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# Scanning Brains for Insights on Racial Perception

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After a decade of mapping brains in tasks like recalling numbers, perceiving facial expressions and using verbs, neuroscientists have recently homed in on a much more controversial subject: the act of categorizing other human beings.

In recently published papers, two separate teams of brain scanners joined by social psychologists describe how one particular part of the brain becomes more active when people look at members of a different race.

Scientists involved in both studies emphasize that the work does not mean racial differences are more scientifically real than, say, ghosts or leprechauns -- both of which would also produce measurable effects in the brains of people who were scared of them.

Nor are they surprised that looking at people from a different race causes changes in the brain.

"Everything causes changes in the brain," said Prof. Elizabeth A. Phelps, a neuroscientist at New York University.

But the two papers are the first published efforts to map exactly what happens in the brain when it perceives a racial difference. It is the first time neuroscientists have published papers on the kinds of messy questions many prefer to leave to social psychologists and sociologists.

"What really stands out in this work is the union of social psychology,

neuroimaging and psychiatry," said Allen J. Hart, a social psychologist at Amherst College who worked on one of the studies, which appeared in the Aug.

3 edition of the journal *NeuroReport*. "Social psychologists have been heading toward the study of emotions and group perception, and the imagers have been heading towards mapping emotion. And now we've met."

Both teams -- Professor Hart and his colleagues, who used a magnetic resonance imaging scanner at Massachusetts General Hospital in Boston, and a Yale-N.Y.U. collaboration that used Yale's M.R.I. scanner -- focused on the amygdala, a well-studied cluster of nerves that lies deep inside each brain hemisphere. Because of its involvement in strong emotions, memory and learning rules, the amygdala is a promising target for research on how perceptions of race could affect the brain, the researchers said.

Work on animals and people suggests the amygdala behaves like a spotlight, calling attention to matters that are new, exciting and important to know more about.

"It's a learning area," said Paul Whalen, a neurobiologist at the University of Wisconsin who was the amygdala expert on the Massachusetts General study.

"It really seems to be about noticing," said Professor Phelps, a co-author of the Yale-N.Y.U. paper. "It's involved in grasping that something is emotionally significant."

In the Mass General experiment, scientists placed four men (two who described themselves as black and two who said they were white) and four women (divided the same way by race) in an M.R.I. scanner. As they lay in the tunnel, with the machine banging and clanging as its powerful magnets shifted alignment, the volunteers saw photographs of black and white faces flash by.

An M.R.I. device feeds magnetic signals into a computer, which turns them into an image in which the parts of the brain with concentrations of glucose and oxygen -- the fuel of brain-cell activity -- are "lit up." The

earliest scans in the Mass General experiment showed the volunteers had nearly equal amounts of amygdala activity no matter whose pictures were flashed.

That's not surprising, Professor Whalen said, because in a novel setting "the amygdala fires to everything at first." But after a short time had passed, one set of pictures elicited more firing up than the other. White subjects showed lower amounts of amygdala activity when they looked at white faces; blacks showed less amygdala activity when they looked at blacks.

The study, the authors noted, did not look at other areas of the brain (the amygdala is branched into many other regions). Nor did it link amygdala activity to any particular behavior or prejudice. Indeed, after the tests, the volunteers said they felt no strong emotions about the photographs, one way or the other.

The other study, being published today in *The Journal of Cognitive Neuroscience*, tried to address this by relating amygdala activity to particular states of mind.

Conceived by Professor Phelps and Mahzarin R. Banaji, a social psychologist at Yale, this experiment used only white volunteers. They found that those whose amygdalas fired up most at the sight of blacks were those who scored higher on two other measures of unconscious feelings about blacks.

The 14 volunteers in the Yale scanner saw pictures of young men of both races.

Days later, the researchers gave the volunteers two other tests to measure their unconscious responses to blacks.

In one, the volunteers sat at computers and classified the photographs by race at the same time as they classified words flashing on the screen as either "good" or "bad."

When they take this "implicit association test," Professor Banaji said, many Americans (most whites and half of blacks) are measurably quicker to associate positive words like joy, love and peace with whites and

negative words like cancer, bomb and devil with blacks.

The responses are outside conscious control, Professor Banaji said.

People whose conscious political positions are egalitarian and antiracist are often upset to find that they, too, were quicker to be positive about whites and negative about blacks.

True to Professor Banaji's expectations, she said, most volunteers in this study showed a preference for white faces over black. And those who showed the most unconscious preference were those whose amygdalas showed the most activity when they looked at black faces.

The Yale-N.Y.U. team also showed the photographs again to the volunteers while electrodes measured how strongly the muscles around their eyes were preparing to blink.

Unconsciously preparing to blink is a response to something alarming, and the amygdala is clearly on the circuit of brain areas that creates the response, Professor Phelps explained.

Knowing a volunteer's level of amygdala activity at the sight of black faces, the team's paper says, also allowed them to predict how he would score on the startle measure. "We didn't see the amygdala effect in everybody, but when we did see it we found we could make the prediction," Professor Phelps said.

In a second experiment, the N.Y.U.-Yale group showed a new batch of volunteers a set of famous faces -- including Joe Namath, Tom Cruise, Denzel Washington and Michael Jordan. "We thought perhaps familiarity with a person would remove the effect," Professor Phelps said. And, in fact, with famous faces, the racial difference in amygdala reactions disappeared.

"Of course, it could also be an effect of fame, rather than just that these faces were familiar," Professor Phelps said.

"We don't know."

In fact, authors of both papers emphasize that there is a lot they do not

know.

Neuroimagers do not map the whole brain any more than tourists on a tight schedule would visit every block in Manhattan. The scientists concentrate on one landmark at a time, which leaves open many questions about what is happening in the other parts of the brain to which the amygdala has connecting fibers.

Beyond the uncertainty, neuroscientists interviewed about the two papers were uncomfortable with issues like stereotype, prejudice and identity.

But they believed that those issues were relevant to their field. The reason, several said, is that there is no such thing as "the brain." Each brain is different, having been shaped by its environment.

A large part of a person's environment is other people. So one of the most important ways that a brain is shaped is by experiencing how other brains judge its owner. That deserves more attention than it has gotten, several researchers said.

For example, the NeuroReport paper notes that brain scanners have generally used photos of white faces when they studied how "the brain" reacts to "the face." If blacks respond differently to white faces than do whites, that fact will have to be taken into account, the authors write.

Until the recent work, "we in neuroimaging have attempted to minimize the differences among people," said John Gabrieli, a brain researcher at Stanford.

"We have people do things like memorize nonsense words, as if we could somehow get at pure thought, unmediated by the environment.

It's not clear to me why we've had many studies of things like short-term memory for numbers before we had even one on the social influence of brain function."

With so many questions, the scientists hesitate to speculate about what the amygdala work means. Among the theories, there is "bottom up" -- the amygdala, always seeking important information, notices a racial difference and that perception then goes into the conscious thoughts. But

there is also "top down" -- racial thinking, picked up from other people, teaches the amygdala that race is important to notice.

Very likely, Professor Whalen says, the best explanation will have a bit of both top and bottom in it. It could be that the mind is tuned to racial difference in a way it is not to others, he speculated. At the same time, he said, "learning trumps everything else" in the life of the brain. For example, he expects that the amygdala of a black person raised among whites would "scan" like that of a white person. "It's not the color of the skin of the person in the magnet," he said. "It's what color the eyes are used to seeing."

Despite their unease about venturing into what one journal recently dubbed "social neuroscience," none of the researchers doubts that the work will continue.

"Everyone knows it's preliminary and impossible to interpret at this point," Professor Whalen said of the studies.

"But that doesn't make the answers any less interesting."