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Antonello da Messina, Portrait of a Man, *1470*

The Riddle of the Smile

Red deer stags signal their interest in females by prancing about with adolescent exuberance. Greylag geese challenge rivals by extending their necks, and then duel until one cries "uncle" by lowering its head to the ground. The three-spined stickleback woos its consort with a zigzag dance and, having won her interest, swims toward his nest on the chance that she will follow. All of these behaviors are fixed action patterns that serve the function of social display—acts of communication that have evolved by virtue of their contribution to survival and reproduction and that are, apparently, under rigid genetic control. By contrast, most behaviors involved in human social rituals appear to be less a matter of genetic than of cultural inheritance. The handshake is not practiced everywhere. The curtsy came and went. And not even the most strident sociobiologist would argue that applause results from some genetic predisposition to clap the hands together.

But consider the smile. The subtlest play of the risorius—the facial muscle that governs the smile and that shares its etymology with the word *risible*—can spell the difference between the passing indifference of strangers and the flowering of lifelong romance, between peaceful coexistence and deadly violence; in an evolutionary sense, the most important things can easily hinge on it. It is difficult to believe that natural selection could have left so important a signal to the vagaries of individual learning. And, as far as we can tell, it did not. If there is one human social display that qualifies as a fixed action pattern, it is the tendency of people in certain well-defined situations to draw back the corners of their mouths and expose their teeth. Smiling, it appears, is something we are born to do.

The evidence for this assertion is diverse. First, there is the sheer universality of the smile. Film studies in remote areas of the world, mainly by the German ethologist Irenäus Eibl-Eibesfeldt, have shown smiling to be a consistent feature of greeting, often in combination with raising of the eyebrows. In France, Bali, and Samoa, among the !Kung of the Kalahari and the Waika of South America, this complex motor action sequence runs like clockwork when people who enjoy each other come face to face.

Also pointing to a genetic underpinning of the smile are findings in psychology, zoology, and neurology. The smile appears with uncanny regularity in human infants; even blind and blind-and-deaf children begin smiling roughly on schedule—by about three months of age. Further, we see apparent precursors of the smile in the primates that are our nearest living relatives—a silent, bared-teeth grin in monkeys and a more recognizable smile in chimpanzees. Finally, the facial muscles behind the smile—the risorius, along with zygomaticus major and other, more delicate sheets of tissue—must contract in a precisely orchestrated concatenation to produce a genuine smile, implying the existence of a genetically determined central neural mechanism of great coordination. (Consider the ease with which we detect hesitation, ambivalence, and, especially, fakery in a smile.)

But these strands of evidence, though converging on the conclusion that the smile is a legacy of natural selection, diverge over the question of just how it earned a place in our genetic heritage. There is general agreement on why greylag geese stretch their necks and why sticklebacks zig and zag, but isolating the evolutionary function of the smile is more difficult. Indeed, it sometimes seems that the more closely the smile is examined, the more enigmatic it becomes.

The first complication in the quest for a unified theory of smiling is that there are two kinds of smiles. It is possible to lose either the capacity to smile on command or the capacity to smile spontaneously in response to a joke or a friendly greeting without losing the other. Typically, the loss of smiling on command—what we might call the flight attendant's smile—is due to lesions either in the part of the cerebral cortex that exerts motor control over the facial muscles or in the corticospinal tract, the stream of fibers connecting the cortex to the nerves governing those muscles. The loss of spontaneous smiling is somewhat more difficult to pin down neurologically, but recent studies of stroke victims have linked it to structures in the cerebral hemispheres, known collectively as the basal ganglia. This finding is consistent with the fact that Parkinson's disease, which affects primarily the basal ganglia, entails a masked-face syndrome—an emotional deadness of the face.

Whatever the cerebral mechanisms that control the spontaneous smile, they are in place early in life. Unless a three-month-old has indigestion, or is otherwise indisposed, any halfway intelligent adult prepared to stoop to its level can easily elicit a smile. It is as if the infant's brain had matured to the point at which a semi-reflexive smile had clicked into use—but without any cultural context, or social discrimination, or hesitancy, or ambiguity. The smile is automatic, almost like flinching from pain.

An analogy that is more than an analogy may be helpful in illuminating the underlying neurology. Young frogs dart their tongues out at all small dark objects moving across their visual fields. Then, gradually, the response habituates—wanes selectively in the face of unpalatable results: after reaping too many flecks of dirt in the wind, and too many inedible insects, the tongue flick becomes rather finely tuned to the flies that constitute appropriate food. It would be inefficient for natural selection to wire in images of all the insects frogs eat, so the releasing stimulus—the visual pattern that evokes the reflexive tongue flick—is wired in crudely, painted in very broad strokes. Experience, mainly with things that don't taste good, takes over shortly after the first flick and fills in the details.

Similarly, the visual configuration that will evoke a smile from a four-month-old is very simple—an oval shape with two dark dots placed where eyes would be if the oval were a face. (Control shapes—for example, an oval with the dots in the wrong place—will not work so well.) But over the course of several months, the infant becomes more discerning: the configuration has to be more similar to a real human face to earn a smile. It's as if there were some hard wiring designed to set the infant on a path, after which guidance is left to experience.

Experience will do more than direct the smile; it will also determine its frequency. Experiments have shown that infants who receive no social stimulation after smiling, such as an adult's approving gaze, will begin smiling less often, somewhat in the manner of rats that stop their bar-pressing after the rewards cease. And infants raised in environments with inadequate social stimulation, such as foundling homes, will smile much less at eight months or a year than will infants raised in middle-class homes. Nonetheless, the rise of social smiling by about three months of age is affected very little by learning. Maturation initiates, after which experience can differentiate.

The infant's smile, and the parents' responses to it, suggest a theory as to the evolutionary advantage that smiling confers. It appears to transform the infant's first, most fundamental relationship. Mothers say it is at this stage that they feel themselves to be dealing with another human being—that they are not mere attendants of a screeching diaper-soiling device but people involved in an intimate relationship: the infant has at last become a person. To be sure, the smile is not solely responsible for this change. Prolonged gaze contact is another of the infant's new capabilities, and it, too, evokes reverential, endless looks from the mother. And something that psychologists call contingent responsiveness—the infant's increasing sensitivity to the consequences of its acts, including a growing attentiveness to the mother and father—also matures at around three months. But it is the smile that rewards the parent, the smile that decisively seals the emerging bond. Perhaps this is the evolutionary function of smiling—to help the baby wrap the mother around its little finger and thus receive the attention and nourishment needed to grow up and have babies of its own.

But this explanation raises as many questions as it answers. If the purpose of smiling is infant–mother bonding, then why do adults continue to smile with such predictable frequency and in so many situations? And why does the smile's apparent phylogenetic precursor—the "smile" found in the primate species closest to us on the taxonomic landscape—suggest an entirely different function?

In monkeys we find nothing quite like smiling. But J.A.R.A.M. Van Hooff, the Dutch ethologist, has traced the smile to other monkey signals, in particular the silent, bared-teeth grin. This expression, characterized by a liberal display of teeth, looks like a less comfortable, grimmer version of a smile (though that impression may just reflect my human bias). Usually, it occurs in the course of submissive behavior; a low-ranking monkey might flash it upon encountering the troop's dominant male. (This sort of grin is, of course, common in human hierarchies, too; an employee will often smile, sometimes uncomfortably, when passing the boss in the hall.) Our closest relatives, the chimpanzees (which in general exhibit a range of facial expressions very much like our own), have a look that resembles a smile more closely than does the monkeys' grin, and they, too, flash it as a sign of submission.

Could the smile, then, have arisen as a way to communicate status? That would certainly have made it a signal of some significance. Social hierarchies determine monkeys' access to food and other resources, and moving from one level to another within them typically entails much posturing and outright fighting. It is in the interest of any monkey likely to lose such fights to avoid them altogether; low status without bloodshed is evolutionarily advantageous—compared, at least, with low status with bloodshed. So the precursor of the smile, like other submissive signals, may simply mean something like "Don't bother attacking me, I am no threat to you. Let's not waste our time and energy fighting over what's already been decided."

However, this interpretation, like the theory of mother–infant bonding, soon encounters complications. In some monkey species, dominant males display the silent, bared-teeth grin to subordinates. And among chimpanzees, too, the smile occasionally appears without regard for status. Apparently, then, even among the lower primates, smiling can be more reciprocal, and more human, than a simple gesture of submission. It can mean "We are no threat to each other," which, I suppose, is a way of saying "We are friends." What is friendship, after all, if not the submission of two individuals to each other?

Already, our list of the smile's social functions has grown onerously long: a sign of submission or of benign dominance, a gesture of friendship, cement for the bond between parent and child. And what of its role in romance, and in childhood play? (A modified smile, known as a play-face, appears during the play of young chimpanzees and is accompanied by sounds resembling laughter.) On what basis are we to choose from among the various explanations of the smile's existence? The answer, of course, is that we needn't. Evolution works too parsimoniously to assign only one function to each trait. Just as the canine tooth serves to kill, to consume, and to ward off, so the smile has come to perform a number of

functions that help primates survive and reproduce.

Perhaps (as Van Hooff has argued), what was originally a sign of peaceful submission was adopted by high-ranking primates as a gesture of benign dominance to discourage fighting. After all, as soon as a chimpanzee has scaled the social hierarchy, it is in its interest to minimize challenges. Once the meaning of the smile was established—"I am no threat to you" —it was a natural candidate for other functions. Thus, the same signal, occurring between male and female during sexual arousal, could exert a critical influence. And a similar signal might prevent rough-and-tumble play from degenerating into costly fighting. Once smiling had acquired a positive affective value, its expression by infants charmed mothers—all the more reason for babies to practice it often in the company of adults.

Of course, this is only a just-so story—one of many evolutionary scenarios that would fit the uneven body of evidence now available. The point is that there is an abundance of evolutionary explanations for the smile, not a shortage of them. And their unifying thread is that the smile began as an act of communication, as did the stickleback's mating swim and the greylag's neck extension.

Yet the smile has a subtlety, a multiplicity of meaning—an ambiguity—that is quintessentially human. Indeed, its mode of expression, its context, and its shades of meaning are shifting even now. During the past ten years, the hearing-impaired have had their lives transformed by the use of teletype devices that permit communication by telephone, and a new set of signals has arisen. One of these is the appearance of the word *smiles* as a sort of punctuation. It means "I am smiling as I write this." Without it, the same text could have a meaning different from—even the opposite of—what was intended. Indeed, it often appears after words that might otherwise create mistrust or distance between the speakers.

Thus, this phylogenetically ancient, maturationally guided, neurologically based motor-action pattern surfaces, completely transformed, not only in language but in writing, and on one of the most modern of all human machines. Is this a tribute to the ability of humans to emancipate their signals from the constraints imposed on other animals? Or is it the opposite—a demonstration that there is no escape from our higher-primate heritage, even while we communicate through telephone wires? It is, in all likelihood, both. ●

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