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Perspectives

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PERSPECTIVES

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Have you noticed how lately we have become a nation of stunning "white" smiles? Although we Americans have always been critical of the teeth of others, such as those of the French and British, at no other time in history has this difference been as evident as now. From Hollywood to the daily news to our colleagues and children, white teeth are everywhere. Okay, I am guilty, too, and I accept it. Twice a year I go to the drugstore and buy my whitening strips, and when I am done with them, my wife makes fun of my "ghost" teeth. In my case, the search for perfect teeth started when I was very young because my mother admired beautiful American teeth (as I imagine other mothers in other Third World countries also did). So after years of orthodontics akin to medieval tortures, I feel the need to keep them as white as possible. History repeats itself, and now I do the same to my children.

Why not have beautiful white teeth when a smile can mean so much? Nice teeth increase your confidence and you smile more. Babies are said to recognize smiles within the first 6 weeks of life. At first, their smiles are nonselective and babies smile at everyone. Visual recognition happens first, but shortly thereafter, smiles become linked to auditory stimuli (congenitally blind babies smile when they hear specific sounds but their ability to smile develops later). Smiles are integral parts of our faces, and babies immediately associate both—face plus smile—and are said to recognize the smile of a mother or father at about 2 months of life.

Specific parts of our faces, such as our eyes, trigger smiles. If you look someone directly in the eyes, one of their first spontaneous reactions is to smile. If someone looks directly at your mouth, you also tend to respond with a smile. From 3 months of age on, smiles become tools of social interaction. Parents and children exchange smiles in response to emotional, auditory, physical, and even olfactory and tactile stimuli. Children often smile as they are falling asleep or during sleep. By 4 months of age, smiles become organized and predictable. At about 5 months of age, the "cognitive" smile develops, presumably an indication of self-recognition. As such, children smile when they perceive they have done well or accomplished something. Last to come is the "mastery" smile—that is, one elicited when children feel that they have made something happen. At about 24 months of age, children are very familiar with humor and smile at jokes, but they also smile when they feel satisfaction at having breached social rules.

There are 4 different types of smiles in adults. The simple smile is just an upward curving of the mouth (as in the "happy face" illustrated in the title of this *Perspectives*). The other 3 types are variations of the same but of differing intensities. The Duchene smile involves opening the mouth and raising the cheeks. The Duplay smile includes crinkling of the eyes, and in the last type of smile—the play smile—the mandible drops and after that we cross to laughter.

Because examining the effects of smiles in infant brains is difficult, the opposite has been done: examining the effects of baby smiles on their mother's brains. In 1 study, 28 mothers were shown pictures of their babies and of other babies while happy (smiling), sad, or neutral; then they were assessed with fMRI.[1] Dopamine-associated reward-processing brain regions were activated when mothers viewed their babies, regardless of facial expression. These areas include the ventral tegmentum, substantia nigra, striatum, and frontal lobes. When the same mothers viewed pictures of their own smiling babies, the substantia nigra and dorsal putamen were activated, something that did not occur with sad or neutral expressions. Thus, it seems that specific brain areas are responsible for the mother-infant attachment, and even more specific areas function when a child smiles at his or her mother. Because smiles generally signify happiness and self-fulfillment, it seems logical to assume that the brain responds differently to anger or happiness. In another study, PET showed that facial expressions associated with anger elicited predominantly right-sided responses involving the medial, superior, middle, and inferior frontal lobes and cerebellum, whereas smiles increased activity in the cuneus, temporal lobe, and middle, medial, and superior frontal lobes.[2] Dynamic and static expressions of happiness also result in activity in different brain regions—that is, seeing someone smile in the movies (or in real life) or in a static photograph results in different brain activations. Since smiles may be fleeting, capturing one at its best in a photograph is not trivial.

Because we want to be photographed with our best smile, newer cameras have smile-recognition software that allows us to capture that fleeting moment when teeth flash. This ability started with facial-recognition programs that later were tailored to identify smiles. Once a camera detects a smile, the shutter is activated. This capability makes a camera somewhat more expensive but allows you to capture spontaneous smiles. Computers recognize smiles by measuring the geometry of the face, skin patterns, patterns of wrinkles, or changes in temperature associated with opening the mouth. Smiles are spontaneous, so the software must incorporate a vector field capable of following geometric distortions in real-time. The same programs can be applied to blink recognition, which prevents you from taking a picture of a subject with his or her eyes closed.

Computers can recognize smiles and other emotions, a feature that is thought to be key in the future acceptance of artificial intelligence by humans (we want machines to be sympathetic and kind to us). Because less than 10% of human communication is based on actual words, recognizing changes of facial expression is critical. Computers are able to recognize varying degrees of smiling on the basis of assigning them specific percentages. These sophisticated programs accomplish this by measuring not only the mouth but also pupillary reactions and wrinkling of the eyes. 3D systems allow recognition of smiles even when faces are turned or out of focus. A smile-decrypting program was tried on the most baffling of smiles: the Mona Lisa. Researchers using sophisticated computer analysis say Mona is 83% happy, 9% disgusted, 6% fearful, and 2% angry.[3]

Emotion recognition programs work by tracking the place and movement of about 12 points in the human face. Face-tracking algorithms match movements to 6 basic expression patterns: anger, sadness, fear, surprise, disgust, happiness, or a mixture of these. Companies that study marketing use these programs to measure customer likes and dislikes. The most honest reactions occur in privacy, so subjects are generally

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tested in empty rooms with hidden cameras. The Glad or Sad Web site analyzes pictures and rates them according to the 6 previously mentioned facial expression patterns.[4] Let's say that you took a picture of George Clooney but cannot read his expression. Simply upload it, and the program will analyze it (you are likely to find out that he was angry at having his portrait taken without permission).

Smiles can be improved as evidenced by many Web sites containing pictures of smiling celebrities before and after cosmetic dental treatments. When I go to the dentist, I am surprised (and somewhat intimidated) by a plethora of posters asking me if I am happy or ashamed of my smile (I am neither). Some 20 years ago, orthodontists treated only children, but today 25%–50% of their work is done on adults. These are folks whose parents did not have the means to get their teeth straightened or individuals who stopped using their retainers before reaching 25 years of age (when the face finally stops growing). Straight teeth make cleaning easier and wear more evenly. Adult treatments take longer and are more painful, but overall they involve the same hardware used in children. Uncomplicated treatments start at about US $3000, and dentists are willing to treat even those individuals older than 90 years of age who desire to improve self-confidence by way of a beautiful smile. Some Northern European countries (such as the Scandinavian ones) offer orthodontics free of charge to their citizens younger than 18 years of age.

Dental braces have been around forever. Mummies dating back to 500 BCE harboring metal dental hardware in combination with natural animal fibers have been found in the Middle East and in the Mediterranean countries.[5] A French dentist, Pierre Fauchard, is credited as the father of modern orthodontics. Later another French dentist established the practice of extracting the premolars to alleviate crowding and improve the growth of the mandible. For his work, he was named dentist to the King of France.

At the start of the 20th century, straightening crooked teeth took second place to correcting mandibular and malocclusion defects—that is, the alignment of teeth ceased to be the main goal, and correcting malocclusions became paramount to a successful treatment. In reality, one cannot be accomplished without the other. Malocclusions can be class I (neutrocclusion) when the relationship of the occlusion is normal for the maxillary first molars but not for the others. Class II (distocclusion) refers to anterior displacement of the upper molars and can be further divided if the anterior teeth protrude or are retroclined.[6] Crowding of teeth is generally due to a small maxilla or mandible, which, for unknown reasons, seems to occur predominantly in Western individuals. Of course, one of the complications of dental braces is that teeth may become discolored, a minor problem easily solved with bleaching.

Dental bleaching or whitening is perhaps the most common and benign procedure in the armamentarium of cosmetic dentistry. Our teeth become dark and yellow with age as the enamel changes and becomes (normally) stained. The most popular bleaching methods are strips or trays that contain oxidizing agents such as hydrogen peroxide or carbamide peroxide. If done at the dentist's office, a light energy source (generally halogen) may be used to accelerate the process (the same is found at many shopping malls, spas, and even in some of the more expensive home kits). Lightless treatments are called low-concentration and take longer and are less effective than high-concentration ones (which use light enhancement and higher concentrations of bleaching agent). Teeth stained by tetracycline take longer to whiten regardless of treatment type. Side effects are minimal and generally include only a temporary increase in tooth and gum sensitivity. High-concentration treatments may cause dehydration of the enamel, and the consequences of this are not known. Some have concerns regarding the potential carcinogenic effects of peroxides, but this has not been proved.[7] If bleaching fails, veneers can be applied for those who still desire a dazzling white smile.

Smiles generally mean happiness, and because we expect ourselves and those around us to be happy, we tend to smile a lot. Never has so much smiling been seen since the introduction of Happy Face (or Smiley) in 1963. Smiley used to be everywhere in the form of stickers, and now it has come back as an emoticon available on all e-mail systems and mobile telephones. Something that always baffles me is that we are expected to smile when asked how we are doing even if we are feeling terrible. A few days ago, I got into an elevator with a colleague of mine who asked me how I was feeling that morning. Being the typical insensitive person that I am, I decided to respond with the truth, "Awful, did not sleep well last night, children problems at home, and in desperate need of a cup of coffee." Well, she certainly acted offended at my answer, so the next day when we took the elevator together again, with trepidation, she once more asked how I was doing. I decided to lie, "Wonderful, today life is just peachy," and flashed her a smile with my perfectly aligned ghost-white teeth. This time she responded with a beautiful smile equally full of white perfect teeth.

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