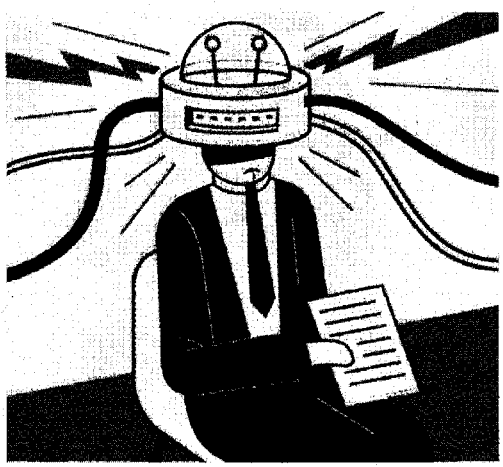
Mind Reading Is Now Possible

CRIME INVESTIGATORS ALWAYS HAVE THEIR EARS OPEN FOR INFORMATION only a perpetrator could know—where a gun used in a murder was stashed, perhaps, or what wounds a stabbing inflicted. So imagine a detective asking a suspect about a killing, describing the crime scene to get the suspect to visualize the attack. The detective is careful not to mention the murder weapon. Once the suspect has conjured up the scene, the detective asks him to envision the weapon. Pay dirt: his pattern of brain activity screams "hammer" as loud and clear as if he had blurted it out.

To detect patterns of brain activity, a subject must agree to lie still in a neuroimaging device such as a functional magnetic resonance imaging (fMRI) tube, but in an age when many jurisdictions compel not only convicts but also suspects to provide a DNA sample, that isn't difficult to imagine. Now, neither is the prospect of reading thoughts by decoding brain-activity patterns. Just a year ago, neuroscientists couldn't do much better than distinguish thoughts of faces from thoughts of places (the brain has distinct regions that process images of each). "All we could do was tell which brain region was active," says neuroscientist John-Dylan Haynes of the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig, Germany. "There were real limits on our ability to read the content of that activity." No longer. "The new realization is that every thought is associated with a pattern of brain activity," says Haynes, "and you can train a computer to recognize the pattern associated with a particular thought."



We'll get to the ethical implications of that, but first consider how quickly mind reading is advancing. Less than three years ago, it was a big deal when studies measured brain activity in people looking at a grating slanted either left or right; fMRI patterns in the visual cortex revealed which grating the volunteers saw. At the time, neuroscientist Geraint Rees of University College London said, "If our approach could be expanded upon, it might be possible to predict what someone was thinking or seeing from brain activity alone." Last year Haynes and colleagues found that even intentions leave a telltale trace in the brain. When people thought about either adding two numbers or subtracting them, an fMRI scan of their prefrontal cortex detected activity characteristic of either.

Now research has broken the "content" barrier. Scientists at Carnegie Mellon University showed people drawings of five tools (hammer, drill and the like) and five dwellings (castle, igloo ...) and asked them to think about each object's properties, uses and anything else that came to mind. Meanwhile, fMRI measured activity throughout each volunteer's brain. As the scientists report this month in the journal PLoS One, the activity pattern evoked by each object was so distinctive that the computer could tell with 78 percent accuracy when someone was thinking about a hammer and not, say, pliers. CMU neuroscientist Marcel Just thinks they can improve the accuracy (which reached 94 percent for one person) if people hold still in the fMRI and keep their thoughts from drifting to, say, lunch.

As always, the results have to be replicated by independent labs before they can be accepted. But this is the first time any mind-reading technique has achieved such specificity. Remarkably, the activity patterns—from visual areas to movement area to regions that encode abstract ideas like the feudal associations of a castle—were eerily similar from one person to another. "This establishes, as never before, that there is a commonality in how different people's brains represent the same object," said CMU's Tom Mitchell.

If what your brain does when it thinks about an igloo is almost identical to what mine does, that suggests the possibility of a universal mind-reading dictionary, in which brain-activity pattern *x* means thought *y* in most people. It is not clear if that will be true for things more complicated that pliers and igloos, however. "The more detailed the thought is, the more different these patterns get, because different people have different associations for an object or idea," says Haynes. "We're much closer to this than we were two years ago, but still far from a universal mind-reading machine." How far? The CMU group is determining the brain patterns that encode abstract ideas (honesty, democracy), words and sentences, a big step toward a mind-reading dictionary.

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Scientists are keenly aware of the ethical issues posed by reading minds. For one thing, it probably isn't necessary, if you decide to read people's thoughts, to get them to lie still in an fMRI tube and think. Nothing in physics rules out remote detection of brain activity. In fact, says law professor Hank Greely of Stanford, an infrared device under development might read thoughts using little more than a headband. He can imagine a despot scanning citizens' brains while they look at photos of him, to see who's an opponent. The use of mind reading in criminal and terrorism investigations seems inevitable, raising issues of reliability and self-incrimination. As with all technology, some uses will bring unalloyed benefits (translating a quadriplegic's thoughts to move a prosthetic limb). Other uses ... well, as Greely says, "we really don't know where this will end." That mind reading has begun, however, there is now no doubt.

ILLUSTRATION BY HARRY CAMPBELL FOR NEWSWEEK