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<https://reachmd.com/programs/focus-on-future-medicine-and-genetics/nothing-but-the-truth-brain-scans-and-lie-detection/4101/>

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## Nothing but the Truth? Brain Scans and Lie Detection

It sounds in some ways like a modern day witch trial. Using brain scans to detect the suspect recollection of an act based on accused of committing. Some experts around the world suggest this test could put an end to lying hailing the technology as an advanced potentially as important as DNA evidence. What are the legal ramifications for using this type of technology in court, and if this test isn't the <\_\_\_\_\_> is there another method in the pipeline that could be.

You are listening to ReachMD, The Channel for Medical Professionals. Welcome to a special segment, Focus on Future Medicine. I am your host, Dr. Mark Nolan Hill, Professor of Surgery and Practicing General Surgeon. Our guests are Mr. Henry Greeley, Professor of Law and Director of the Center for Law and the Biosciences at Stanford University, and Dr. J. Peter Rosenfeld, Professor of Psychology at Northwestern University.

### DR. MARK NOLAN HILL:

Welcome Mr. Greeley and Dr. Rosenfeld.

### MR. HENRY GREELY:

Nice to be here.

**DR. J. PETER ROSENFELD:**

Nice to be here again.

**DR. MARK NOLAN HILL:**

As I understand that this test builds on a body of work on neuroscience-based lie detection. Could you comment on that?

**MR. HENRY GREELY:**

I think in 1987, I was the first person who actually published peer-reviewed paper in which P300 was used as a so-called Guilty Knowledge Indicator. We had people who pertain to steal the right amount of box of jewels and then we tested them for recognition of that item by presenting the names of all the items on a screen every 2 or 3 seconds and when the items that they actually took out of the box and concealed on them appeared on the screen. They generated a P300 event-related potential or brain wave. A lot of people have played with this protocol since then including ourselves and it is quite promising, some more work remains to be done, but meanwhile another technology called Functional Magnetic Resonance Imaging (fMRI) was developed around the same time, but it didn't become use as the deception indicator until somewhat later. It basically indicates when different parts of the brain are becoming metabolically active in certain psychological states and one of the states that people have been looking at has been a state of deception. There are about dozen papers, maybe by know its 15 or 16. I am not really sure in which fMRI has attempted to have been used as a deception indicator. There are some promising directions, but a lot more work remains to be done with fMRI than with the older EEG technologies like P300.

**DR. MARK NOLAN HILL:**

Generally, which would you say would be more credible, the functional MRI or this special system that is used in India.

**MR. HENRY GREELY:**

The system used in India is not based on any research that I know about any peer-reviewed serious research, and in fact, the claims that are put forward by these Indian developers that one can distinguish recognition from participation. There is nothing like that to cognitive memory literature that is where you learn about something by being told about it versus by actually participating in whatever it was yourself, cannot be distinguished as far as I know by any extent methodology.

**DR. J. PETER ROSENFELD:**

So, how did this test theoretically separate events witnessed from deeds committed.

**MR. HENRY GREELY:**

That is proprietary. They wouldn't tell us that and so I cannot give you an answer.

**DR. J. PETER ROSENFELD:**

We have no idea. We just have to trust them.

**DR. MARK NOLAN HILL:**

As if we could give them a lie detection test and see if they decided that were telling us the truth or not.

**MR. HENRY GREELY:**

I rather would give them my detection test.

**DR. J. PETER ROSENFELD:**

The BEOS system is Indian system I think should have no credibility right now, at least in the absence of any kind of peer-reviewed published support for it. The FMRI basis, there are now about 15 or 16 peer-reviewed published articles along with a colleague, name Judy Allis. I <\_\_\_\_\_> an article that reviewed the event 12 published articles as of March 2007 and I think it is a promising technology, but I wouldn't put nearly enough confident on it at this point to use it in court or to use it in anything other than a research context.

**MR. HENRY GREELY:**

Yeah, I would agree with that.

**DR. J. PETER ROSENFELD:**

And there were too many limitations in the research that has been done and as far as I know not a single one of these studies has been replicated by an independent lab. So, every one says we found a signal. Most of them disagree about what the signals look like and no independent lab has replicated anyone's results yet.

**MR. HENRY GREELY:**

If I may just take a very small perhaps a relevant issue and I'll explain why it turns out that there is some agreement among I would say, at least 6 of the investigators involved that there is one area of brain called the anterior cingulate cortex and the other friable cortical systems that are associated with this connected to and this ACC system seems to wide-up in many of the studies, at least half of the

studies, perhaps two-thirds.

**DR. J. PETER ROSENFELD:**

I think that is right, although the studies also show other systems being activated that aren't consistent from.

**MR. HENRY GREELY:**

That's right and what I would say that is why I say this consensus is possibly irrelevant. It turns out the anterior cingulate cortex lie itself for almost anything. I mean not just deception, but recognition, anger, depression, all sorts of things. A very generalized piece of cortex that tends to have lied up in many psychological states and its I don't think anybody would say including the 16 people, who have the publications that the anterior cortex is the deception center.

**DR. MARK NOLAN HILL:**

**If you have just joined us you are listening to a special segment, Focus on Future Medicine on ReachMD, The Channel for Medical Professionals. I am your host, Dr. Mark Nolan Hill and guests are Mr. Henry Greely, Professor of Law and Director of the Center for Law and the Biosciences at Stanford University, and Dr. J. Peter Rosenfeld, Professor of Psychology at Northwestern University. We are discussing the future of lie detection.**

Gentlemen, past mechanisms that have been used to extract the truth, why have they been so unsuccessful such as truth serum and polygraphs.

**DR. J. PETER ROSENFELD:**

Frankly, I never heard of a truth serum. There were some movies made in the 50s and 60s. I remember an Italian movie called General della Rovere in which scopolamine was supposed to be a truth serum used by Nazi interrogators to extract information, but you know that's movie stuff, Scopolamine doesn't have any specific deception detecting function.

**MR. HENRY GREELY:**

I think there is actually worrisome experiments and even perhaps some intelligent community uses of sodium pentothal and some other things, but Dr. Rosenfeld tried that they did not have any specific truth detecting capabilities, they sort of make you drunk, you lose your ambitions about telling the truth, but thus if fairly long been abundant.

**DR. MARK NOLAN HILL:**

Well, tell us about polygraphs.

**DR. J. PETER ROSENFELD:**

A polygraph is one word that actually describes two protocols. One is called the control question test, which is, Did You Do it kind of test that is very found of in North America, Canada, and US, and other countries where they basically say did you do this, and I am not an expert on polygraph methods, which use lower body responses like sweat gland activity, respiration, heart rate, and such, but I do know what the scientific community thinks about the control question test and it tends to be very dismissive and negative. There is another protocol, which doesn't ask Did You Do It, but asks again if you recognize crime relevant information that's called the guilty knowledge test and by the way the only difference between it and that the protocol we uses they look at the lower body and we look at the upper body, we look at P300, they look at respiration, heart rate, and blood pressure, and that sort of things.

**DR. MARK NOLAN HILL:**

Mr. Greely, how do the courts look at the polygraph?

**MR. HENRY GREELY:**

The polygraph is inadmissible in courts in the United States.

**DR. MARK NOLAN HILL:**

Why it is so?

**MR. HENRY GREELY:**

Because courts have found first that it is generally not sufficiently reliable as scientific evidence and second that even if it were reviewed as being reliable the potential for delay and confusion of the jury and prejudice in the jury outweighs any probative value any truthful value the polygraph might have. I should say that in law every thing has exceptions. The state courts in New Mexico allow the polygraphing presumptively. All other 49 states deny its use except under some very limited circumstances. There is a very nice report put at by national academy of sciences committee about the polygraph and specifically its use in security screening in 2004 that reviews the scientific literature on polygraphs and concludes that when well done and when done on people who are not using countermeasures to it, the polygraph is better than chance to detecting lie. It may be as good as 75 to 80 or 85% accurate. That committee concluded that was not nearly useful enough to justify its continued use in security screenings. Federal Government said thank you for the report and

proceeded to ignore it.

**DR. MARK NOLAN HILL:**

What are the countermeasures you are referring to?

**MR. HENRY GREELY:**

For polygraphy, a common and I think this goes more to the control question test that Dr. Rosenfeld was talking about. Commonly your reactions your physiological reactions associated with anxiety, your pulse, your breathing rate, how much you are sweating will increase when you feel anxious. You will be asked a series of questions, some of the questions will be bland control questions, some of the questions will be questions where they expect anyone might lie or feel nervous, so question like have you ever stolen anything in your life, and then there will be some questions focused on the particular incident or particular concern they have gotten. If you can elevate your physiological response, your anxiety kind of response to the control questions, it will make it very hard for the polygrapher to tell the difference between when you are actually anxious and when you are pretending to be anxious. Some of the methods that people have used have been mental, some of them have been more physical like putting a tack in their shoe, spiking their toe with it to cause some pain when they are answering one of the control questions or tightening all the sphincters that they can tighten in their body, which should apparently has some effect on blood pressure and pulse and so on. So, there are a number of these countermeasures out there. There is not a whole lot of very rigorous scientific research on how good they are with polygraphy. They are widely believe to have some effect and plus we do know that there are people who were regularly polygraphed and regularly managed to beat the machine, Aldridge Ames a CIA employee who turned out to be a Russian spy or Russian agent passed scores of not 100s of polygraphic examinations. So, the one thing we know for sure is the polygraphy is certainly far from perfect.

**DR. MARK NOLAN HILL:**

If it is far from perfect and some people say it is unreliable. Why does it exist any further?

**MR. HENRY GREELY:**

Well, because certain federal agencies are attached to it, but again I think that speaking about the control question test. The guilty knowledge test actually is I would not say scientifically acceptable, it is very accurate. I mean it can be as accurate as you want to make it and how that is technical and I wont <\_\_\_\_\_> with it, but the problem with the guilty knowledge test is that like the control question test, it is vulnerable to countermeasures and the countermeasures are different, but they work.

**DR. MARK NOLAN HILL:**

What about the countermeasures there?

**MR. HENRY GREELY:**

Well, in the guilty knowledge test that they show you, I think I mentioned before, shoes of items most of which are irrelevant to the crime under investigation and one of which or two of which are relevant and when you see the gravid one, you react with a physiological response that indicates you guilt. Now, if you can tell what the irrelevant items are that are not relevant to the crime and then do a secret response and it can be something even mental like thinking about your first name or your last name, then you have turned the so-called the relevant items into the relevant targets, and then you make physiological responses to those that were actually be the rings waves or with autonomic nervous system.

**DR. J. PETER ROSENFELD:**

The real I think barriers to the possible use of any of this lie detection. If it is something like a tack in the shoe, examiners can check your shoes. They can look to see whether there are tacks. They can even try to have sensors to determine whether you are tightening your muscles in various ways, but if all that is involved in a countermeasure, is thinking about something or thinking about it in a different way, it is going to be awfully hard for them to detect that as a countermeasure. Firstly I am rather agnostic about whether EEGs or FMRI will lead to successful highly reliable lie detection, but I think the biggest barrier in any of these methods will have to confront is the possibility of countermeasures, which ironically would mean that the people you most want to catch the people who may be terrorists or confirmed criminals will be the ones, who are most likely that pass the test because they will receive training in the appropriate countermeasures.

**DR. MARK NOLAN HILL:**

I want to thank our guests, Mr. Henry Greely and Dr. J. Peter Rosenfeld. We have been discussing the future of lie detection. I am Dr. Mark Nolan Hill and you have been listening to a special segment Focus on Future Medicine on ReachMD, The Channel for Medical Professionals. Be sure to visit our website at [www.reachmd.com](http://www.reachmd.com) featuring on-demand podcast of our entire library and thank you for listening.