What Affective Computing Reveals about Autistic Children's Facial Expressions of Joy or Fear

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This installment of Computer's *series highlighting the work published in IEEE Computer Society journals comes from* IEEE Transactions on Affective Computing

What would fictional character Sheldon Cooper from CBS's television series "The Big Bang Theory" do if he wanted to study the differences in autistic individuals' facial expression of emotions? He might be intrigued by rapid improvements in the field of affective computing, in which computer-supported behavior analysis—by means of automated facial, bodily, or vocal expression analysis—promises to provide deeper insight into differences across various neurodevelopmental and other disorders.

For example, Tanaya Guha, Zhaojun Yang, Ruth B. Grossman, and Shrikanth S. Narayanan's recent study "A Computational Study of Expressive Facial Dynamics in Children with Autism" (*IEEE Trans. Affective Computing*, vol. 9, no. 1, 2018, pp. 14–20) uses affective computing techniques to follow up in more detail on the difference between the facial expressions of young typically developing (TD) individuals and their counterparts on the autism spectrum.

The authors used motion capture to track the 32 "most critical" facial points by reflective markers (including four stability markers) affixed across the face of the participants during data collection. Twenty children with high-functioning autism (HFA) and 19 TD peers (all between 9 and 14 years of age and mostly male, in keeping with autism's common prevalence distribution) mimicked expressions according to video stimuli selected from the broadly used Mind Reading corpus in the Ekman "Big Six" emotion classes.

The authors divided the face region into three macro-areas of equal height from forehead to chin—upper, middle, and lower face. Mean square error across tracked facial points in a region was then used to investigate complexity and (dis-)similarity of expressions across the two groups.

Guha and her colleagues found significant differences between the HFA and TD participants for disgust and sadness in all three facial areas, for joy in the upper and lower face, and for surprise in the lower face—but none for anger or fear. The observed dissimilarities were marked by lower complexity of the facial expression display among the children with HFA. The study further found that the children with HFA showed the highest complexity, and thus most natural expression, in the cheek region, in contrast to reduced complexity of movements in the eye region. They reason that the latter might be explained by the observation that individuals with autism tend to avoid looking at the eye region of others' faces. This difference in complexity across regions might explain the common description of autistic facial emotional display as atypical and awkward.

Computer analysis has yet to unleash its full potential in supporting behavioral and more general psychological studies. The authors stress the limitations of their study, given its smaller sample size and mimicked emotions. Yet, in light of the recent melding of artificial (emotional) intelligence with increasingly "big(ger) data" resources that can be handled even under adverse in-the-wild conditions, it will be exciting to see what new insights affective computing will bring as a supporting discipline feeding into psychology, medicine, and much more.

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