Letters to the Editor

Tele-Operating an Android Robot to Promote the Understanding of Facial Expressions and to Increase Facial Expressivity in Individuals With Autism Spectrum Disorder

TO THE EDITOR: Facial expression is crucial for conveying emotions and communicating. Altered facial expressivity could contribute to social isolation and difficulties in emotional regulation (1). Individuals with autism spectrum disorder (ASD) exhibit little facial expressivity (2). However, few studies have investigated interventions for improving facial expressivity in such patients. This letter documents the case of a patient with ASD who received intervention using an android robot. The patient provided informed consent, and the study design was approved by the appropriate ethics review boards.

An 18-year-old man with ASD diagnosed according to DSM-5 criteria had a history of hospitalization because of social impairment, including a suicide attempt. However, he did not meet criteria for any other DSM-5 diagnoses. The Childhood Autism Rating Scale total score (34) indicated mild to moderate ASD. Despite extensive treatment, including behavioral therapy to improve communication skills, his aversion to communicating with others persisted. He did not understand the importance of facial expression and required training to describe his feelings through facial expressions. However, his full-scale IQ was high (141). Considering his interest in advanced technology, we decided to use an android robot for the intervention. We selected an android robot rather than an avatar because we believed a three-dimensional learning environment, wherein the patient interacted with an android robot, may be more powerful than one involving an interaction with an avatar. We used an ACTROID-F robot (Figure 1) (Kokoro Co. Ltd.) that closely resembles a human being in terms of realism and facial expressions (3). During the intervention, an operator entered words into a computer, which were read aloud by ACTROID-F. The operator could also replicate facial expressions, such as a smile, surprise, or sorrow, by using ACTROID-F. The operator could monitor the expressions made by ACTROID-F and the interlocutor via video.

We encouraged the patient to communicate with a teacher by operating ACTROID-F. Each intervention session lasted approximately 30 minutes, and he underwent five sessions. After each intervention, the patient revisited what he had learned through the communication with his teacher. The patient could voluntarily control his facial expressions and watch the interaction in a panoramic manner.

Through this intervention, the patient learned to understand the meaning of facial expressions and realized their importance in communication. After the intervention, he used facial expressions to express his subjective emotions in daily life and became interested in having conversations with others, and his self-confidence increased. Before the intervention, the patient thought it was difficult to pursue his dreams because of his lack of confidence in communicating. However, after the intervention, he was confident he could overcome his communication issues and went on to pursue his dreams by joining his preferred university. Although university admission is unlikely to be a common outcome after five treatment sessions with a robot, robotic intervention serves as a starting point.

FIGURE 1. A Photograph of the Android Robot ACTROID-F Used to Treat Individuals With Autism Spectrum Disorder

The simulation of facial expression of emotions is known to promote the recognition of facial expressions (1). During the intervention, the facial expressions generated using ACTROID-F promoted the patient's understanding of facial expressions and their importance. This interaction between the patient and the robot, and the benefits thereof, could be attributed to the patient's interest in advanced technology. These case findings suggest that intervention using a robot

might trigger the understanding of facial expressions and increase facial expressivity in individuals with ASD. An important future study would be one with a single-case experimental design with regular information gathered regarding the key outcome variables and other relevant variables.

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Association Between Low Barometric Pressure and Completed Suicides

TO THE EDITOR: Associations between low barometric pressure and behavior have been previously demonstrated, including associations with both violence and suicide attempts (1, 2). We extend those associations to completed suicides in the first North American study with an adequate sample size of 714 completed suicides.

The Jefferson County, Ky., medical examiner's office provided information regarding the dates of completed suicides between January 2000 and December 2011. Meteorological data were obtained from the Louisville office of the National Weather Service for this same 11-year period.

There were 714 completed suicides in the 11 years studied. Information on age, gender, and method of suicide was not available. Barometric pressure was lower on days with completed suicides than on days without any completed suicides (29.48 inHg [SD=0.038], compared with 29.53 inHg [SD=0.0036], respectively; $p<0.0001$, $t=2.44$). Neither average daily temperature (59.1°F [SD=0.67] for suicide days, compared with 58.1°F [SD=0.37] for nonsuicide days; $p=0.63$, $t=0.92$) nor solar radiation (6.95 MJ/m^2 [SD=0.11] for suicide days, compared with 6.96 MJ/m^2 [SD=0.06] for nonsuicide days; $p=0.09$, $t=0.13$) showed a relationship to completed suicide.

A multitude of biological, psychological, social, and environmental factors can play a role in a person's decision to commit suicide. Although we have demonstrated a significant association between lower barometric pressure and completed suicide, the mechanism of the effect—which has now been demonstrated worldwide (3–5)—remains to be determined.

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