How Children with Autism Spectrum Disorder Recognize Facial Expressions Displayed by a Rear-Projection Humanoid Robot?

Farzaneh Askari[1], Huanghao Feng[1], Mohammad H. Mahoor[1], Timothy Sweeny[2] and Anibal Gutierrez[3]

[1]University of Denver, Department of Electrical and Computer Engineering,
[2]University of Denver, Department of Psychology,
[3]University of Miami, Department of Psychology

Background

Autism Spectrum Disorders (ASDs)

- **Autism Spectrum Disorder** is a brain development disorder that impairs social interaction and communication.
- Currently, about 1 in 68 children suffer are diagnosed with an ASD.
- ASDs are characterized by difficulties in social interaction that include **abnormal patterns of gaze direction** and facial expression.
- Gaze direction is fundamental to understand
  - approach and avoidance
  - perception
  - communication (e.g., basic social communication skill)
- Children with ASD exhibit markedly different gaze patterns than typically developing children.

Scientific Aims

- Evaluate facial expression perception on a rear-projected facially-expressive humanoid robot.
- Evaluate how children with high functioning autism (HFA) differ from their typically developing (TD) peers in recognition of facial expressions demonstrated by a life-like rear-projected humanoid robot.

Percipients and Robot

- Participants: 7 ASD and 7 TD children aged 7 to 16.
- Agent: Ryan the robot with a rear-projection, life-like humanoid robot. See Fig. 3
- Expressions: 6 basic facial expressions (happy, sad, angry, disgust, surprised and fear) with 4 different intensities (25%, 50%, 75% and 100%). See Fig. 4
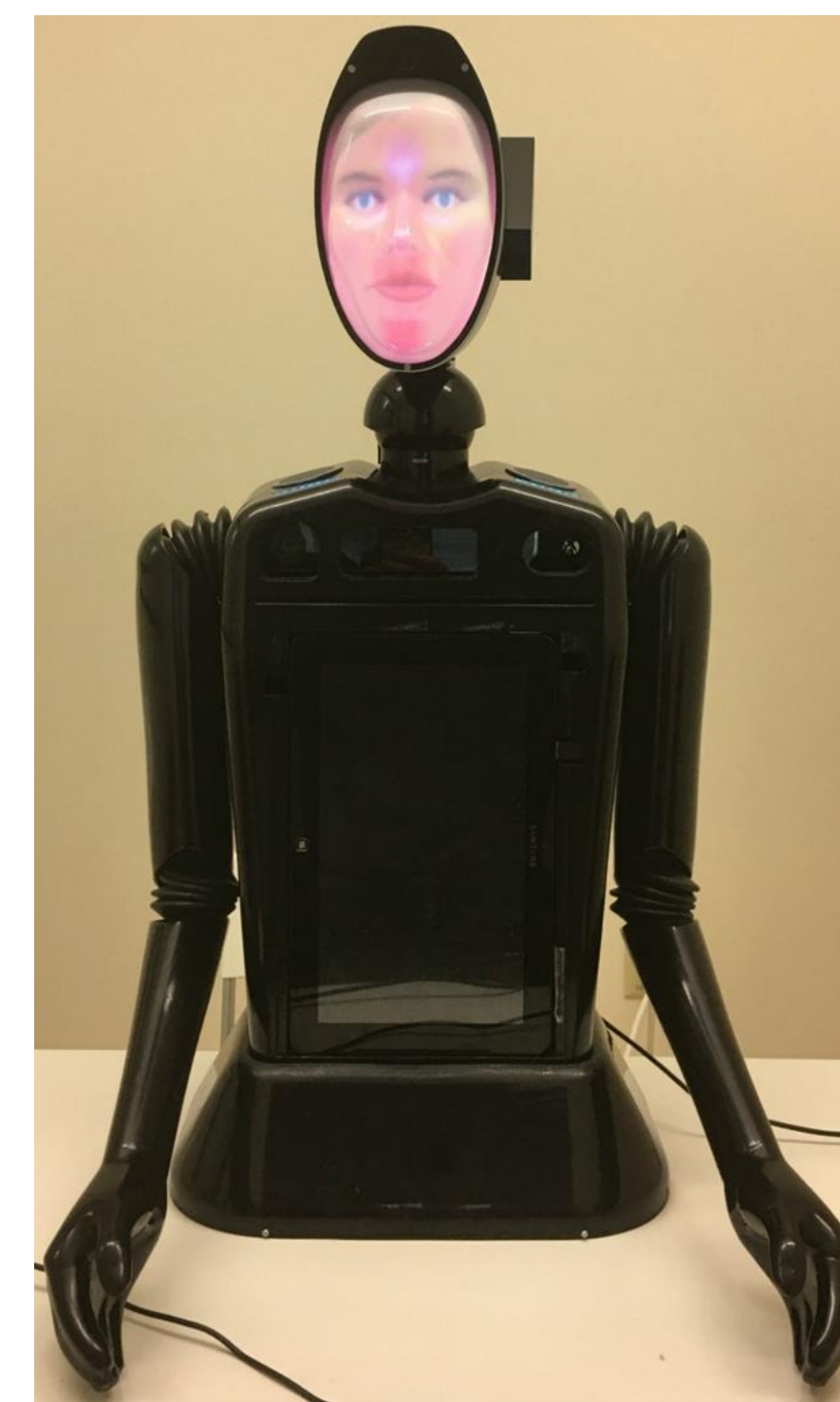

Fig. 3   Fig. 4

Results

We evaluated the intensity of expression in which participants required to reach the peak accuracy. They were best for happy and angry expressions in which the peak accuracy of 100% was reached with at least 50% of expression intensity. See Fig. 5 and Fig. 6
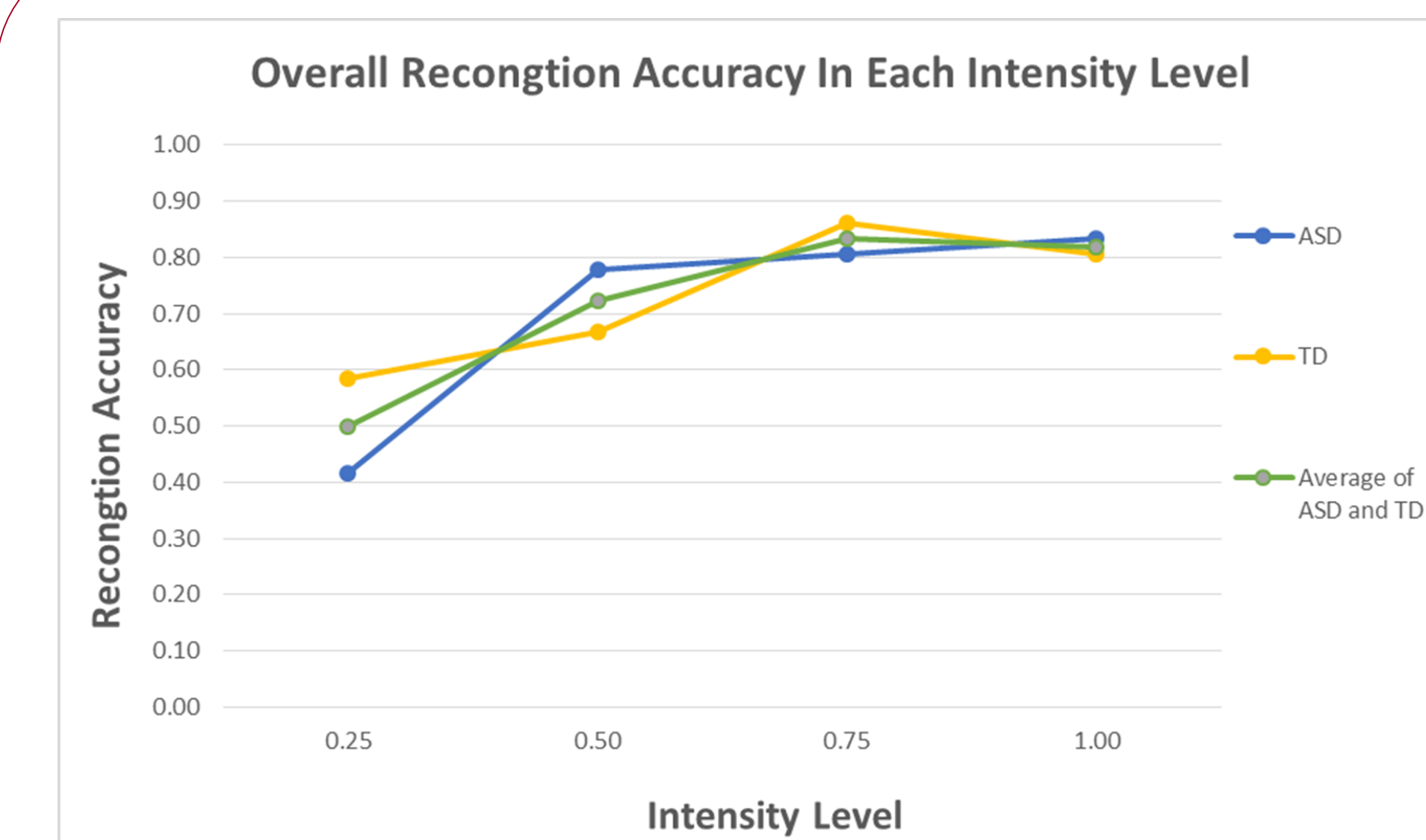

Fig. 5:
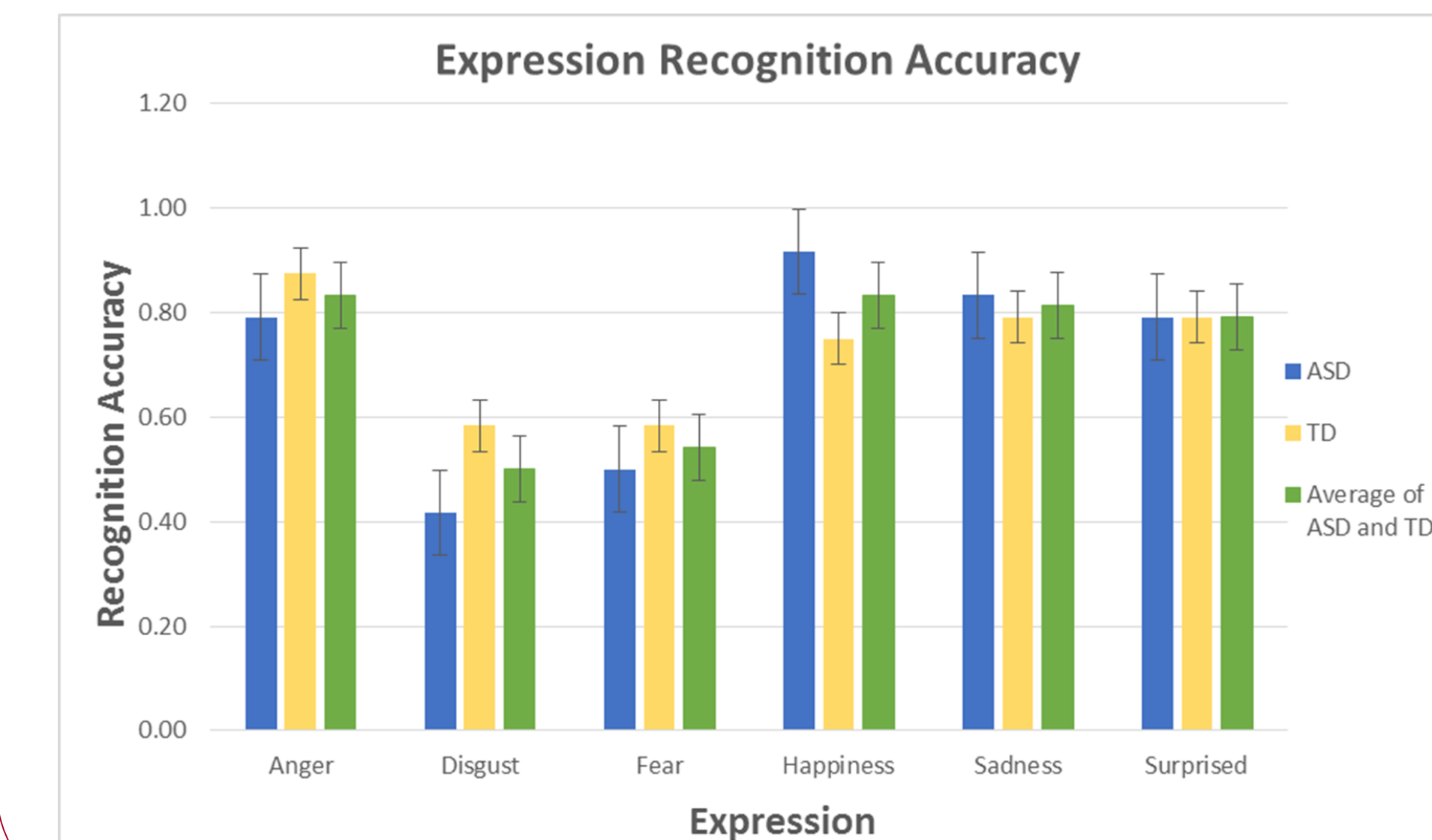The same peak accuracy was reached for surprised and sad expressions in the intensity of 75% and 100%, respectively.

Fig. 6:
Fear and disgust recognition accuracy never reached above 75%.

Method and Procedure

Room Settings

- A 6' x 4' table at the center of the room.
- Robot and Participant sitting at both Length side of the table.
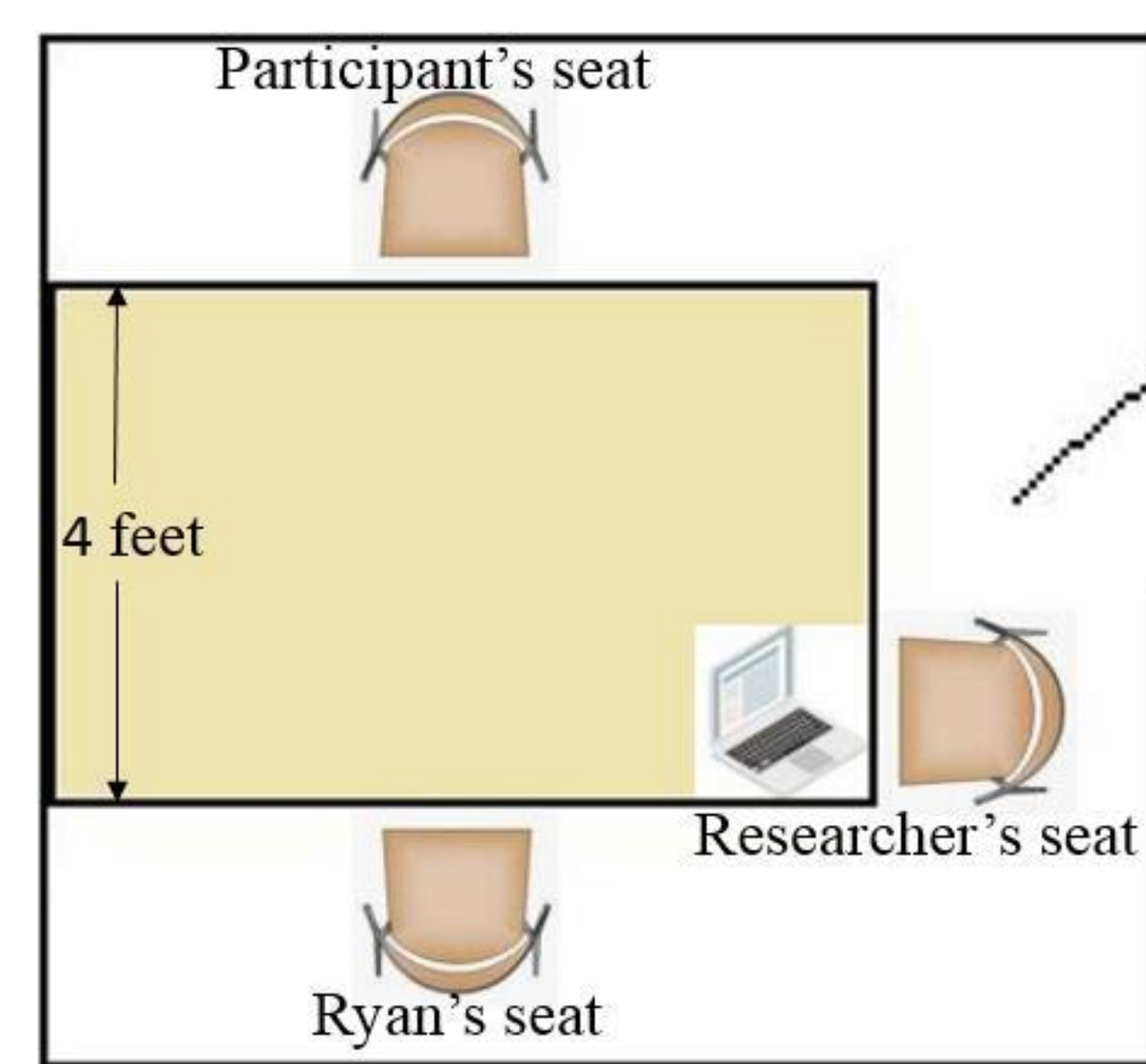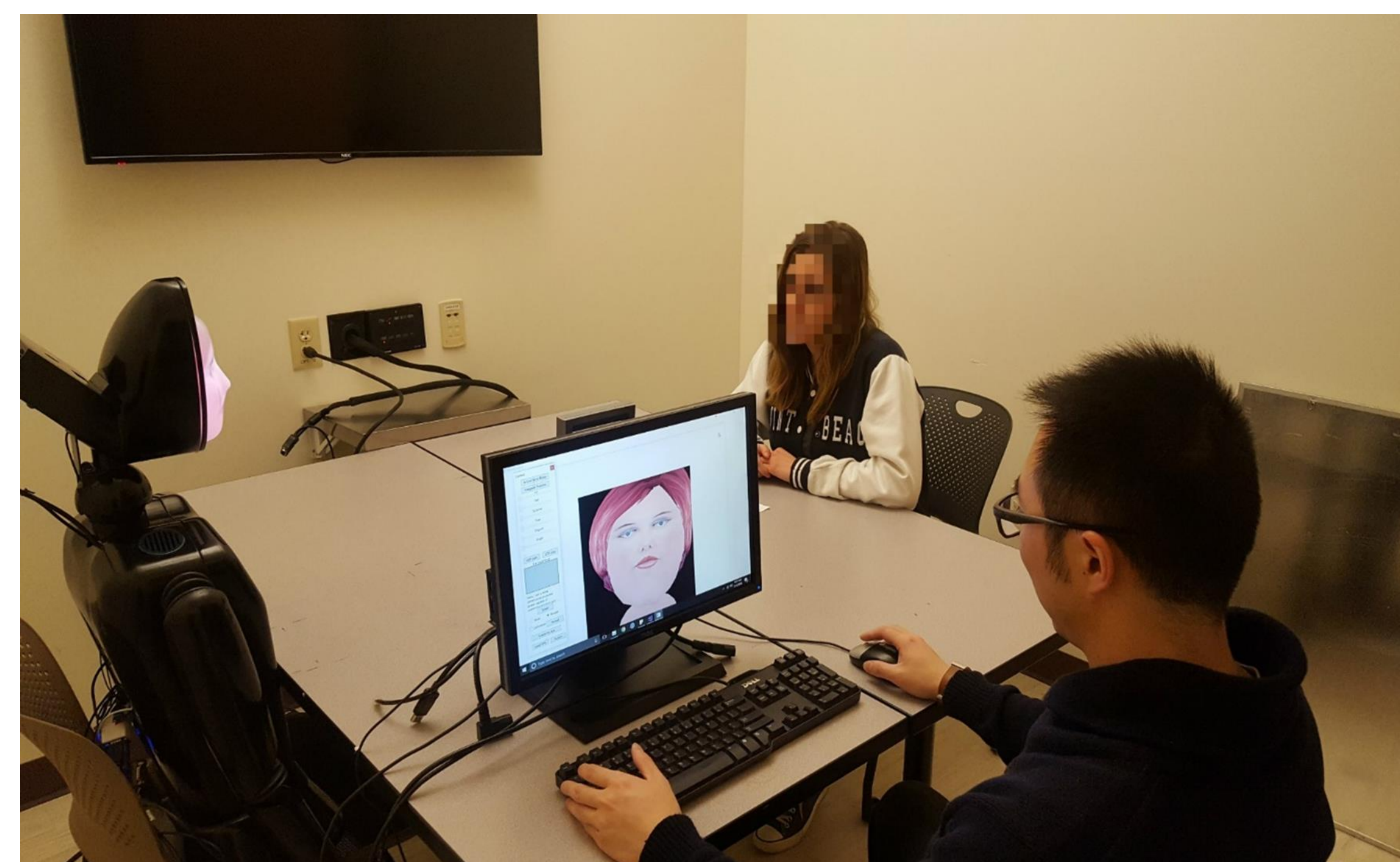- Research Assistant sits next to Ryan. See Fig. 1

Fig. 1

Fig. 2:
A research assistant will help to record the result once participant delivered.

Conclusions

- The recognition rate of negative facial expressions are slightly lower than other expressions for both groups.
- As a rear projected life-like robot, Ryan can successfully communicate with children in terms of facial expressions.
- Children showed engagement and excitement with interact with Ryan during the test.