Fear factor: Study shows brain's response to scary stimuli

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(Medical Xpress)—Driving through his hometown, a war veteran with post-traumatic stress disorder may see roadside debris and feel afraid, believing it to be a bomb. He's ignoring his safe, familiar surroundings and only focusing on the debris; yet, when it comes to the visual cortex, a recent study at the University of Florida suggests this is completely normal.

The findings, published last month in the *Journal of Neuroscience*, show that even people who don't have anxiety disorders respond visually at the sight of something scary while ignoring signs that indicate safety. This contradicts a common belief that only people with anxiety disorders have difficulty processing comforting visual stimuli, or safety cues, said Andreas Keil, a professor of psychology in UF's College of Liberal Arts and Sciences.

"We've established that, in terms of visual responding, it's not a disorder to not respond to a safety cue," Keil said. "We all do that. So now we can study at what stage in the processing stream, with given patients, is the problem occurring."

Co-authors Keil and Vladimir Miskovic, both members of the UF Center for the Study of Emotion and Attention, examined the effect of competing danger and safety cues within the visual cortex. The study results could help distinguish between normal and abnormal processes within the visual cortex and identify what parts of the brain are targets for the treatment of anxiety disorders.

"You'd think the visual cortex would just faithfully code for visual information," said Shmuel Lissek, an assistant professor of psychology at the University of Minnesota not involved in the study. "This kind of work is testing the idea that activations in the visual cortex are actually different if the stimulus has an emotional value than if it doesn't."

For the experiment, 21 undergraduates took turns watching flickering shapes appear on a computer screen while EEG sensors recorded their brainwaves. Through repeated observation, the students learned that one shape was always followed by an unpleasantly loud noise, while another was always followed by silence.

The "loud" shape—the threat cue—appeared and disappeared, and then the "silent" shape—the safety cue—took a turn. The participants learned to fear the "loud" shape, as shown by reactions in their visual cortices.

But when the "loud" and "silent" shapes appeared together on the screen in the second phase of the experiment, the participants' brains reacted the same in response to the "loud" shape. They essentially ignored the "silent" shape, even though it signaled relief from the loud noise. This was determined using a method called frequency tagging, in which the two shapes flicker at different rates, allowing the researchers to isolate and track the responses to both in the visual cortex.

"When threat and safety compete with each other, more attention is still paid to the threat," Keil said. "The visual cortex is very conservative; it's not easily swayed."

Finally, the threat cue shape appeared repeatedly without the bang, until the participant finally trusted that the noise was gone, thus un-learning their fear of the "loud" shape through exposure.

The entire experiment was conducted in about half an hour, although the longer participants are exposed to the loud sound, the more time it takes to eradicate the fear response.

"The longer it takes to learn something, the longer it takes to get rid of it, because it affects a lower and lower level of your brain," Keil said.

In the next stage of their work at the Center for the Study of Emotion and Attention, Miskovic and Keil will study how the brain reacts if participants can take actions to avoid the fear-inducing noise. They will also train participants to alter their fear response in the same way some people can consciously alter their heart rates, which eventually could help people with anxiety disorders control their fear response.

Their work is consistent with the center's basic research aim, said Peter Lang, center director, which is to illuminate the physiology and behavior that characterizes human emotion.

"In this effort, an important focus is the study of brain mechanisms that mediate emotional reactivity," said Lang, a graduate research professor in the department of clinical and health psychology. "The goal is to use the new knowledge to improve the diagnosis and treatment of these mental illnesses like PTSD and other anxiety and mood disorders."

Provided by University of Florida

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