

"Long before it's in the papers"

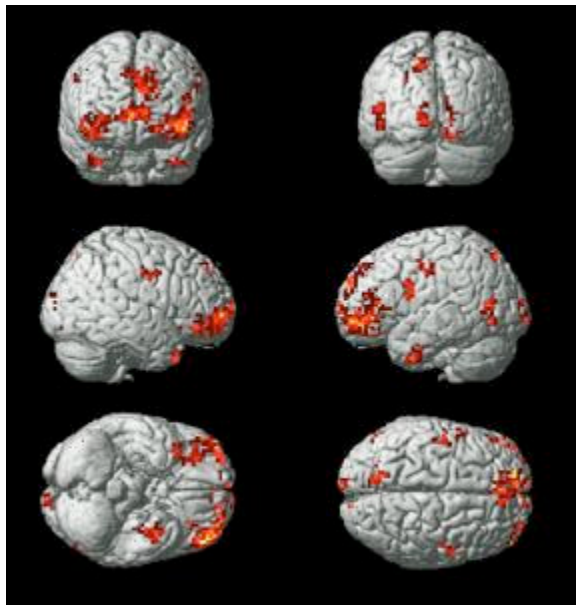
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Scientists report reading emotions from brain activity

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Courtesy of Carnegie Mellon University
and World Science staff

Scientists say that based on brain activity, they've identified with some accuracy which emotion a person is feeling—and used the results to better learn how the brain organizes emotions.

In a study published June 19 in the journal *PLoS One* online, they combined brain scanning with computer learning techniques to measure the relevant brain signals.



Areas of enhanced blood flow associated with various emotions, shown by a computer model. (Courtesy Carnegie Mellon U.)

The findings provide the first reliable process to analyze emotions, the researchers claim. A lack of reliable ways to assess these had hampered past research, they said—mostly because people can be reluctant to honestly report their feelings, but also because some emotions are unconscious.

The findings, from Carnegie Mellon University in Pittsburgh, build on previous work by Marcel Just and Tom M. Mitchell of the same school. They had used similar techniques to find out people's thoughts of concrete objects, a process often dubbed "mind reading."

The new work could be used to assess someone's "emotional response to almost any kind of stimulus, for example, a flag, a brand name or a political candidate," said Carnegie Mellon's Karim Kassam, lead author of the new study.

One problem was to find a way to repeatedly and reliably evoke different emotions in the

participants. Traditional methods, such as showing subjects emotion-inducing film clips, would have worked poorly because the clips' impact fades with repeated display, the investigators said.

To solve this, they brought in actors from the university's drama school and asked them to work themselves into different emotional states repeatedly while lying in a brain scanner—a functional Magnetic Resonance Imaging machine, which measures blood flow in the brain.

The results from this and other tests were then fed into a program designed to use the information to “learn” the signatures of the various emotions.

When new people were placed in the scanner, the computer was found to guess their emotions with a 71 percent “rank accuracy.” This means when the computer produced a list of its guesses from most to least likely, the right answer didn't always top the list, but on average it was near the top—the 71st percentile.

The study shows that despite obvious differences between people's psychology, our brains tend to encode emotions “in remarkably similar ways,” said Amanda Markey, a graduate student involved in the research.

A surprising finding, the scientists said, was that almost the same accuracy was achievable even when the computer read patterns in only one part of the brain. “This suggests that emotion signatures aren't limited to specific brain regions, such as the amygdala, but produce characteristic patterns throughout a number of brain regions,” said Vladimir Cherkassky, a research programmer at the university involved in the work.

The research team also found that the computer was best at identifying happiness, worst at identifying envy, and rarely confused positive and negative emotions—suggesting these have distinct signatures. It was also least likely to confuse lust with other emotions, suggesting lust creates brain activity distinct from other feelings.

“We found that three main organizing factors underpinned the emotion neural [brain] signatures,” said Just. These are the emotion's positivity or negativity; its intensity; and “its sociality— involvement or non-involvement of another person. This is how emotions are organized in the brain.”