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Brains of outgoing people react more positively to happy faces than those of shy individuals, study shows

It doesn't matter whether people are shy or outgoing, their brains react the same way to something scary -- call it a universal human trait of self-preservation.

But Stanford researchers have discovered that people's brains are *more* likely to react to something positive -- such as a happy face -- if they are upbeat and outgoing rather than serious and shy.

"We think this is a nice example of the way the brain supports both universal human traits or characteristics, and variations that make one person different from the other," said John Gabrieli, associate professor of psychology. "We don't know to what extent this is a cause or a consequence of your view of the world."

The findings are published in the journal *Science* on June 21 in an article titled "Amygdala Response to Happy Faces as a Function of Extraversion."

The research focuses on the amygdala, a pea-sized area of the brain associated with emotion and memory that is found in the middle of the head behind the eyes.

According to Turhan Canli, the paper's lead author who is currently an assistant psychology professor at State University of New York-Stony Brook, previous research on the amygdala using functional magnetic resonance imaging (fMRI) has mostly focused on recording negative emotions.

For example, work has been done on fear conditioning with animals where a neutral stimulus is paired with a negative experience such as an electric foot shock. "The animal will learn very quickly to avoid that kind of stimulus, or it will respond to it with fear," said Canli, a former Stanford postdoctoral student. "That makes evolutionary sense -- when bad things happen you don't want to have to encounter them more than once."

In addition to being associated with emotional learning and memory, the amygdala activates or "lights up" in fMRI scans when the brain processes a socially and emotionally significant image, such as the human face.

Activation of the amygdala by fearful faces compared to neutral faces has been relatively consistently reported in scientific literature, Canli said. What has not been consistently found is reaction to other emotional stimuli, particularly happy faces. "When people start looking at happy facial expressions, the verdict is split," said Canli. "Some have found activation; others haven't."

Canli thought that the inconsistent findings might be due to differences in the samples of volunteer subjects. For example, if people in a sample group tended to be outgoing, the amygdala would be more likely to respond or "turn on" to positive stimuli.

To test this theory, Canli and other researchers in Gabrieli's cognitive neuroscience lab recruited 15 student volunteers with no psychiatric histories. They were assessed for extraversion -- the tendency to be optimistic and sociable, and neuroticism -- the tendency to be anxious, worried or insecure. The two are not opposing personality traits and both can exist in one person, Canli said.

The participants, one by one, lay down on a bed attached to an fMRI scanner and looked at pictures of faces depicting a variety of expressions. They were given no instruction about how to respond beyond judging whether the faces were male or female -- a task devised to keep them focused on the pictures, Gabrieli said. The fMRI recorded the brain's spontaneous response to each image.

The researchers found, as expected, that the amygdala in all participants responded to fearful faces. However, when subjects looked at happy faces, the amygdala "turned on" more in those with high extraversion scores. "We got this very clean association between amygdala reaction to two different kinds of emotional facial expressions," Canli said. As a result, he explained, "You can use extraversion as a factor that can explain or predict amygdala activation to happy faces." In other words, the more outgoing someone is, the more his or her brain is likely to react to something perceived as pleasant.

Why is this important?

According to Gabrieli, the research tries to understand a small part of what people have in common and what makes everyone unique. "Personality is one big thing that makes us different," he said. "Regardless of whether you're outgoing or shy, worried or extra-relaxed about life, probably the survival aspects of responding quickly to fearful situations are pretty much the same for everyone.

"But not everyone likes to go to a party and be with a bunch of strangers. Some think it's a great opportunity to meet everyone, while others think it's an excellent opportunity to feel lonely and awkward. It's interesting to imagine the mechanisms in the brain that support this desire for what seems to be a pleasant experience, and how they differ from one person to another." Extreme introversion is associated with severe shyness or social phobia, Gabrieli added, both of which can be debilitating conditions that prevent a person from forming meaningful relationships with others.

The next step, Canli said, is to try to find out *why* the amygdala lights up more in some people than others. "No one knows," he said. "Imaging is a fantastic tool to discover these relationships and to localize them in the brain in the context of the specific tasks that people do. But to explain the biology underlying these phenomena, we will have to go to lower levels of analysis, particularly molecular biology."

Other contributors to the *Science* study included Heidi Sivers, who earned her doctorate in psychology from Stanford last year and went on to pursue postdoctoral work at the University of Oregon Health Science Center; Susan Whitfield, a science and engineering associate in the Psychology Department; and Ian Gotlib, professor of psychology. The research was supported by a grant from the National Institute of Mental Health.

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