

# AL TRUISTIC ASD (AUTISM SPECTRUM DISORDER) VIRTUAL REALITY GAME ASSISTING NEUROTYPICALS UNDERSTANDING OF AUTISTIC PEOPLE

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## **ABSTARCT**

*Autism spectrum disorder is a developmental disability that can cause significant social, communication and behavioural challenges. Parents of children on the spectrum find it difficult for their kids to communicate with them and other people, which makes it challenging for social interactions. Researchers have introduced different solutions such as Therapy Robot that Teaches Social Skills to Children with Autism. Additionally, Virtual reality was used to teach emotional and social skills to children with autism spectrum disorder. However, these solutions focus only on the person on the spectrum, neglecting the fact that the social challenges that people on the spectrum face are partly due to the lack of understanding on the neurotypicals' end. In this study, the solution introduced focuses on the neurotypical perspective; An advanced and interactive intelligent technology that can educate neurotypical people on how to communicate with people on the spectrum in different scenarios and environments. It also allows the learner to see the consequences of the different interactions from the point of view of a person on the spectrum, be aware of their actions, and fully engage in the scenarios through Virtual Reality (VR). Virtual Reality is a technology that simulates experiences that can be similar to the real world. The project objective was achieved by implementing a storyline game that is VR-based.*

## **KEYWORDS**

*Autism, Neurodivergent, Neurotypical, Virtual Reality, Communicating on the spectrum.*

## **1. INTRODUCTION**

Autism, or autism spectrum disorder (ASD), refers to a broad range of conditions characterized by challenges with social skills, repetitive behaviours, speech, and nonverbal communication [1]. autistic people find it hard communicating in general, and recent studies have shown that people on the spectrum prefer only contacting other autistic people [2], which may be due to the fact that neurotypical people do not have enough knowledge on how to communicate with people on the spectrum. The aim of this project is to make people with the least interaction with people on the spectrum experience situations from an autistic person's perspective to raise awareness about autism. This is achieved by allowing the learner to view how this neurological condition affects the integration of individuals living with it. This is done in an effort to make the learner understand the way people on the spectrum think by projecting the challenges they face daily, such as:

-social communication challenges, where adults and children with autism have difficulties with verbal and non-verbal communication for example they may not understand or appropriately use spoken language (around a third of people with autism are non-verbal), gestures, facial expressions and expressions not meant to be taken literally.

-additional social challenges: Including difficulty with recognizing emotions and intentions in others, expressing emotions, feeling overwhelmed in social situations, taking turns in conversations, and gauging personal space (appropriate distance between people).

lack of awareness and understanding of an autistic person's behaviour affects them in many ways psychologically and physically when a person misunderstands their behaviour, hence, Researchers have focused on solutions for ASD, and ignored the neurotypicals who interact with them. Therefore, there is a lack of studies that teaches neurotypicals on how to communicate and interact with people on the spectrum in our everyday life.

## **2. RELATED WORK**

There is no doubt that technology has completely changed our world. It has given us unlimited access to information and communication while removing the need for physical, social interaction. Technology has helped kids with Autism learn and develop skills like never before. However, this related work covers solutions that have used technology to enhance a life of people with autism.

### **2.1. Therapy Robot Teaches Social Skills to Children with Autism**

For some children with autism, interacting with other people can be an uncomfortable, mystifying experience. Feeling overwhelmed with face-to-face interaction, such children may find it difficult to focus their attention and learn social skills from their teachers and therapists—the very people charged with helping them learn to socially adapt. What these children need, say some researchers, is a robot: a cute, tech-based intermediary, with a body, that can teach them how to interact with their fellow humans more comfortably [3].

### **2.2. Upgraded Google Glass Helps Autistic Kids “see” Emotions**

When a face is recognized, the head-up display's boundary turns green, and the display identifies the facial emotion with an emoticon, emoji, or written text. Users can alternatively opt for an auditory cue a voice defining the emotion from the bone-conducting speaker included into the glasses, which transmits sound waves through the skull to the inner ear. Happiness, anger, surprise, sadness, fear, disgust, and contempt are among the seven facial expressions recognized by the system, which we renamed "meh" to make them more child friendly. Children are supposed to quickly learn how to detect the feelings of their social partners and then stop wearing glasses once they have achieved social confidence [4].

### **2.3. Using Virtual Reality to Train Emotional and Social Skills in Children with Autism Spectrum Disorder**

In the beginning mentioned that training became popular with new emerging technology, focusing on virtual reality (VR) to help children with autism spectrum disorder (ASD) with social skills and developing communication with outside world by an environment that is managed and supervised to make them feel safe and practice skills repetitively. The Centre for innovative applications of internet and multimedia technologies (AIMTech Center) at university of Hong

Kong developed a VR-enabled training program to examine efficacy on emotional and social skills with six VR scenarios with typical daily lives of children in Hong Kong, 94 children from mainstream primary schools in Hong Kong completed the study and 72 children were included in the analysis. Emerging modern technology offers solutions for different cases in our time, taking for example treating depression with computerized and internet-based treatment was found to be effective with therapist support, with the virtual reality (VR) technology increasing studies and application lately been increasing based on training and therapy, the environment of virtual reality (VR) provides a whole experience of situations [5].

### **3. RESEARCH APPROACH**

#### **Phase 1: Defining the Scenarios**

The game was created with the assistance of specialists in that field so that we can educate neurotypical people on how to interact properly with people on the spectrum. The scenarios will be based on real life told by people on the spectrum and how it affected them and how the situation could have been avoided if things were different. Our advantage is that we take a scenario that occurred in real life with a person on the spectrum and present it to a specialist to determine what would have been the best way for a neurotypical person to handle the situation and educate people so that the social environment can be more accepting and welcoming of people on the spectrum. Our project will make an impact socially because it will raise awareness and help people deal with different situations connecting with people on the spectrum.

#### **Phase 2: Designing and Developing the Video Game**

We developed the game using the Unreal engine. The game is a storyline that teaches the users how to interact with a person on the spectrum as they go through scenarios and choose what action to make depending on their perception of what is the right way to act with a person with ASD's. The main idea of this game is using the knowledge the average person has about people on the spectrum to help them choose the correct action to make and witness the consequences of it. The game aims toward raising knowledge to those who are not aware of the right way to behave with an autistic person, where we saw the neglect on this area and the main focus and display of technology is on autistic people, employing VR technology to mimic a real life situation with an autistic person and from the point of view of an autistic person benefits both sides, where it will have a positive reflect on autistic people making them feel understood and ease the communication at the same time raise the level of knowledge and awareness in neurotypical people.

The game starts with the main menu, then the first level scenario will play. The scenarios are taken from real life events and set up as an open level where the player interacts with the other character which is a person on the spectrum. Based on the specific scenario, there are options for the player to choose from. The player must choose the appropriate action regarding the scenario given. The correct choice will move the player onto the next level, with each level being more challenging than the previous one. Wrong choices display the autistic person's point of view.



Figure 1. Home screen



Figure 2. 1st scenario environment



Figure 3. ASD Point of View

### 3.1. Implementation

Our system is developed using unreal software which gives us the ability to develop our application providing the high-quality experience using virtual reality through the unreal software.

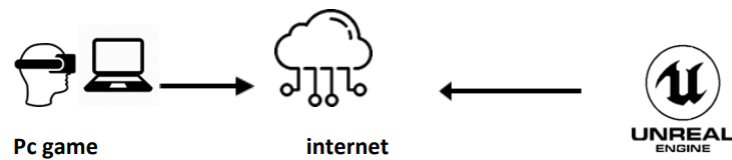


Figure 4. Application Architecture diagram

### 3.2 System Architecture Layers Description

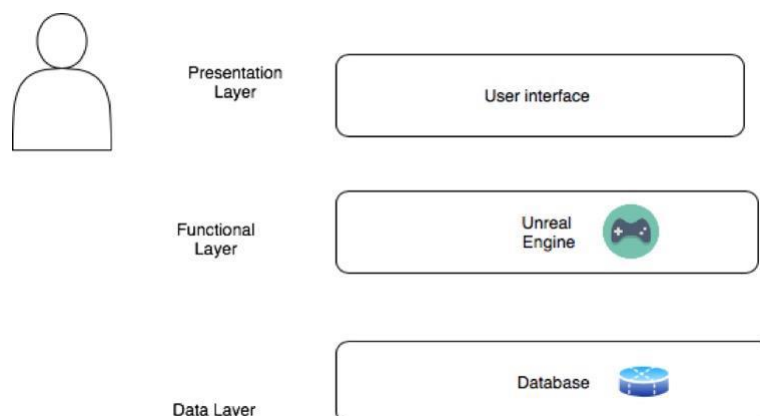


Figure 5. System Architecture layer description

The System Architecture Layer diagram shown above defines the main components in our Proposed System. We chose a three-Layered Architecture in our design (see figure 5), and they all serve different purposes:

- Presentation Layer: this layer is responsible for the user interfaces /user interaction with the System, it consists of components within the application layer like game scenarios.
- Functional Layer: the main functionality of the system is in this layer which allows users to use/interact with the Game.
- Data Layer: Data will be stored in the Database to perform many functions like setting backup, recovery, updates, and tests.

## 4. STUDY DESIGN PROCEDURES

The participants took the usability test in a meeting room ,we provided the game on a PC so that the users can try it .All the interactions were monitored by two of the team members after they gave a brief introduction about the game and the idea behind it .A questionnaire and a consent form were filled by all the 10 participants to test their background information on the topic and if they ever used a VR headset before. We informed the participants that the time to complete the tasks will be measured and the team members will be observing their behaviours and interactions with the game. After completing the tasks all the participants will complete a post-task interview to give their honest feedback on the game. The questions were created using this model (TAM). The technology acceptance model (TAM) is a theory of information systems that describes how consumers accept and use technology. When users are introduced with modern technology, the model argues that a few factors influence their decision about how and when to use it: (1) perceived usefulness, (2) perceived ease of use, and (3) satisfaction. The emphasis on the potential user's perceptions is a fundamental component of this strategy. That is, while the inventor of a technology product may believe it is valuable and user-friendly, potential users will not accept it until they share those thoughts

### 4.1. Test Results

During the usability test our analyses were focused on the performance of the game and meeting the goal of educating neurotypicals on how to communicate with a person on the spectrum. We tested all 4 tasks in the game which are: Starting the game, Viewing the scenarios, making

choices, Watching the POV. The time taken to finish the game was shorter than we expected, and it was measured by calculating the mean times for completion to figure out the efficiency for the game

Table 1. First scenario mean time

Task	Mean	Min	Max
1	1:58 s	1 min	2:30 s
2	38s	30 s	50 s
3	32 s	30 s	40 s
4	40 s	30 s	1 min

Table 2. Second scenario mean time

Task	Mean	Min	Max
1	1:42 s	1 min	2:30 s
2	48 s	40 s	1 min
3	34 s	30 s	50 s
4	37 s	30 s	50 s

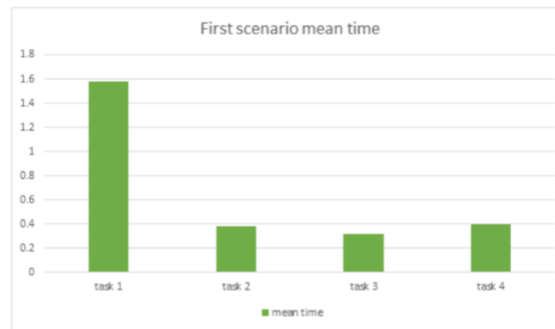


Figure 6. Mean time for the first scenario

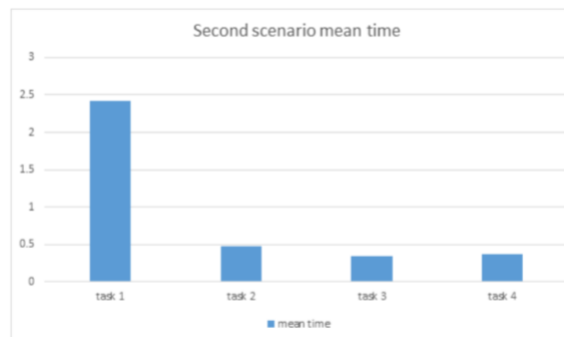


Figure 7. Mean time for the Second scenario

From the figure graphs shown above we can indicate that the mean time for the first task in both scenarios took longer than the rest. The first scenario took less time to play due to the simplicity of the interaction making the idea of the game understandable and easy to follow. We also found that the users took a longer time playing the second scenario which was expected considering that the difficulty increases through the game showing how complex dealing with people on the spectrum can be. The users faced a harder time comprehending the reaction of the person on the spectrum during the second scenario which explains the increase in time it took to finish it. For the rest of the tasks all the users took less than a minute to complete them since they were clear and easy to understand with no instructions needed. We concluded based on the analyses we did that it took the specialists less time to complete the game compared to the other users without any experience in dealing with a person on the spectrum because they have had experienced similar interactions before.

## **5. FINDINGS**

### **5.1. Efficiency**

During the usability test our analyses were focused on the performance of the game and meeting the goal of educating neurotypicals on how to communicate with a person on the spectrum. We tested all 4 tasks in the game which are: Starting the game, Viewing the scenarios, making choices, Watching the POV. The time taken to finish the game was shorter than we expected, and it was measured by calculating the mean times for completion to figure out the efficiency for the game as shown above.

### **5.2. Usefulness**

Based on the participants' feedback they all agreed that the game helped them understand people with autism better and the approach we chose to help raise awareness on this topic was unique and easy to understand. The participants agreed that this game will have a significant impact on our society by teaching neurotypicals how to interact with people on the spectrum properly which will be a great step in achieving the kingdom's 2030 vision in making the society more vibrant and coherent.

### **5.3. Learnability**

All the participants agreed that the game was fast to learn although the second scenario was more intense and complex which resulted in requiring some instructions due to its difficulty and a longer time to complete by the players. We noticed that the first scenario didn't need any instructions and took less time to finish considering that it was an introduction to the idea of the game.

## **6. CONCLUSION AND FUTURE WORK**

At the end of the project, the initial vision for the game was not fully achieved due to time constraints and some technical difficulties that are to be solved in the future. Adding the motion aspect to the characters was an integral part of programming the levels and was technically challenging. Therefore, in future work, more technical support will be utilized to accomplish programming goals in a timely manner. However, it must be stated that the progress made from the ideation stage to final execution was tremendous, due to continuous research and hard work. This effort can be seen in the development of the environment and different scenarios created for each level of the game, and the programming of choices into the levels.

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