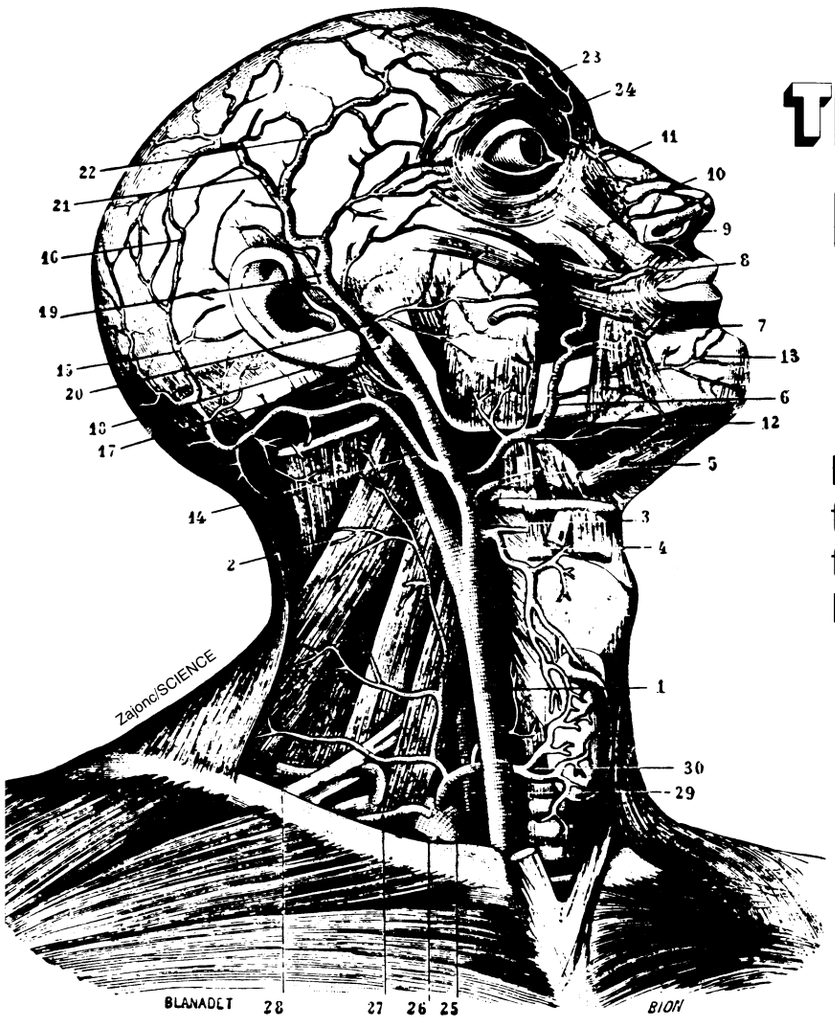


THE FACE OF EMOTION

Facial expressions may create feelings as well as communicate them; the possibility, at least, should be explored, says one researcher

By BRUCE BOWER

Charles Darwin, the father of modern evolutionary theory, may have had a few things to learn about facial expressions from Israel Waynbaum. No, Waynbaum was not a gifted turn-of-the-century mime. In 1906, this upstart French physician published a radical theory explaining the function of facial expressions — a theory that defied conventional thought about emotions, including Darwin's dominant ideas. At the time, Waynbaum was criticized by a few psychologists and ignored by everyone else. Until recently, he remained virtually unknown.

But psychologist Robert B. Zajonc of the University of Michigan in Ann Arbor is out to resurrect Waynbaum's ideas and put a modern face on them. In a recent presentation at the National Institute of Mental Health and in the April 5 SCIENCE, Zajonc explained why he thinks Waynbaum's theory of facial and emotional expression is superior to Darwin's and, when modified in light of what is now known, becomes a powerful guide for emotion researchers.

Yet it is Darwin who has most influenced these investigators, points out Zajonc. In *The Expression of the Emotions in Man and Animals,* first published in 1872, Darwin argued that emotional expressions are adaptive responses; they communicate internal states, send out signals that enemies are present and have a powerful survival value for many species. This is a valuable insight, says Zajonc, but Darwin never explained why different muscles contract or relax in association with different emotions. Darwin's primary interest was in describing facial expressions and demonstrating that they are linked to the same emotions in all human cultures.

Over the past two decades, emotion researchers have uncovered convincing data to support Darwin's contention that there are facial expressions with "universal" meanings. "But this does not explain anything about the dynamics or biological substrates of emotions," asserts Zajonc.

Above: Nineteenth-century rendering of the circulatory system of the head. Waynbaum thought the blood to the brain and face was supplied solely by the common carotid (1), the internal carotid (2) and the external carotid (3).

Waynbaum, in contrast to Darwin, saw muscular movements of the face as more than characteristic twitches following specific emotions. The 80 muscles laced across the face control blood flow to the brain, held Waynbaum, and in some instances regulate the subjective experience of emotion. By pressing against or easing up on the branches of the carotid artery — which in Waynbaum's time was considered the sole source of cerebral blood — facial muscles allow either more or less blood to reach the brain, he reasoned.

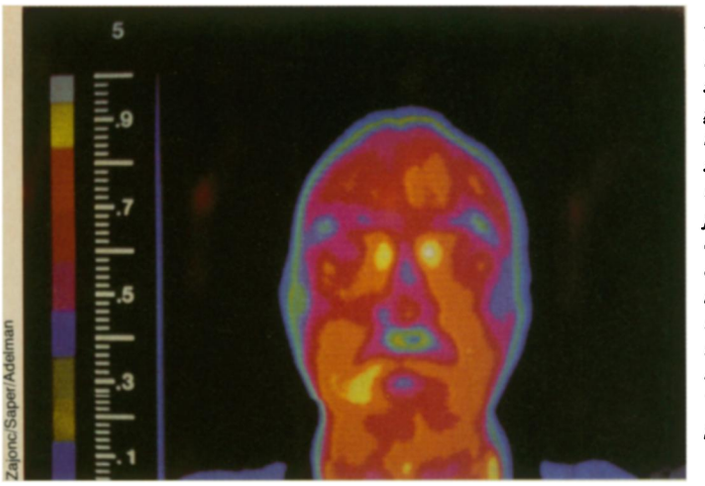
For example, Waynbaum said that blushing occurs after an intense emotion sends a sudden surge of blood to the brain. Someone may be ashamed or wish to hide, but there is little they can do about it. As in suppressed rage, mobilized energy and increased cerebral blood flow have to be relieved, so the facial muscles allow the surplus blood to drain to the face. The result: a rosy blush.

Darwin, on the other hand, concluded that blushing occurs because the attention of others is focused on part of one's own body. He wrote that it is primarily a social phenomenon and noted that "women blush much more than men."

As an observer of bodily processes rather than social ones, Waynbaum emphasized anatomy over adaptation. The muscle that contracts during laughter, he maintained, increases blood flow to the brain, thus creating, rather than

following, a feeling of elation. A hard laugh eventually slows return circulation to the brain and the face again becomes red, or even violet. Tears shed at the end of a laughing bout relieve the rising pressure of cerebral blood. Similarly, sad expressions elevate blood flow in the brain and lead to weeping, says Zajonc. "Tears allow for decongestion," he observes. "They are, in fact, mostly plasma."

Waynbaum rightly emphasized a connection between the vascular system and emotions, continues Zajonc, even if he could not have known that cerebral blood is supplied by a large network of vessels rather than the carotid alone. Also, it now appears likely that changes in cerebral blood flow are related to brain temperature; these temperature changes, in turn, can affect the release or inhibition of neurotransmitters that influence emotions and brain function, holds Zajonc. Little is known about the effect of brain temperature on neurotransmitter release, he acknowledges, "although it would be surprising if the optimum temperature for their synthesis and release were not confined to a narrow range, perhaps a fraction of a degree."



This thermograph, with a color-coded scale on the left as a guide, shows the face of a relaxed subject—compared with the angry subject shown on the cover—to be significantly cooler. The forehead, particularly, loses much of the "hotter" orange areas in favor of "cooler" red and pink patches.

If facial movements create feelings as well as communicate them, a number of perplexing emotional states can be more fully explained. It is not clear, for instance, how the process of empathy, in which the feelings of one person are transmitted and partially experienced by another, takes place. Consciously or unconsciously reproducing the expression of another may produce in the onlooker a similar emotional condition, suggests Zajonc, not to mention alterations in cerebral blood flow, brain temperature and neurotransmitter release.

This explanation, he says, is "diametrically opposed" to the "facial feedback" theory that grew out of Darwin's work and now influences much emotion research. The facial feedback theory assumes that facial expressions follow emotions and furnish feedback about what was previously felt.

A major proponent of the facial feedback idea, psychologist Paul Ekman of the University of California at San Francisco, has modified his position a bit. He demonstrated that facial expressions consciously produced by actors are associated with specific heart rate changes (SN: 10/17/83, p. 182). The muscle pattern that conveys disgust, for example, reduced heart rate, while that related to sadness accelerated it. Ekman also reports that anger, disgust, fear and sadness — but not happiness — are experienced by people instructed to move their facial muscles into expressions appropriate to each emotion. He suggests that "manufactured" facial expressions spark nerves that directly communicate with brain areas responsible for heart rate and emotion.

Zajonc, however, sees facial expressions as the first link in a chain of biological reactions that alter blood flow and temperature in the brain and neurotransmitter release. In sad expressions, he says, these muscles allow more blood to move out of the brain through the facial artery and increase the circulation of blood back to the brain. As a result, brain temperature and heart rate temporarily rise.

Ekman had no comment on Zajonc's interpretation, but psychologist Carroll E. Izard of the University of Delaware in Newark, also an influential backer of the facial feedback theory, expressed several reservations about the Zajonc-Waynbaum approach.

To begin with, says Izard, Zajonc misintreprets Darwin's views of facial expressions. Darwin did, in fact, assign expressions a role in the activation and regulation of emotions, he contends. The emphasis on internal states preceding facial changes appears in Darwin's early writings, but this view was modified over the 36 years it took him to complete his book, asserts Izard.

In addition, he says that Zajonc neglects to consider that facial movements are invaluable feedback tools for infants; expressions serve to signal their needs and develop a bond with the mother or other caregiver. Later in life, emotions become more regulated. Anger, for instance, may produce a variety of expressions among adults who cope with it differently. "Even if there is a flicker of an angry expression before a more controlled expression takes its place, it's difficult to say whether it creates the effects described by Zajonc," adds Izard.

The role of cerebral blood flow in emotion still deserves study, says psychologist Jerome Kagan of Harvard University, "although one particular type of feedback, whether it's from facial muscles or from blood flow in the brain, isn't seminal for emotion." Researchers need to synthesize three aspects of emotion in their work, he explains: the external or internal events that precede feelings, the physiological changes associated with feelings, and the thoughts and reactions that accompany physiological changes.

That's a tall order, according to psychologist John Lanzetta of Dartmouth College in Hanover, N.H. "It's difficult to hit every aspect of emotion in the lab," he says. "The [Zajonc-Waynbaum] theory needs to be examined, but there's not much evidence for or against it." Lanzetta is now studying how an emotional disposition, such as mistrust, toward another person affects responses to displays of emotion from that person.

"The emotion research field is in ferment right now," he points out. "There's a lot of talk and not a lot of data."

Zajonc concedes that his proposals need to be tested, perhaps with recently developed methods of measuring cerebral blood flow and facial temperature. "I imagine my position will cause controversy," he told SCIENCE NEWS shortly before his paper appeared in SCIENCE, "but I'll be happy just to see Waynbaum's theory reclaimed." □

Israel Waynbaum, turn-of-the-century physician and theorist of emotion.