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Facial expressions reveal how the body reacts to stress

A provocative study has found that people who respond to stressful situations with angry facial expressions, rather than fearful expressions, are less likely to suffer such ill effects of stress as high blood pressure and high stress hormone secretion.

Darwin first proposed that facial expressions of emotion signal biological responses to challenges and opportunities.

Over a century later, a number of scientists have taken up Darwin's hypothesis, making the biological significance of facial expression a topic of renewed scientific inquiry.

One important, but unexamined, question concerned the biological significance of facial responses to stressful circumstances. Because stress responses are central to survival, the authors of the present study reasoned, stressful situations should be especially likely to reveal coordinated biological reactions and facial communication, in part to warn or warn off others.

"We tested whether facial muscle movements in response to a stressor would reveal changes in the body's two major stress-response systems – the sympathetic nervous system (SNS) and the hypothalamic pituitary adrenocortical (HPA) axis. Analyses of facial expressions revealed that the more fear individuals displayed in response to the stressors, the higher their biological responses to stress. By contrast, the more anger and disgust (indignation) individuals displayed in response to the same stressors, the lower their responses," said Jennifer Lerner, at Carnegie Mellon and lead author of the study.

This paper challenges two long-held assumptions: one, that stress elicits undifferentiated negative emotions and as a consequence produces a uniform biological response; and two, that all negative emotions, such as fear and anger, provoke the same psychological and biological reactions.

This paper builds on a line of work led by Lerner showing that anger triggers feelings of certainty and control as well as optimistic perceptions of risk.

A landmark study by Lerner found that Americans' initial emotional reaction to the Sept. 11, 2001, terrorist attacks predicted their risk perceptions two months later, those reacting with anger the most optimistic and the most likely to favor aggressive responses to terrorism. No other study, however, has demonstrated that a person's facial expressions reveal changes in both of the body's stress response systems.

"Anger can sometimes be adaptive. We're showing for the first time that when you are in a situation that is maddening and in which anger or indignation are justifiable responses, anger is not bad for you," Lerner said. In the past, researchers have assumed that anger can contribute to coronary disease and hypertension, co-author Shelley Taylor added. Although a chronically angry, explosive temperament may do just that, justifiable anger in response to short-term frustrating circumstances appears to be a healthier response than responding with fear.

During the experiment, 92 participants performed mathematical exercises, including counting

backwards by seven from 9,095, and counting backwards by 13 from 6,233.

To make the exercises more stressful, participants were informed of each mistake they made, and they were urged to go faster by a harassing experimenter.

Participants, who also were asked to complete arithmetic problems from an intelligence test, were told these tasks were indicative of general intelligence and that their responses would be compared to other participants' scores.

To ensure that the tasks were creating stress, researchers assessed the participants' emotional states and measured their stress hormone (i.e., cortisol) level, pulse, heart rate and blood pressure during periods of relaxation as well as immediately following the exercises. Increases in those biological measures were less pronounced in the participants displaying anger and indignation than in the participants displaying fear.

Taken together, the data reveal that the face represents an important window into the influences of stress and emotion on health. Because facial expressions can be assessed from the first moments to the last moments of life, across cultures, across social contexts and even across species, these results open up new opportunities for tracking developmental trajectories in stress responses, for assessing culture-specific appraisal patterns, and for assessing stress responses in naturalistic work and family settings.

Source: Carnegie Mellon University, 2005

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