BEHAVIOR

Measuring emotions electronically

Most people know when they are happy or sad, but researchers and therapists can't always be sure that the people with whom they are working are accurately reporting their feelings. Now researchers report that by monitoring facial muscles they can detect even subtle emotional states. Gary E. Schwartz of Harvard University and a group at Massachusetts General Hospital report these findings in the April 30 SCIENCE.

At least six distinct emotions can be recognized in the human face: happiness, sadness, anger, fear, surprise and disgust. But these feelings are not always shown by a big grin or an obvious frown. And the speed and sensitivity of facial muscle activity is sometimes too rapid or subtle to be detected by the average observer. Discrete patterns of low-level muscle activity can, however, be detected. The researchers recorded electromyographic (EMG) activity as a measure of facial muscle activity.

In an experiment, the EMG activity, facial expressions and emotions of 24 women were monitored. The women were first rated on a scale of depression—12 scored in the normal range, 6 were classified as depressed and the remaining 6 were even more depressed and were about to begin drug therapy. With electrodes placed over specific muscles, each woman was asked to imagine happy, sad and angry situations that had evoked strong emotions in the past. The EMG patterns were distinct enough to distinguish depressed from nondepressed women. As would be expected, the nondepressed subjects generated more happy and less sad patterns even when they were imagining neutral situations. Video tapes of the women's faces showed that what the EMG picked up would not always have been detected visually. The researchers suggest that "facial EMG can provide a sensitive and objective procedure for indexing normal and clinical mood states."

Education and job satisfaction

Education may be a means to social advancement, but it does not pay off in job satisfaction. This is the finding of a study recently conducted by the Institute for Social Research at the University of Michigan. Researchers analyzed nine national surveys of the work force conducted between 1962 and 1973. There was no increment in job satisfaction with each succeeding year of education. One reason cited for this is that too many people have too much education for the jobs they are doing.

Obesity in the family

It is highly probable that a child born to obese parents will itself become obese. Two reasons have been suggested: it may be the result of some genetic factor or it may have to do with early overfeeding. In the April 22 NATURE Mary Griffiths and Philip R. Payne of the London School of Hygiene and Tropical Medicine suggest a third possible cause. They found a significant difference between the energy expenditure of children of obese parents and those of nonobese parents.

Twenty children, four to five years old, took part in the study. None was overweight (for age or height), but 8 had at least one parent who was or had been 20 percent or more overweight. Daily energy expenditure of the children was based on the relationship between pulse rate and oxygen consumption. Energy intake was measured by analyzing duplicate portions of all the food and drink consumed. The two groups did not differ in body size, but energy intake and expenditure were much lower in the group with obesity in the family. The energy expended on physical activity for this group was only half that used by the children in the other group. Whether this is due to genetic or environmental factors is still a question.

SPACE SCIENCES

The 15,000-hour blast

Engineers at the NASA Lewis Research Center in Cleveland have claimed a world record in space propulsion by successfully firing an ion thruster—an electrically powered rocket that gets its push by expelling an ionized beam of, in this case, mercury—for 15,000 hours. Such engines produce minuscule thrust, measured in thousandths of a pound, but they use so little propellant so efficiently that many view them as ideal for such tasks as controlling the orientation of long-life, earth-orbiting satellites.

The record-holding thruster, for example, produced only 1 millipound of thrust, but in 15,000 hours of thrusting it consumed less than 30 pounds of mercury, an amount that could readily be stored in a one-liter Thermos bottle. Its efficiency rating, or specific impulse, was 2,352 seconds, dwarfing that of even the most efficient chemical rockets. The liquid-hydrogen-burning Centaur, for example, has a specific impulse of only 460, and the rockets responsible for U.S. manned space feats have been mostly down in the 200's. The ion thrusters aren't meant to compete with the big chemical burners, however. Perhaps the largest ever built emitted an ion beam 1.5 meters in diameter and drew more than a million watts of electricity to produce just half a pound of thrust.

The main advantage, apart from long-life reliability, is the weight saving, largely due to the miserly use of propellant. Typically, according to Bruce Banks, head of Lewis's small thruster section, a 765-pound satellite designed for a 7-year lifetime could save 100 pounds by using ion thrusters instead of conventional hydrazine rockets to keep it pointed in the right direction. The proposed orbiting power stations would be a natural for ion engines, says Banks, with the gentle, low-mass thrusters periodically nudging the stations' huge solar collectors to keep them aligned with other, only fragilely connected components. Periodic nudges are the ion thrusters' forte, and the 15,000-hour test included 460 restarts. "The restarts," says project engineer Shigeo Nakanishi, "demonstrated that ion thrusters can be started up and shut off without a discernible change in performance."

NATO milcomsat aloft

The third in a series of military communications satellites for the North Atlantic Treaty Organization, NATO 3-A, was launched April 22, aimed at a geosynchronous point at longitude 15.5°W, south of the western extension of Africa. The 1,540-pound, drum-shaped satellite, designed for a seven-year lifetime, was launched for NATO by NASA. An identical probe, NATO 3-B, will be sent to a different longitude in September.

George Low to leave NASA

George M. Low, who managed the Apollo spacecraft program during the years that climaxed with the first manned lunar landing, will leave NASA next month to become president of his alma mater, Rensselaer Polytechnic Institute in Troy, N.Y.

Following nine years with NASA's predecessor, the National Advisory Committee for Aeronautics, Low joined the space agency at its inception in 1958, serving initially as chief of manned space flight and as chairman of the special committee that formulated the original plans for the Apollo moonlanding program. He later became deputy director of the Manned Spacecraft Center in Houston, then becoming Apollo spacecraft manager following the 1967 spacecraft fire that killed three astronauts and forced a major Apollo redesign. He was appointed to his present post, deputy administrator of NASA, in December 1969.

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