

## James Belarde //

*“Sometimes your joy is the source of your smile, but sometimes your smile can be the source of your joy.” -*  
Thích Nhất Hạnh

One of the biggest smiles I’ve ever flashed came after purposefully having my jaw broken, subsequently facing a six-week period where I couldn’t chew. While this sounds masochistic at best, I was willing to go through that hell to finally have my open-bite malocclusion surgically corrected. Before surgery, I could bite down tightly and still manage to stick out my tongue through a half-inch gap between my clenched teeth. While not life threatening, this condition made eating difficult (pizza was a nightmare, the only time you’ll ever catch me saying that). But even more upsetting was that I was fundamentally embarrassed to smile. During photos, I would keep my lips tightly shut, distressed by my grossly misaligned teeth.

The smile is an important communication tool in both the comic arts and life, and evidence suggests I’m not alone in my willingness to endure difficult medical procedures to ensure a confident one. In 2018, the US orthodontic industry saw a revenue of \$11.5 billion, with millions of Americans in braces. This doesn’t even include the cost of more invasive maxillofacial surgical procedures like the one I needed. How has a simple facial expression become so valuable, and what are the consequences of medical conditions that inhibit one’s ability to smile? Research into the biology and social nature of the smile provides helpful clues to address these questions.

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Duchenne (right) and assistant electrically stimulate a subject's face muscles, Public Domain. *Wikimedia Commons*

During the mid-19<sup>th</sup> century, famed French neurologist Duchenne de Boulogne (mercifully short for Guillaume-Benjamin-Amand Duchenne de Boulogne) became one of the first to scientifically address the smile. In a series of experiments that even Dr. Frankenstein would hesitate to conduct, Duchenne applied electrical shocks to patients' facial muscles and photographed the resulting expressions. He identified two muscles involved in smiling: zygomaticus major, which raises the corners of the lips, and orbicularis oculi, which closes the eyelids. Duchenne believed the former to be under voluntary control but thought the latter would only contribute to a smile resulting from a true feeling of joy.<sup>1</sup> This view persisted for decades, and a "true" smile involving squinting of the eyes is known as a Duchenne smile. Though more modern research shows some people can voluntarily contract the orbicularis oculi to form such a smile despite no stimulus, there does seem

to be a degree of truth to Duchenne's theory. In studies where participants are asked to select between photographs of true and fake smiles, people overwhelmingly rely on eye contraction to pick out the "true" smile.



Examples of smiles elicited by Duchenne's experiments. CC BY 4.0 , [Wikimedia Commons](#)

But smiles are more deeply connected with our biology, beyond the muscles that form them. MRI studies show that our dopamine-based reward circuits in the brain, the ones that make us feel good and encourage repeating certain behaviors, are activated when we're gifted a grin. For instance, this response is seen strongly in mothers who receive a smile from their babies. Smilers themselves benefit from similarly rewarding electrical brain activity, regardless of whether the smile is from genuine feeling or a voluntary smile elicited on demand. Happiness can make you smile, but the simple act of smiling might also make you feel happy. Smiling is so ingrained in our behavior that reciprocal smiling, or smiling back at someone who smiles at us, happens so fast in studies measuring facial muscle response that it is often completely involuntary and unavoidable.<sup>2</sup>

With such strong biological underpinnings, it's clear that smiling serves an important enough function that evolution has selected for it over many millennia. Of course, anthropologists have offered several possibilities for the development of the smile. One popular theory is that it developed from a relaxation of more aggressive facial expressions. If an early primate heard or saw something strange, they would adopt a defensive posture, including a threatening snarl. But if the perceived threat turned out to be a familiar face, the unwelcoming tooth-clenched expression would be relaxed into something like a smile to indicate a friendlier reception. An interesting acoustic theory by John Ohala suggests the smile began as a way of modulating one's voice to sound more infantile and appeasing. Similarly, a pouting expression of the lips lowers one's pitch to sound larger and more threatening, despite how ineffective this approach might be when used by a grumpy toddler.<sup>2</sup>

Whatever the origin, it's been difficult to pinpoint a specific role for our modern smile other than its clear importance as a social communicator. There are two primary reasons for this challenge. The first has to do with functionality, meaning that despite the smile's strong association with happiness, research demonstrates that humans smile for over a dozen reasons, including some that can hardly be called happy.<sup>3,4</sup> We smile when we're embarrassed, distressed, confused, or even when trying to reinforce a social hierarchy. There isn't just one happy smile, which is a major reason why studies attempting to discern between "true" Duchenne smiles and "fake" smiles have been largely abandoned in recent decades.

Additionally, cultural differences complicate the interpretation of a smile. Not only do distinct cultures have varying conceptions of when it's appropriate to smile, but they also differ in how one smiles. For example, people in the United States tend to flash big, toothy grins, and it's believed we smile so frequently and expressively because of our heterogenous background. With so many immigrants settling in America, there was a good chance you wouldn't speak the language of many people you came across. A nonverbal smile was the quickest way of expressing good will.<sup>5</sup> (Supporting this, research shows that historical heterogeneity is the single best predictor of smiling behavior for a given nation.)<sup>4</sup> Contrast this with some Eastern cultures that traditionally discourage being overly demonstrative with one's emotions, where one tends to smile more with the eyes and less with the mouth. These differences have even infiltrated our modern texting habits. Westerners are more likely to text the curved-lip :) emoticon, while those from Eastern nations often express smiling with a more eye-focused ^\_^ emoticon.

Given this variety, being able to appropriately employ and perceive smiles is important for any social situation. Unfortunately, there are numerous medical conditions that prevent effective use of smiling. One of these is Bell's palsy, a temporary paralysis of half the face caused by dysfunction of the facial nerve. Normal subjects shown photographs of such patients consistently perceive them as having a more negative affect and being less happy compared to healthy faces, and they also rate the quality of life for these patients much lower than the patients rate for themselves. These differences are minimized when the patient has undergone surgery to restore facial function.<sup>6</sup>

Even children suffer in their social interactions when smile aesthetics are deemed poor, such as in the case of crooked teeth or a misaligned jaw. Research shows that children with smile defects are perceived by their peers as more aggressive, less honest, less intelligent, and less happy than normal smile controls. Thus, children with "non-ideal" smiles are teased more, less talkative, and experience significantly lower levels of self-esteem. These effects can be so long lasting some have proposed the need for psychotherapy in addition to orthodontic care when diagnosing and treating tooth deformities.<sup>7</sup>

Clearly, a smile is important for more than showing amusement at a comedy show. It plays an enormous role, especially subconsciously, in how we perceive and are perceived by others. Given this, is it any wonder I couldn't help beaming in the mirror with my newly corrected jaw, even though I was forced to have Christmas dinner blended into a soup?

## References

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