

Stomach-churning experiment not for the faint of heart

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(PhysOrg.com) -- If someone is sick next to you on the bus, you'll probably feel disgusted, your stomach will turn and you will start to feel sick as well. But is your stomach churning because you feel disgusted, or is your sense of disgust caused by your stomach churning?

In 1894, William James, a US psychologist, posed a similar question: do we run from a bear because we are afraid, or are we afraid because we run? In other words, do our emotions cause physiological changes in our body, or is it the other way around?

Now, a study funded by the Wellcome Trust has found that if James had ever met his bear, he would most likely have been afraid because he was running away - his increased <u>heart rate</u> and body movements would have directly contributed to his feelings of fear. The results of this study are published in the <u>Journal of Neuroscience</u>.



Dr. Neil Harrison and Professor Hugo Critchley, from Brighton and Sussex Medical School at the University of Sussex, carried out a study attempting to answer James's question. Their study focused on the anterior insula, a region of the <u>brain</u> implicated in the experience of a broad range of <u>emotional feelings</u> and on physiological responses to two different types of disgust.

"If James was correct and emotional feelings are the product of changes in our physiological state, then we should see different patterns of activity in the anterior insula, depending both on which emotion was being experienced and also how our body was responding," explains Dr. Harrison.

"On the other hand, if the physiological response made no contribution to our experience of emotional feelings, we would expect to see changes in <u>brain activity</u> in areas known to regulate the body's <u>physiological</u> <u>response</u> but not specific changes in activity in the anterior insula."

The researchers worked with Wellcome Trust funded video-artist, Tina Gonsalves, to produce videos designed to elicit responses of 'core disgust', where we feel nauseated and our stomachs turn. These videos included a person vomiting and someone licking and putting their fingers in fake vomit.

To analyse physiological responses to these videos, the researchers used an electrogastrogram (EGG), which measures electrical activity across the stomach. They found that, the more disgusted the volunteer reported feeling, the faster their stomach contracted.

At the same time they also recorded changes in brain activity using a functional magnetic resonance imaging (fMRI) scanner. As they expected, they found that 'core disgust' correlated with activity in the right anterior insula, a region of the brain known to be involved in



processing emotions. However, they also found that activity in this brain region correlated with changes in stomach activity, suggesting that changes in stomach contractions influence the same part of the brain that supports feelings of core disgust.

The researchers then showed the volunteers a series of images intended to provoke a reaction known as 'body-boundary violation disgust', where we feel light-headed and faint. These images included simulations of gore and mutilated bodies. This time, using an electrocardiogram (ECG) to measure changes in heart rate, the researchers found that this type of disgust elicited an increase in heart rate.

Using fMRI, the researchers showed that the experience of this type of disgust also correlated with activity in the anterior insular, but this time on the left-hand side. Once again, activity in this brain region also correlated with a change in physiology in the heart, suggesting that changes in heart rate influence the same part of the brain that supports feelings of body-boundary violation disgust.

"Our research asks the question 'what are emotional feelings?'," explains Dr. Harrison. "We showed that the emotions we experience depend on patterns of activity within the anterior insula, which themselves are dependent upon how our body is responding."

More information: Harrison N et al. The embodiment of emotional feelings in the brain. *J Neurosci*; 22 Sep 2010.

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