Virtual Reality Experiential Training for Individuals with Autism: The Airport Scenario

Virtual Reality Experiential Training for Individuals with Autism: The Airport Scenario

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Abstract. — One of the common traits of individuals with Autism Spectrum Disorder (ASD) is the inclination to perceive unknown situations and environments as a source of stress and anxiety. It is common for them to tend to avoid novel experiences -including traveling to new places- and therefore an environments like an airport can be overwhelming. Virtual Reality can be a functional tool to provide ASD users with a training system that allows them to experience the airport process, even several times, before facing the real life experience. We hereby present the scenario in which our investigation takes place, the system we developed, and a draft of the evaluation of the training technique.

Keywords: Virtual Reality · Neurodiversity · Autism · Experiential Training · Airport Simulation · Mixed Reality

1 Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder characterized by deficits in social communication and interaction, accompanied by restrictive and repetitive behaviors or interests. Since ASD affects individuals in different ways, it is considered a spectrum condition. Some autistic people, for example, may have learning disabilities and cognitive issues, while others have full intellectual abilities [5]. Moreover, people with ASD are in some cases overwhelmed by environmental features that are, instead, easily managed by neurotypical individuals [11],[12].

A majority of people with ASD may perceive as stressful all kinds of unknown situations and thus tend to avoid novel experiences [14], often preferring deterministic situations and rigid and repetitious routines [14]. As consequence, they are less likely to explore new places, and more likely to revisit well-known locations [16]. Indeed, this heavily affects the travelling experience. Most of these issues can be addressed by means of a meticulous planning of the tour, in order to prepare the user to tackle all the steps related to the travel experience[4].

Several studies show that Virtual Reality (VR) is a useful tool for improving social skills, cognition, and functioning in autistic individuals, through a specific experiential training [17][2][6][3].

Following these results, we developed a VR application to support people with ASD minimize the level of stress and anxiety while travelling, and therefore rise autonomy and comfort. For this purpose, we give the chance to experience the situation before it happens, underline the difficulties and the solutions. In particular, we focused on the travel experience in an airport, since there may be an excess of sensory stimuli that make the circumstance daunting. This is an ongoing work, and the current paper describes the main motivation, the goals of the project and the implementation.

2 Related work

Users with ASD show a positive attitude towards new technologies mainly because of the predictability of the interaction [10], including VR, as shown in the following studies. Kandalaft [6] investigated the feasibility of a training intervention in VR on high-functioning users with ASD focused on enhancing social skills, cognition, and occupational functioning. Significant increases in real life were found post-training. Similarly, providing several selected scenarios in VR helps autistic children adapt to new environments and contain anxiety [13]. Some works exploit Virtual Reality for training specific skills needed to travel on buses using serious games paradigms in VR[1, 15]. Regarding flights, Miller suggests the efficacy of a training in VR to teach basic air travel skills to young children diagnosed with autism [8].

In general, it is uncommon for airports to offer pre-planned visits of the structure, even if several airports offer specific info material for ASD travelers. Among others,the airport of Dublin visually describes the different parts of the building and provides tips on how to face all the different situations, together with some general rules to follow during a trip[1]. Also in Italy, Caselle Airport, in Torino[2] as well as Milan Malpensa and Linate Airports[3] offer a similar support, offering a textual and visual description of all the steps to follow in order to take a plane.

To the authors' knowledge, the closest approach to VR for training ASD flight travelers in airports is proposed by the Airport of Boise, in Idaho, USA[4]: focusing on children, they provide a solution where users can watch a 360° video in order to explore the structure they will go through, from the check-in to the boarding phase.

In this scenario, a VR solution seems perfectly suitable: users can move freely into scenes, interact with objects and perform actions as if they were in a real life situation. Based on this consideration, we propose a VR system to learn the important steps to be done in an airport, leading their own experience in the virtual environment.

[1] www.dublinairport.com/at-the-airport/help-and-support/travelling-with-autism
[2] https://www.aeroportoditorino.it/autismo
[3] https://www.milanomalpensa-airport.com/en/passenger-guide/special-assistances/autism-project
[4] https://www.cityofboise.org/programs/stories/virtual-reality-at-the-boise-airport

3 Description of the project

The project is a joint collaboration between the Computer Science Department at University of Torino and the Adult Autistic Center of the Local Health Agency of the City of Torino. In the past few years, the Department developed and validated several technological solutions dedicated to the autonomy of ASD users especially in transportation, and recently investigated the use of VR. As mentioned, travelling can be challenging for people with ASD, especially in contexts like airports or stations, where the excess of multi-sensory stimuli might be perceived as overwhelming.

We developed a virtual scenario in which users reach the airport, go through a specific process, like all travellers have to, and reach the aircraft. We defined the steps following the indications from the flyer of the Airport of Torino Caselle, in Italy[5]. In particular the steps are: entrance, check-in, security checks, duty free shops, gates and waiting rooms, plane boarding. A 360° view of the check-in desks is represented in Figure 1, while in Figure 2 we can see a view of the security check area. The simulations is a generic representation, valid for a number of airports, as we describe general steps that users have to follow to board.

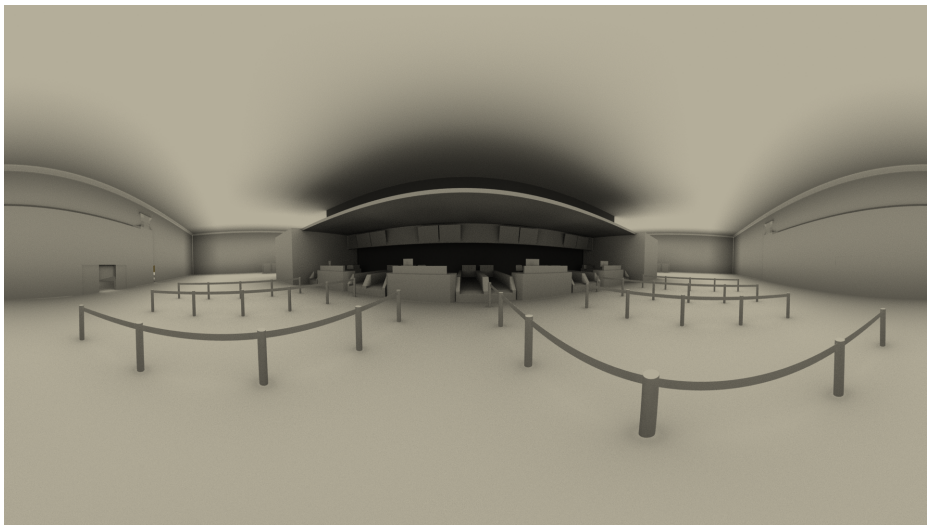

Fig. 1. 360° view of the check-in area of the airport

The system was designed in Maya2020[6] and developed in Unity2019.4.3f1[7] to run on an Oculus Quest[8]. We found that head mounted display the most

[5] https://www.aeroportoditorino.it/en
[6] https://www.autodesk.com/products/maya/overview
[7] https://unity.com/
[8] https://www.oculus.com/quest

Fig. 2. View of the security check area of the airport

suitable option among the commercial solutions, because of the six degrees of freedom, the lack of wires, and the headphones-free spatial audio.

We plan to test the prototype with some patients of the Adult Autistic Center in order to assess the usability and acceptability of the solution, as well as the efficacy of the intervention in increasing people autonomy and lowering stress. The experimentation will involve 10-15 participants, of all genders, all adults, with ASD. The first step will consist in a usability test: the participants will be wearing the head mounted display and familiarize with the controllers. We will use as a baseline the data of a similar population of neuro-typical users in the same conditions. The way we quantify the acceptance values will be through a User Experience questionnaire [9] and collecting responses on a Lickert scale. The analysis of the single ASD data set will confirm the expected acceptability of the experience, while a compared data analysis will give us an insight on the difference of acceptance rate of neuro typical and atypical users.

As a next step, to quantify the efficacy of the training in VR, we will run some sessions in a time slot of two weeks. Half of the users will do the training and half won't, so the outcome of the final performance will underline the significance of the training. As metrics, we will be focusing on a check of the successfully performed tasks, together with a subjective report on the sense of comfort. We will start from the Kirkpatrick Evaluation Model (based on Reaction, Learning, Behavior, Results) where the calculation of the single factors will be re-adapted to our scenario, according to specific topics to which ASD are more sensitive. [18][7].

4 Discussion and Conclusions

In the current paper, we underlined why travelling might be a source of anxiety or confusion for people with autism, and identified the airport as a potentially disturbing scenario. To prevent a negative experience in real life, we propose a Virtual Reality training system that ASD users can benefit of, before facing the actual task.

As an outcome, the general appreciation of the use of technologies by ASD users let us believe they will enjoy this virtual experience. We also expect that, after the training, they will be prepared to manage a trip into an airport with all the necessary skills. Still, the experimentation has not been done yet.

Some issues might appear: users in general, and ASD users in particular, may not be keen on wearing a head mounted display for long periods, for example more than 10 minutes per session. We therefore need to implement tasks that can be resolved in a short time. A delicate topic related with this technology solution are intrinsic in the concept of simulation. The transfer of skills from virtual to real must be shown to be successful, as simulators might be unhelpful or even counter-productive in the training for the real task.

As a development of the training process, in the different training sessions, the objects in the environment might be recombined or changed of location, in case the users feel confident in facing more complex adventures, in terms of novelty. Also, we start proposing a scene with no characters, but adding some avatars might be part of the steps of the training, as they are often source of stress and unexpected noise. While the current project involves VR, we are planning to develop different paradigms of mixed or augmented reality (XR) applications with similar training goals.

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