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June 28, 2009

How Technology May Soon "Read" Your Mind

60 Minutes: Incredible Research Lets Scientists Get A Glimpse At Your Thoughts



(CBS)

(CBS) This story was first published on Jan. 4, 2009. It was updated on June 26, 2009.

How often have you wondered what your spouse is really thinking? Or your boss? Or the guy sitting across from you on the bus? We all take as a given that we'll never really know for sure. The content of our thoughts is our own - private, secret, and unknowable by anyone else. Until now, that is.

As **60 Minutes** correspondent **Lesley Stahl** first reported in January, neuroscience research into how we think and what we're thinking is advancing at a stunning rate, making it possible for the first time in human history to peer directly into the brain to read out the physical make-up of our thoughts, some would say to read our minds.

The technology that is transforming what once was science fiction into just plain science is a specialized use of MRI scanning called "functional MRI," fMRI for short. It makes it possible to see what's going on inside the brain while people are thinking.

"You know, every time I walk into that scanner room and I see the person's brain appear on the

screen, when I see those patterns, it is just incredible, unthinkable," neuroscientist Marcel Just told Stahl.

He calls it "thought identification."

Whatever you want to call it, what Just and his colleague Tom Mitchell at Carnegie Mellon University have done is combine fMRI's ability to look at the brain in action with computer science's new power to sort through massive amounts of data. The goal: to see if they could identify exactly what happens in the brain when people think specific thoughts.

They did an experiment where they asked subjects to think about ten objects - five of them tools like screwdriver and hammer, and five of them dwellings, like igloo and castle. They then recorded and analyzed the activity in the subjects' brains for each.

"The computer found the place in the brain where that person was thinking 'screwdriver'?" Stahl asked.

"Screwdriver isn't one place in the brain. It's many places in the brain. When you think of a screwdriver, you think about how you hold it, how you twist it, what it looks like, what you use it for," Just explained.

He told Stahl each of those functions are in different places.

When we think "screwdriver" or "igloo" for example, Just says neurons start firing at varying levels of intensity in different areas throughout the brain. "And we found that we could identify which object they were thinking about from their brain activation patterns," he said.

"We're identifying the thought that's occurring. It's...incredible, just incredible," he added.

"Are you saying that if you think of a hammer, that your brain is identical to my brain when I think of a hammer?" Stahl asked.

"Not identical. We have idiosyncrasies. Maybe I've had a bad experience with a hammer and you haven't, but it's close enough to identify each other's thoughts. So, you know, that was never known before," Just explained.

60 Minutes asked if his team was up for a challenge: would they take associate producer

Meghan Frank, whose brain had never been scanned before, and see if the computer could identify her thoughts? Just and Mitchell agreed to give it a try and see if they could do it in almost real time.

Just said nobody had ever done an instant analysis like this.

Inside the scanner, Meghan was shown a series of ten items and asked to think for a few seconds about each one.

"If it all comes out right, when she's thinking 'hammer,' the computer will know she's thinking 'hammer'?" Stahl asked.

"Right," Mitchell replied.

Within minutes, the computer, unaware of what pictures Meghan had been shown and working only from her brain activity patterns as read out by the scanner, was ready to tell us, in its own voice, what it believed was the first object Meghan had been thinking about.

The computer correctly analyzed the first three words - knife, hammer, and window, and aced the rest as well.

According to Just, this is just the beginning.

"Who knows what you're gonna be able to read," Stahl commented. "A little scary, actually."

"Well, that's our research program for the next five years," Just said. "To see what, you know - we're not satisfied with 'hammer.'"

And neither are neuroscientists 4,000 miles away in Berlin at the Bernstein Center. John Dylan-Haynes is hard at work there using the scanner not just to identify objects people are thinking about, but to read their intentions.

Subjects were asked to make a simple decision - whether to add or subtract two numbers they would be shown later on. Haynes found he could read directly from the activity in a small part of the brain that controls intentions what they had decided to do.

"This is a kind of blown up version of the brain activity happening here. And you can see that if

a person is planning to add or to subtract, the pattern of brain activity is different in these two cases," Haynes explained.

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