

## Tell a Whopper and Watch the Screen Light Up: Thanks (or No Thanks) to Sophisticated Scanning, The Lie May Be on Its Last Legs

# Brain on Fire

By JOEL GARREAU  
Washington Post Staff Writer

**T**he Siemens Magnetom Trio at the University of Pennsylvania is a 10-foot-tall, 14-ton “functional magnetic resonance imaging” machine — fMRI, for short. It promises to be the most formidable lie detector ever built. By peering directly into our brains, its keepers aim to set a new gold standard for the

recognition of honesty in everyone from politicians to criminals to lovers.

*The check's in the mail.  
That was wonderful.  
I'm from Washington and I'm here to help you.*

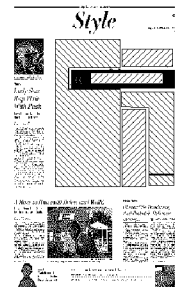
In the pipeline are several cheaper, faster, easier-to-use brain-examining technologies, all intended as major improvements on the unreliable chicken-scratching polygraph we use now. Some seem to identify mental preparations for telling a lie even before the liar opens his mouth — verging on mind-reading. Another is meant to work from across the room, even if you do not wish to cooperate. Think of it as the “mental detector” at your airport screening, and not without good reason. Much of this research is being funded by the military as part of the anti-terror juggernaut.

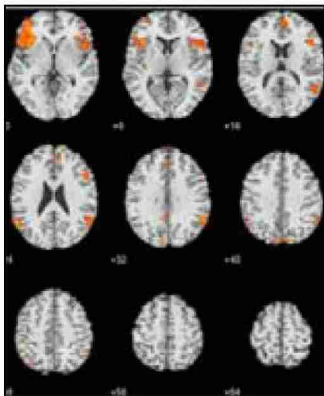
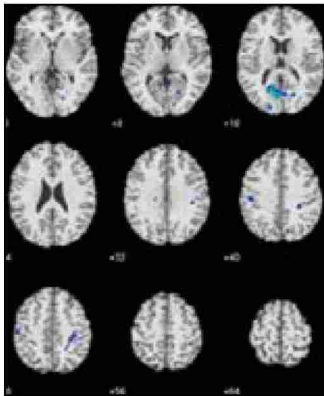
You're chambered into this dimly lit tunnel of truth like a shell into a shotgun. First you are instructed to twist plugs far into your ears. Then you lie on a gurney narrower than a stretcher. A woman in a lab coat slides a helmet over your head. It is not really like a Hannibal Lecter mask, although the researchers like to make that joke. Your nose barely clears the equipment, your eyes can only look up, and your head is

cradled to discourage movement.

Into your hands the researchers place a box with two buttons. The left one, when punched, signifies a

See LIES, C2, Col. 1





**Mom was right: It's easier to tell the truth, top photo, where the brain shows only a modest amount of activity when scanned, as seen in blue. A huge lie, however, lights up the brain, as seen in red, because the liar must hold the truth and the lie in the mind simultaneously.**

“yes” response to questions. The right one means “no.” When they slide you into the bore, it is barely wide enough for your shoulders. To your hip they’ve taped a bulb that you are supposed to squeeze if you have a panic attack, because there is the possibility that no one will hear you scream — when the machine goes to work, it pounds like a high-frequency jackhammer, except when it shrieks like the klaxon on a submarine when somebody shouts “Dive! Dive!”

All of this in the service of making every atom in your brain align in the same direction to banish lies forever. A seductive thought. Especially if you believe, as does Ruben C. Gur, director of the Brain Behavior Center at Penn, that “the brain is the soul.”

To get this far into a quest for the future of truth, you’ve had to answer hundreds of med-

ical questions. One of them is whether you suffer from anxiety.

## The Profit Motive

Sixteen hundred years ago, Saint Augustine defined lying as having one thing in one’s heart, and uttering another.

Two U.S. companies are for the first time gearing up to offer brain scans meant to explore exactly such conflict for anyone with several hundred dollars and a burning desire to — like *The Shadow* — know what evil lurks in the hearts of men.

This commercialization is derided by many researchers as premature. It is not yet clear, they say, how well this technology identifies different kinds of lies, or how well it works across a great array of people, or how well it stands up to countermeasures.

Nonetheless, the University of Pennsylvania has licensed the technology developed there — on which it has applied for a patent — to the California firm No Lie MRI Inc. The firm planned to scan for lies the brain of its first customer yesterday. But at the last minute, with NBC and CBS camera crews standing by to record the event, she decided she didn’t want to put to the test her assertion that she had not cheated on her husband while he was in alcohol rehab, according to Joel T. Huizenga, the company’s founder.

No Lie MRI’s Web site has proclaimed that the company hopes to revolutionize truth telling in America, offering “objective, scientific, mental evidence, similar to the role in which DNA biological identification is used,” to everyone from the FBI, CIA and NSA to the Department of Homeland Security.

No Lie is not alone. Its Massachusetts competitor, Cephos Corp., has licensed competing fMRI lie detection technology from the Medical University of South Carolina.

The boundless desire for a way to dig through deception is why political consultant John Zogby, president of Zogby International, expects the new brain scanning devices to be in widespread use in the 2008 presidential election. He can clearly see a demand to discover what voters really think of candidates — and their commercials.

## Brainy Game

At the Treatment Research Center at Penn, Daniel D. Langleben — who was the first to show that lies and truth look different in the brain — is proud of more modest accomplishments. He can detect whether you’re lying about playing cards.

Here’s the setup: He gives you two playing

cards. He doesn't know which they are. You memorize them — for example, the seven of spades and the five of clubs. Then he asks you to lie about whether you have one, and tell the truth about whether you have the other. Into the fMRI you slide, and cards flash randomly on a screen above your head, one every three seconds. From the pattern of your brain's reaction to them, his team can tell you which two are in your mind, and which one you were lying about, with what he characterizes as 86 percent accuracy. As the gear is tweaked, he expects the accuracy rate to rise well north of 95 percent.

The "Guilty Knowledge Test," as it is known, is considered hot stuff in the research community.

"No question it is important," says Antonio Damasio, the neurologist who is director of the Brain and Creativity Institute at the University of Southern California. For 15 years, Damasio, the author of "Descartes' Error: Emotion, Reason, and the Human Brain," has pioneered the understanding of how the brain processes feelings and decision making.

"It is a very deep problem," Damasio says. "I don't do any work on lie detection. But you are in essence having to detect a discrepancy between an overt behavior and an internal representation. It is complicated enough to find out what is going on when the idea and the behavior are consistent."

Card recognition, unfortunately, is not a terrific representation of the real world. Human lies are rarely so neat and clean, yes and no, with zero shades of gray.

So Langleben's next round of research is more ambitious. He is trying to determine whether his machine can handle a much more common set of lies — for instance, those told by somebody applying for a job who has cooked his résumé.

He invites a reporter to be only the second subject in this round of tests.

Langleben's fictional scenario is that the subject is applying for a job as a writer at the lab. The reporter submits a résumé in which he carefully includes 16 lies — some of them whoppers, like that PhD from MIT — but many of them more subtle, like the bachelor's degree he actually didn't get from that university he attended for four years. In this case, Langleben selects three truths and three lies from this résumé and prepares them as yes/no questions to be displayed on the fMRI's screen. ("Is this your house?" "Did you serve in the military?")

Each of these six questions is accompanied by a picture. "Do you work for The Post?" for example, is accompanied by a pic-

ture of a Washington Post front page. The images that go with the lies are concoctions — a phony diploma, phony Marine discharge papers, and a copy of the cover of the magisterial book "Lying: Moral Choice in Public and Private Life," in which the name of the author, Harvard's Sissela Bok, is, with her permission, replaced by the name of the reporter.

Langleben keeps the rest of the lab team blinded to what is true and what is a lie.

On the big day of the trip into the fMRI machine, the reporter is asked an astounding number of preparatory questions. Was your mother right-handed? Have you ever taken antidepressants? Have you ever worked with welding machinery and is there any possibility you've got any metal imbedded in your eye?

The reporter's date of birth makes them nervous. He is significantly more a geezer than the sort of grad student subjects they usually use. Will the decrepitude of his brain affect how it actually works?

No one knows the answer. Nonetheless, they prepare him and the giant machine for a rendezvous with deviousness.

## Nature's Fibs

Lies have been around for a very long time. Only four pages into Genesis, the Lord asks Cain, "Where is Abel your brother?" and he replies, "I do not know; am I my brother's keeper?"

Deception is a fundamental part of evolution, establishing who eats and who is eaten. Gorillas and chimpanzees routinely lie to obtain food and attract mates. Birds feign a broken wing to lure a raptor away from the nest. Even a tasty species of butterfly deceives about its delectability by emulating another species with a bitter flavor.

Attempts to detect lies are almost as venerable. According to an ancient tale from India, a village turns out to have a thief. To determine who it is, a wise man puts into a dark tent a donkey he says has magical powers: if a guilty man pulls his tail, the donkey will sing. When every man in the village, one after the other, has entered the tent to pull the donkey's tail, the wise man then lines them all up, and sure enough, the identity of the thief is obvious. Turns out the wise man had covered the donkey's tail with lamp black, and only

one man had clean hands.

Harnessing science to truth-telling is scarcely 100 years old. One of the early contributors was the psychologist William Moulton Marston. He invented the systolic blood-pressure test as a "lie detector" that is still a component of the polygraph. With another part of his brain, he also invented "Wonder Woman," with her lasso that forced scoundrels to tell the truth.

The polygraph, which means "many writings" in Greek, is so called because it records a variety of physical reactions simultaneously — such as blood pressure, heart rate, sweating and breathing. As a lie detector it entered widespread use in the second half of the 20th century. It was soon joined by other dubious means to detect deception, including voice stress analysis, psychological profiling and "truth serum."

Polygraphs are so notoriously unreliable — they are rarely admitted as evidence into court — that an \$860,000 National Academy of Sciences' National Research Council report concluded in 2002 that "polygraph testing" is "inherently susceptible to producing erroneous results." In a hypothetical group of 10,000 government employees that included 10 spies, the report says, even if the polygraph achieved better results than is usually found in the field, it would still miss two spies and falsely accuse 1,598 innocents. If it were set to greatly reduce the false positives to only 39 innocents, it would miss eight spies.

Nonetheless, as the 3,200-member American Polygraph Association observes, the polygraph remains in widespread use — there has been nothing better. The center of the federal government's polygraph world is the Department of Defense Polygraph Institute (DoDPI — pronounced DOD-pie) in Fort Jackson, S.C. Its main building is the length of a football field. Andrew Ryan, its research division chief, estimates that the world of national security employs five times as many polygraphs as does that of criminal justice.

There are three main additional criticisms of the polygraph:

■ It doesn't measure lying, it measures the body's reaction to stress. As a result, it doesn't catch people who can lie stress-free, such as the FBI turncoat Aldrich Ames. It also unfairly implicates those innocents who are freaked just by being accused.

■ Even after all these decades of use, the NRC said it could find no large-scale, scientifically rigorous, readily replicated clinical trials that examined exactly how well the polygraph works, on what kinds of people, under what sorts of circumstances.

■ Results are highly dependent on the skill of the person who administers the test. Polygraphers admit that their work does have elements of an art. Critics hear "art" and think "voodoo."

Advocates hope brain scans will be superior on all counts.

In 2003, the Nobel Prize in medicine was awarded to Paul Lauterbur and Peter Mansfield for discoveries that have made magnetic resonance imaging possible. X-rays make good pictures of hard bones and teeth. Magnetic resonance imaging has revolutionized

understanding of how the body works by producing more highly detailed pictures of soft tissue than had ever before been possible. In the United States, more than 20 million MRIs are performed each year.

The greatest impact has been on brain research. Its consequence is often compared to the telescope's contribution to physics or the microscope to biology. If an ordinary MRI gives you stunning internal snapshots, an fMRI is like a movie. As different parts of the brain work, demanding oxygen, researchers can watch the flow deep in the brain, in three dimensions, in close to real time. If you are shown a photo of someone about whom you have deep emotion, for example, you can watch parts of the brain rage like a Santa Ana brush fire ripping through a California canyon.

What the lie detection research has shown so far is that "the truth is always simpler," says Gur, of the Brain Behavior Center. "To make a lie you have to know what is true, and you have to distort it. That is the extra work that goes into lying." It lights up the parts of the brain that control behavior, watch for mistakes, and create physical reflections of your thoughts such as blushing. Gur compares it to a stutter.

But much is not known.

## Customer Pool

Entrepreneurs who would commercialize fMRIs for lie detection take one look at the apparently telltale brain pictures and, ding ding ding, they think they have a winner.

"We've never advertised or marketed, but people keep calling — from Australia, Spain, Italy, other parts of the world," says Hui-zenga, the founder of No Lie MRI, whose ré-

sumé includes a bachelor's degree in molecular, cellular and developmental biology from the University of Colorado, a master's in molecular biology from the State University of New York at Stonybrook, an MBA from the University of Rochester, and a background in business development of diagnostic systems for pharmaceutical companies. No Lie plans to charge \$900 for a half-hour test.

His clients' questions, Huizenga says, all seem to revolve around "sex, power or money." So far, everyone wants to prove their innocence, not establish someone else's guilt — which is convenient. Moving your head a fraction of an inch will ruin the images. He has women who want to demonstrate their fidelity to jealous boyfriends and husbands, men in divorce cases who want to refute charges that they touched their children inappropriately, one incarcerated fellow who feels he was railroaded into a plea bargain, and even a client who is trying to prove he didn't steal a large amount of cash from a family member's purse.

Damasio and other skeptics are concerned that Huizenga is engaging in nothing more than "neo-phrenology." Phrenology is the discredited 19th-century idea that you can figure out a person's character by examining the bumps on his head.

"It's not a question of putting someone in a scanner and see what lights up," says Dama-

sio. "The idea of going immediately to the commercialization of a product identifying different mental states is premature."

Steven Laken, the founder and CEO of Cephos Corp., has a résumé that includes being a recipient of the MIT Technology Review 100 Young Innovators Award, being instrumental in developing four commercially available DNA-based diagnostic products, and holding a PhD in cellular and molecular medicine from the Johns Hopkins School of Medicine.

For him, "admissibility is the Holy Grail. I wouldn't be doing this if I didn't think that admissibility" of his product into court as evidence was feasible. "We won't go commercial until we have the scientific data."

Laken sees a huge opportunity in government top-secret security testing that he says has not been well served by the polygraph. "The accuracy rates are not high enough." Like No Lie, Cephos says it has no government clients yet, although Laken says the intelligence communities "have given good constructive feedback."

At the same time, Laken can imagine his product being useful to someone who "looks like Martha Stewart" and, "when accused, in desperation mode, you need to clear your

name."

"Martha has not called yet," he adds.

## The True Test

The day the test results arrive from Langleben's lab starts portentously. His e-mail is stiff and formal: "I would like to debrief you over the phone about the extent you followed my instructions in the scanner and about any strategies you may have used during the task."

Turns out there were some surprises.

The three truths showed utterly predictable, calm brain activity. They clearly register as the truth.

But the lies — each of which featured complex shades of gray — take remarkable bounces. They revealed perhaps even more about the dark recesses of the mind than was intended.

The reporter had followed instructions to behave like someone who really wanted the job he was supposedly applying for. To that end, he had tried to direct his attention not to the question about whether or not he had that bachelor's degree, but just on the university where he'd spent all those fruitless years. He tried to focus not on whether he had written the book "Lying," but on how intently he had just read it. Finally, he tried to concentrate not on the false idea that he had ever been a soldier but on his memories of the Marine Corps, on which he had reported extensively, even accompanying troops into simulated combat in a war game in Oakland, Calif.

The university degree claim registered as a roaring, soaring, leaping, screaming lie. Not a shadow of a doubt.

The counterfeit book produced a less vivid response — but well within the profile of a lie.

The phony discharge papers from the Marine Corps and the question "Have you ever served in the military?," however, registered as the *truth*.

Even more jaw-dropping, a portion of the brain lit up that never before had been observed as important. It is about as far away from the conscious thought lobes as you can get. It was the amygdala, that portion of the limbic system popularly known as the "reptilian brain" that is associated with intense emotional response.

"You love the Marine Corps! Or maybe you hate it. You have an emotional response to the Marine Corps!" Langleben exclaimed. "All our findings focus on the cortex. We don't know much about the limbic system. Your test is the first. Hard to imagine. We never carefully looked there. We deemed it

unreliable.

"You should start working on your disability claim. You should claim 100 percent post-traumatic stress from the invasion of Oakland, California."

## Honest Questions

---

The researchers reacted with aplomb to their brand-new experiment blowing up in their cortexes. Just another fascinating day at the office in a business where you learn something new every day if you're not careful. Their first reaction was to start figuring out how they could reconstruct the experiment in the future to more efficiently lasso and hog-tie this messy reality called human nature.

It takes more effort to get them thinking about what a society without lies might be like.

The day after the experiment, Gur, of the Brain Behavior Center, writes in an e-mail:

"About the future world in which my children will live . . . .

"Our interest in lie detection technology is just as a practical outcome of our work on neural systems . . . focusing on schizophre-

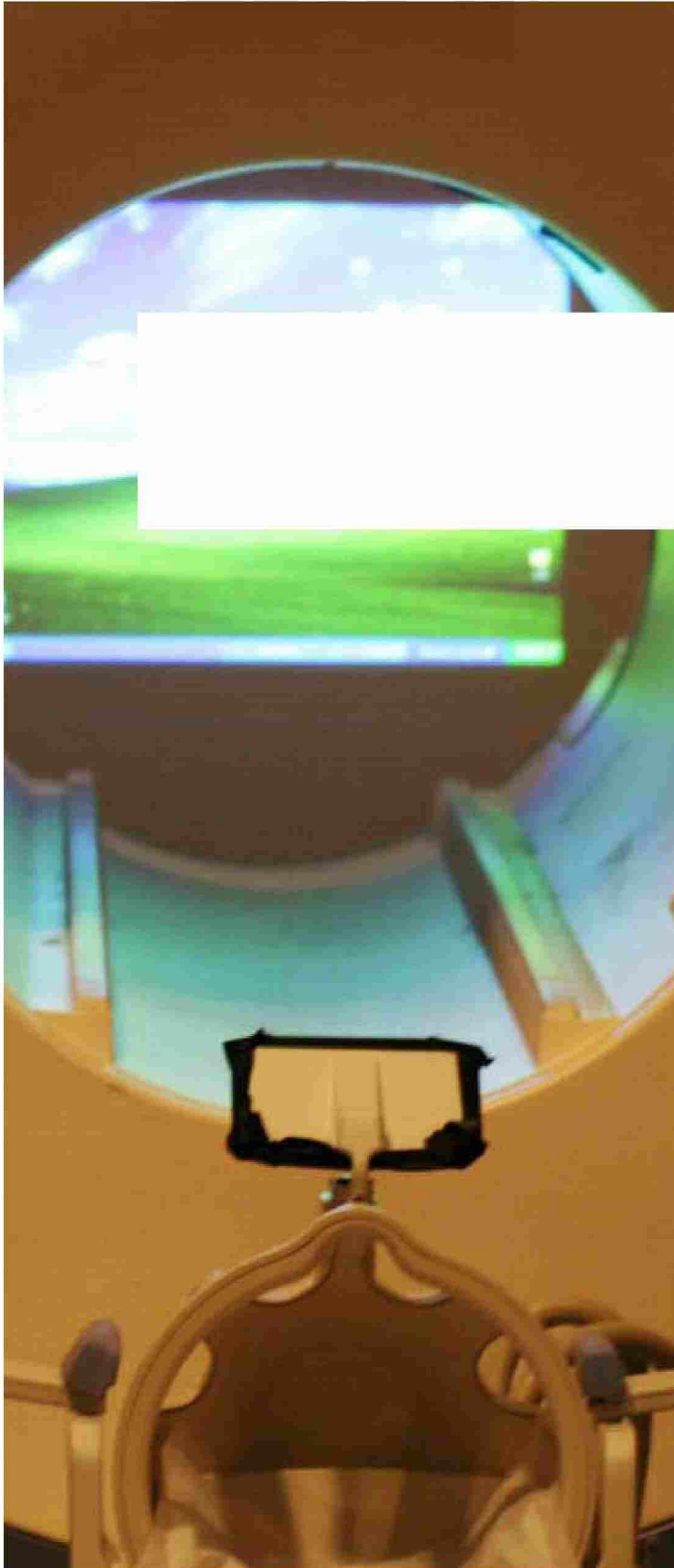
nia. We neither invented lie detection technology nor can do much about the need for it, we have just devised a more reliable version. You know that polygraphy is rampant 'as we speak,' and its imperfections can cause honest people their jobs, or worse, or set loose real bad people. Wouldn't my children's world be better if more innocent people are released and more bad people caught?

"Of course, if the public and its representatives believe that there is a threshold beyond which this technology should not progress, I am ready to stop and focus my energy in other directions. I can understand the ethical revulsion against a 'truth-telling machine.' . . . Every technology can bring good or bad results, depending on who uses it, no? It's the scientist's job to try to push the envelope, and it is the job of people like yourself, the public and its representatives to help gauge when we are approaching a danger zone.

"As a researcher, more than anything, I for one need some guidance."

---

*Staff researcher Bob Lyford contributed to this report.*

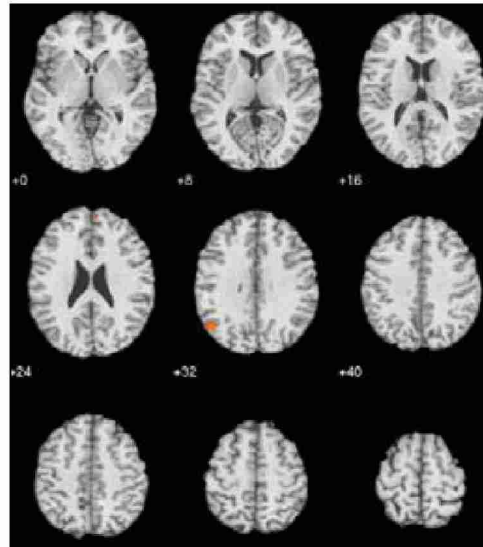
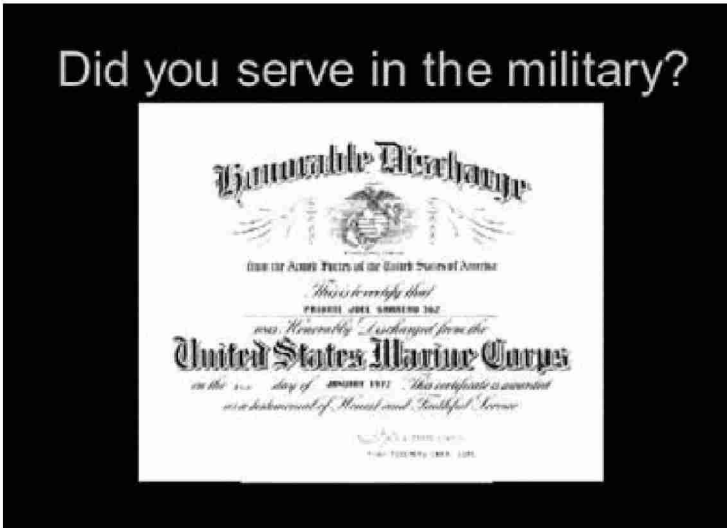


FMRI MACHINE BY ANDREA BRUCE — THE WASHINGTON POST. EXPERIMENTAL SCANS FOR THE POST FROM FORENSIC BRAIN IMAGING GROUP, UNIV. OF PENNSYLVANIA



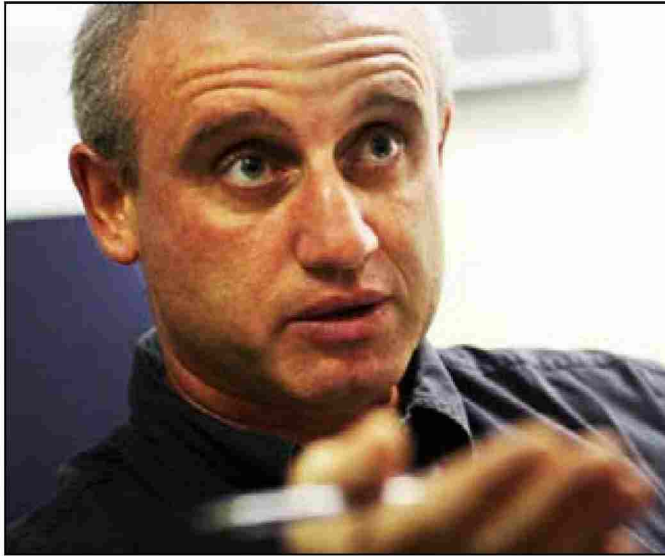
BY ANDREA BRUCE — THE WASHINGTON POST

The fMRI machine scans the brain of Style writer Joel Garreau as he is asked questions such as the one below accompanied by a bogus Marine Corps discharge notice. Below right, the resulting brain scan, which surprised researchers because of the section of the brain that lit up.



ABOVE, DISCHARGE PAPERS BY THE WASHINGTON POST; RIGHT, FORENSIC BRAIN IMAGING GROUP, UNIVERSITY OF PENNSYLVANIA





BY ANDREA BRUCE — THE WASHINGTON POST

**Daniel Langleben of Penn's Treatment Research Center wants to determine if the fMRI machine can sniff out a lie on a résumé.**