Have you ever forged a signature-  
Have you ever kept the truth from someone-  
Have you ever been arrested-  
Do you speed-  
Have you ever littered-

### **Specific Incident Questions**

Before October 28, 1991, did you have knowledge of a bomb at your father's home-  
Did you purchase parts for the building of a bomb-  
Did you plan the planting of a bomb-  
Did you ever participate in bomb building-  
Have you ever helped build a bomb-  
Did you have knowledge of bomb debris at Quincy quarries-  
Have you ever played any role in disposing of bomb making materials-  
Did you intend to hurt your father with a bomb-  
Did you ever buy bomb building material-  
Did Trenkler ever direct you in how to build a bomb-  
Did you work with Trenkler on bomb building-  
Did you purchase bomb making items at a Radio Shack-  
Did you first learn about the October 28 bomb at your mother's-  
Did you go to your father's home on October 29th-

*May 24, 2010 – Did you purchase parts for a bomb from a Radio Shack?*

### **Neutral**

Do you like to swim-  
Do you like to read-  
Are you awake-  
Are you asleep-  
Are you under age 50-  
Are you over age 18-  
Do you like the beach-  
Do you live in the United States-  
Do you live in the United States-  
Do you live in Massachusetts-  
Do you like chocolate-  
Do you like to watch TV-  
Do you have a dog-  
Do you have a cat-  
Is it 2004-  
Do you like movies-  
Do you speak English-  
Is it October-  
Are you at Shields MRI-  
Are you in a MRI-  
Are you laying down-

### **Control**

Do you ever gossip-  
Have you ever done something illegal-  
Have you ever done something illegal-  
Have you ever done something immoral-  
Have you used illegal drugs-  
Have you ever deceived a loved one-  
Have you ever made someone angry-  
Have you ever made someone angry-  
Have you ever committed a crime-



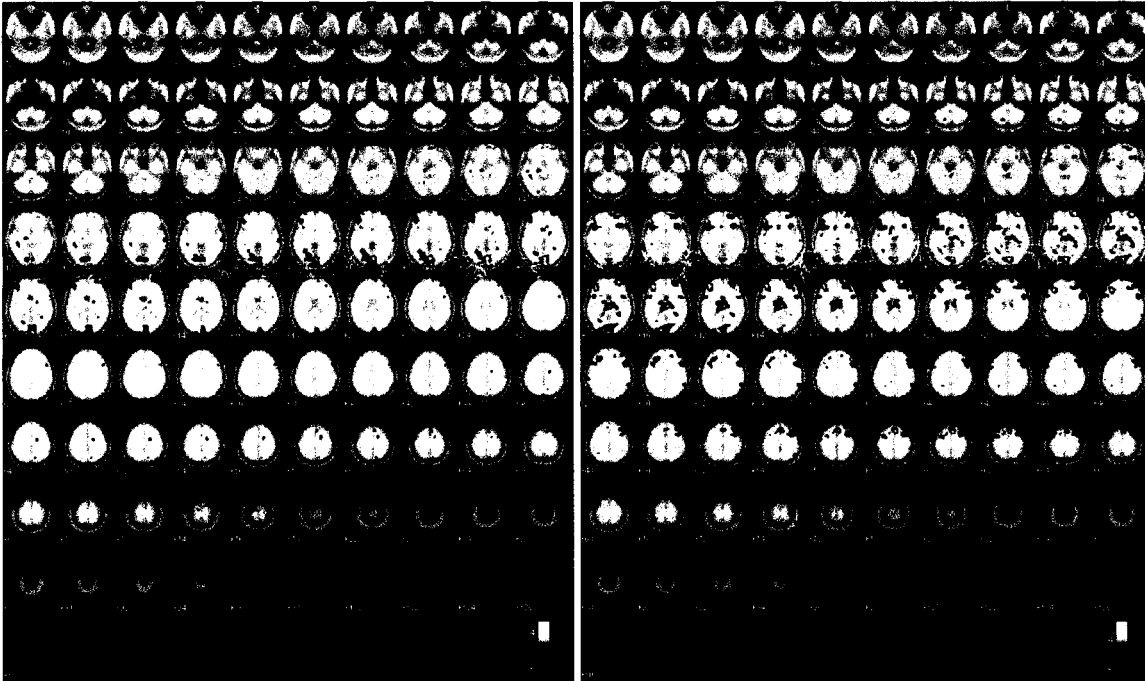
Have you ever cheated on a test-  
Have you ever told a white lie-  
Do you obey every traffic law-  
Have you always told the truth-  
Have you ever cheated on your taxes-  
Do you curse-  
Have you ever faked an illness-  
Are you a law-abiding citizen-  
Have you ever forged a signature-  
Have you ever kept the truth from someone-  
Have you ever been arrested-  
Do you speed-  
Have you ever littered-

### **Specific Incident Questions**

Did Alfred Trenkler direct you to purchase bomb making items-  
Did you ever purchase bomb making items on October 18, 1991-  
Did you purchase items at Radio Shack to make a bomb-  
Had you ever visited the 197 Massachusetts Ave store before October 18, 1991-  
Were you aware of the Radio Shack receipt before Paul Kelly showed it to you-  
Did you give Trenkler any items you purchased-  
Did you lie to Karen Marinella in her interview-  
Did you purchase six items at Radio Shack on October 18, 1991-  
Did you give your father's phone number to the Radio Shack clerk on October 18, 1991-  
Is October 18, 1991 your mother's birthday-  
Did you ever purchase bomb making items-  
Did you purchase bomb making items on October 18, 1991-  
Did you purchase items at Radio Shack on October 18, 1991-

## Appendix 2 – Brain Images

### *Scan 1: Not Taking the Ring (Left) and Not Taking the Watch (Right)*



This figure depicts brain regions preferentially activated when Mr. Shay reported to not taking the ring (Ring) and to not taking the watch (Watch). The image on the left represents regions preferentially activated in {Denying Taking the Ring over Denying Taking the Watch}. The image on the right represents regions preferentially activated in {Denying Taking the Watch over Denying Taking the Ring}. Regions activated are shown in red to orange. Activation shown are equivalent to a minimum statistical threshold of  $p \leq 0.05$ . The computer concluded that Mr. Shay was lying when Denying Taking the Watch. The pictures are displayed in Neurological convention (the left side of the image is the person's left).



## References

1. Abe, N., et al., Neural correlates of true memory, false memory, and deception. *Cereb Cortex*, 2008. 18(12): p. 2811-9.
2. Abe, N., et al., Deceiving others: distinct neural responses of the prefrontal cortex and amygdala in simple fabrication and deception with social interactions. *J Cogn Neurosci*, 2007. 19(2): p. 287-95.
3. Baumgartner, T., et al., The neural circuitry of a broken promise. *Neuron*, 2009. 64(5): p. 756-70.
4. Bhatt, S., et al., Lying about facial recognition: an fMRI study. *Brain Cogn*, 2009. 69(2): p. 382-90.
5. Bles, M. and J.D. Haynes, Detecting concealed information using brain-imaging technology. *Neurocase*, 2008. 14(1): p. 82-92.
6. Browndyke, J.N., et al., Neuroanatomical correlates of malingered memory impairment: event-related fMRI of deception on a recognition memory task. *Brain Inj*, 2008. 22(6): p. 481-9.
7. Fullam, R.S., S. McKie, and M.C. Dolan, Psychopathic traits and deception: functional magnetic resonance imaging study. *Br J Psychiatry*, 2009. 194(3): p. 229-35.
8. Gamer, M., et al., Covariations among fMRI, skin conductance, and behavioral data during processing of concealed information. *Hum Brain Mapp*, 2007. 28(12): p. 1287-301.
9. Gamer, M., et al., fMRI-activation patterns in the detection of concealed information rely on memory-related effects. *Soc Cogn Affect Neurosci*, 2009.
10. Ganis, G., et al., Neural correlates of different types of deception: an fMRI investigation. *Cereb Cortex*, 2003. 13(8): p. 830-6.
11. Ganis, G., R.R. Morris, and S.M. Kosslyn, Neural processes underlying self- and other-related lies: an individual difference approach using fMRI. *Soc Neurosci*, 2009. 4(6): p. 539-53.
12. Hakun, J.G., et al., fMRI investigation of the cognitive structure of the Concealed Information Test. *Neurocase*, 2008. 14(1): p. 59-67.
13. Harada, T., et al., Neural correlates of the judgment of lying: A functional magnetic resonance imaging study. *Neurosci Res*, 2009. 63(1): p. 24-34.
14. Jin, B., et al., Feature selection for fMRI-based deception detection. *BMC Bioinformatics*, 2009. 10 Suppl 9: p. S15.
15. Johnson, R., Jr., et al., The self in conflict: the role of executive processes during truthful and deceptive responses about attitudes. *Neuroimage*, 2008. 39(1): p. 469-82.

16. Karim, A.A., et al., The truth about lying: inhibition of the anterior prefrontal cortex improves deceptive behavior. *Cereb Cortex*, 20(1): p. 205-13.
17. Langleben, D.D., et al., Telling truth from lie in individual subjects with fast event-related fMRI. *Hum Brain Mapp*, 2005. 26(4): p. 262-72.
18. Langleben, D.D., et al., Brain activity during simulated deception: an event-related functional magnetic resonance study. *Neuroimage*, 2002. 15(3): p. 727-32.
19. Lee, T.M., et al., Are errors differentiable from deceptive responses when feigning memory impairment? An fMRI study. *Brain Cogn*, 2009. 69(2): p. 406-12.
20. Lee, T.M., et al., Neural correlates of feigned memory impairment. *Neuroimage*, 2005. 28(2): p. 305-13.
21. Lee, T.M., et al., Lie detection by functional magnetic resonance imaging. *Hum Brain Mapp*, 2002. 15(3): p. 157-64.
22. Lissek, S., et al., Cooperation and deception recruit different subsets of the theory-of-mind network. *PLoS One*, 2008. 3(4): p. e2023.
23. Mohamed, F.B., et al., Brain mapping of deception and truth telling about an ecologically valid situation: functional MR imaging and polygraph investigation--initial experience. *Radiology*, 2006. 238(2): p. 679-88.
24. Monteleone, G.T., et al., Detection of deception using fMRI: better than chance, but well below perfection. *Soc Neurosci*, 2009. 4(6): p. 528-38.
25. Phan, K.L., et al., Neural correlates of telling lies: a functional magnetic resonance imaging study at 4 Tesla. *Acad Radiol*, 2005. 12(2): p. 164-72.
26. Spence, S.A., et al., Behavioural and functional anatomical correlates of deception in humans. *Neuroreport*, 2001. 12(13): p. 2849-53.
27. Spence, S.A., et al., A cognitive neurobiological account of deception: evidence from functional neuroimaging. *Philos Trans R Soc Lond B Biol Sci*, 2004. 359(1451): p. 1755-62.
28. Spence, S.A., et al., Speaking of secrets and lies: the contribution of ventrolateral prefrontal cortex to vocal deception. *Neuroimage*, 2008. 40(3): p. 1411-8.
29. Spence, S.A. and C.J. Kaylor-Hughes, Looking for truth and finding lies: the prospects for a nascent neuroimaging of deception. *Neurocase*, 2008. 14(1): p. 68-81.
30. Tian, F., et al., Functional near-infrared spectroscopy to investigate hemodynamic responses to deception in the prefrontal cortex. *Brain Res*, 2009. 1303: p. 120-30.
31. Wild, J., Brain imaging ready to detect terrorists, say neuroscientists. *Nature*, 2005. 437(7058): p. 457.

32. Yang, Y., et al., Prefrontal white matter in pathological liars. *Br J Psychiatry*, 2005. 187: p. 320-5.
33. Yang, Y., et al., Localisation of increased prefrontal white matter in pathological liars. *Br J Psychiatry*, 2007. 190: p. 174-5.
34. Kozel, F.A., et al., Detection of Deception Using fMRI After Committing a Mock Sabotage Crime, in *Organization of Human Brain Mapping*. 2007: Chicago, IL USA
35. Kozel, F.A., et al., Functional MRI detection of deception after committing a mock sabotage crime. *J Forensic Sci*, 2009. 54(1): p. 220-31.
36. Kozel, F.A., et al., Can simultaneously acquired electrodermal activity improve accuracy of fMRI detection of deception? *Soc Neurosci*, 2008: p. 1-8.
37. Kozel, F.A., et al., Detecting deception using functional magnetic resonance imaging. *Biol Psychiatry*, 2005. 58(8): p. 605-13.
38. Kozel, F.A., et al., fMRI Deception Detection Maximizing Statistical Estimation Data on File. 2008: Pepperell, MA.
39. Kozel, F.A., et al., Replication of fMRI Detection of Deception at Two Independent Sites Using 3.0 Tesla and 1.5 Tesla MR Scanners, in *47th Annual Meeting of the American College of Neuropsychopharmacology*. 2007: Boca Raton, FL.
40. Kozel, F.A., et al., Replication of Functional MRI Detection of Deception. *Open Forensic Sci J*, 2009. 2: p. 6-11.
41. Davatzikos, C., et al., Classifying spatial patterns of brain activity with machine learning methods: application to lie detection. *Neuroimage*, 2005. 28(3): p. 663-8.
42. Johnson, K.A., George, M.S., Kozel, F.A. , Detecting Deception Using Functional Magnetic Resonance Imaging *Directions in Psychiatry*, 2007.
43. Johnson, K.A., et al., Fatigue and Motivation Effects on fMRI Assessment of Deception, in *Society of Biological Psychiatry Annual Meeting 2008*, Society of Biological Psychiatry: Washington, DC.
44. Johnson, K.A., et al., The Neuroscience of Functional Magnetic Resonance Imaging fMRI for Deception Detection. *The American Journal of Bioethics*, 2007. 7(November 9, 2007): p. 58-60.
45. Kozel, F.A., T.M. Padgett, and M.S. George, A replication study of the neural correlates of deception. *Behav Neurosci*, 2004. 118(4): p. 852-6.
46. Laken, S.J., *Questions and control paradigms for detecting deception by measuring brain activity* USPTO, Editor. 2005.

47. Annette, M., A classification of hand preference by association analysis. *Br. J. Psychol.*, 1970. 61: p. 303-321.