I. Introduction

- Young adults with ASD often show delays in adaptive behavior.
- Much of ASD intervention focuses on ameliorating social communication deficits and diminishing challenging behaviors.
- Less work has examined specific programs for adaptive skill development.
- Independent driving is often seen as an important skill for optimizing functional adaptive independence and enhancing quality of life.

We designed and pilot tested a novel virtual reality (VR) driving environment to assess driving skill in individuals with ASD.

• This system was designed to gather data regarding performance, gaze, and physiology in real-time.
• We compared the performance, gaze behavior and physiological signal patterns of teenagers with ASD and typically-developing (TD) controls.

II. Methods

Software
- ESR1 CityEngine
- Autodesk Maya
- Unity 3D
- Microsoft Visual Studio

Hardware
- Tobii X120
- Biopac
- MP150
- Logitech G27

Participants
- 7 individuals with ASD between the ages of 13 and 17 (6 male, 1 female)
- 7 age- and gender-matched TD controls

Task Design
- Each participant attempted 6 “assignments” that included 8 “trials.”
- Example trials included making a left turn at an intersection, decreasing speed in a school zone and pulling over to the side of the road for an emergency vehicle to pass.

Data Collected
- Performance
- Trial failure details
- Vehicle speed
- Eye gaze
- Gaze position
- Fixation durations
- Questionnaires

Physiology
- ECG
- PPG
- Respiration
- EMG
- GSR

III. Results

Participants in the ASD group failed significantly more trials than participants in the TD group (p < 0.05).

The most problematic trial skill for the ASD group was turning-related trials (Fig 2).

![Fig 2. Comparison of skill associated with trials failed.](image)

As seen in Figure 3, there were significant differences between both groups in terms of gaze patterns:

- The average vertical position of the gaze was higher in the ASD group (p < 0.001) by 0.569 cm.
- The average horizontal gaze position in the ASD group tended towards the right portion of the screen (p < 0.001) by 0.123 cm.

![Fig 3. Gaze heatmaps of the ASD group (left) and the TD group (right).](image)

IV. Conclusion & Future Work

Compared to the TD group, participants with ASD:

- Failed more trials.
- Eye gaze gravitated both upwards and to the right.
- Physiological signals indicate a higher level of anxiety

Future directions:
- Evaluate the usefulness of a gaze-sensitive system in which participants receive feedback for gaze-based issues
- We are integrating the Oculus Rift head mounted display into the system to evaluate its potential for immersive VR applications (Fig 4).

![Fig 4. View inside Oculus Rift (left) and Oculus Rift device (right).](image)

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