The use of virtual/augmented reality: care of children and young adults with autistic spectrum disorder

By Adel Fridhi

The use of virtual/augmented reality: care of children and young adults with autistic spectrum disorder

Adel Fridhi[1], Rim Larib[1], Rahim Kouki[2], Naila Bali[2]

[1,2]Higher Institute of Childhood Executives (ISCE), UC, Tunisia

[2]Higher Institute of Special Education, Tunisia

[1,2]Research Laboratory on Disability and Social Unsuitability, LR13AS01, ISES, UMA, Tunisia

adel.fridhi2013@gmail.com

ABSTRACT

In this research article we will analyze the potential contributions of virtual/augmented reality (VR/AR) in the care of children and young with autistic spectrum disorder (ASD) and to find out if these technologies can help the affected population. of an autistic spectrum disorder and if these new information and communication technologies (NICT) could be a tool to improve the emotions and the recognition of emotional expressions of children and young with Autism spectrum disorders. We will also see the results obtained during our therapeutic experiments in a center intended for ASD.

Keywords: Virtual reality, augmented reality, children and young**,** autistic spectral disorder, new information and communication technology, therapeutic experimentation

INTRODUCTION

In recent years, our world has seen a very strong growth in virtual reality and augmented reality. Studies carried out between 2013-2021 by research laboratories revealed a clear progression in the equipment of teaching and learning establishments using computers, mobile phones and digital tablets, with a representative sample of 2000 individuals. In 2018, 83% of children and young aged 14 and over had a computer. We must therefore study the consequences of the dissemination of information in society. VR/AR are tools that question and arouse the interest of a large part of the population. They have occupied an important place in our daily lives. Today, we can see that their use has extended to the fields of teaching and education and therapies. It is no longer possible to demonstrate the importance of integrating VR/AR into education and teaching practices. The Ministries of Education and Teaching have made it a priority to bring schools and universities into the digital world. In this research article we will focus our research studies on disabled children and young and more particularly on autism spectrum disorders (ASD). We will analyze the potential contributions of VR/AR in the care of children and young with ASD. This will involve analyzing the various applications of VR/AR for educational purposes and determining whether the use of these tools could be interesting to solve certain problems linked to autistic spectral disorder (Figure 1). After talking about our problem and ideas, we will discuss how we worked. Finally, we will review and interpret the information that healthcare, teaching, and education professionals have collected using VR/AR to treat children and young with ASD [1].

Figure 1: Users can play major roles in a virtual environment created by virtual reality or in an environment created by augmented reality to imitate certain specific social situations.

VR/AR IN THE CARE OF CHILDREN AND YOUNG WITH AUTISM SPECTRUM DISORDER

VR/AR is advanced technologies [2] explains VR/AR in:

A set of technologies used by computing, microelectronics, multimedia and audiovisual make it possible to find, store, process and send data using different types of text such as: sound, images and video. This allows interaction between children and young and machines.

The domain uses computing and behavioral interfaces to simulate in a virtual environment the behavior of 3D entities that interact with one or more users [3]. It might be necessary to explain the terms 'virtual reality' and 'augmented reality A virtual environment is a computer-generated three-dimensional simulation of a real or imaginary environment [4]. Children and young who use these environments can interact through an avatar, so they can get direct responses based on their behavior in a virtual environment [5]. In a collaborative virtual environment (CVE), multiple users can communicate with each other through their avatars in a collaborative virtual environment (CVE). We are talking about a simple virtual environment if we have a single user [6]. Working with kids with autistic spectrum disorders, ASD, can take advantage of several advantages offered by virtual or enhanced reality. Indeed, it facilitates both environmental control and interpersonal interactions between individuals. The self-esteem of patients who encounter difficulties in controlling social situations can be increased by this [7]. The CVE offers a lot of flexibility, allowing for the establishment of societal guidelines between users to facilitate interaction. Virtual objects can facilitate social encounters and the processes of communication between children and young, according to researchers in this field. This method of communication can be more effective than talking to someone in person [8]. Indeed, users are able to play major roles in a virtual environment created by virtual reality or in an environment created by augmented reality to imitate certain specific social situations [9]. A strong direct relational engagement of the autistic person with another person is not required for interaction in virtual reality. As a result, interactions take longer to unfold, and children with autism spectrum disorders have more time to contemplate various strategies for responding to various circumstances.

This method can be used to enhance emotions and recognize emotional expressions [10]. Furthermore, using the educational potential of this technology, we can have the autistic

person interact with an avatar that is a street, a building, or an animal. (Figure 1) It is also interesting to create situations, such as to cross a boulevard or to put out a fire, in order to anticipate events in the real world [11]. The researchers add that the CVE permits patients to engage in genuine dialogue within a virtual environment. If it's the researcher who picks the real stuff over the model stuff, he/she can pick models of real places and real things in the real world for the autistic. This point takes up the consideration made previously related to the importance of the customization of the models. The first researchers to employ virtual reality in the field of autism were probably Strickland and al. [12]. A complete immersion method was used to learn the steps to cross a street (Figure 2) This recollection prompted a more thorough investigation to see if these experiments could be applied to a real-life scenario. Various analyses have also been carried out to check whether the technology of virtual environments with a computer, a large projection screen, and an application of augmented reality could be applied. We're talking about Nichols here [13]. The virtual environment with these systems is more accessible for children with ASD, according to someone who worked with them. The research disclosed was conducted using the latter system [14]; it was demonstrated that new technologies, such as virtual reality, are effective, comfortable, and offer a supportive emotional context. Virtual and augmented reality shares its advantages, but increases the potential of its effects, according to the researchers. The ability to engage and control the attention, control, and commitment of the emotional participation that virtual environments can offer boosts its benefits in terms of generalization proficiency. A large amount of exploitable resources can be provided by this device for working with the problem of autism.

INTEREST OF CHILDREN AND YOUNG WITH ASD IN VR/AR

Children and young with ASD generally have an interest in digital tools, such as VR/AR, in our experiences. These tools are stable, which does not correspond to a person's normal behavior. Child psychiatrist researchers say it's very interesting to see children and young using these tools. VR/AR always delivers information in the same way, making the ASD population safer. The "technological" message is better understood than the human message, which varies greatly depending on the person and their emotional state [15].

PROBLEMATIC

We are trying to find out if VR/AR can help and improve the daily lives of children and young with ASD (e.g. crossing a boulevard safely while respecting traffic lights (Figure 2). Many parents have said that these tools are helpful for their child with autism and have endless results. Are these professionals working to help these children and young when many families are using VR/AR at home? Have children and young used these tools in their practices? Can our research and experiences using VR/AR improve the empowerment of children and young with ASD?
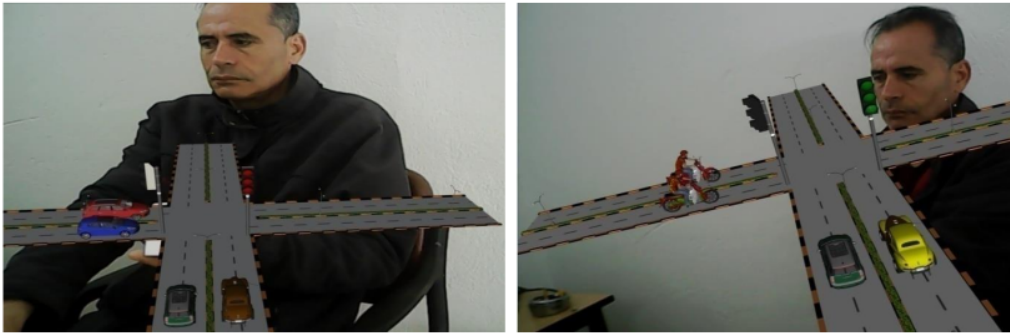
Figure 2: crossing a boulevard safely while respecting traffic lights.

METHODOLOGY

The majority of educators at centers of formation for children and young TSA want to use digital tools and resources appropriate for their learning method. He children and young interviewed are almost all convinced of the interest of VR/AR to help children and young in difficulty, whether they are developmentally invasive, in communication, or on the autistic spectrum. The results of our experiments are considered to be helpful to the TSA. A educational resource has been presented to make it accessible. The RV/RA identifies individuals who have been detected by a TSA, these are applications that allow for the transmission of audiovisual data to this group. This project proposes experiments in which we apply RV/RA to 3D models (avatars) [16] to enhance our understanding and abilities. We will discuss our experiences after using the RV/RA. These tools are very useful for teaching. A good observation, oral understanding and lecture are required for the TSA. We've got some fun stuff to do in different areas of our study, like learning and communicating, group communication, playing and interacting with the environment or avatar-modified.

HYPOTHESES AND RESEARCH QUESTIONS

Before starting our research, we will study how VR/AR is a very effective tool for improving the empowerment and interaction of our study population as well as the many possibilities they offer, by integrating them more in addition to their practices. We will also know if this method is used in health and education services. What are the advantages of this technology? This tool can help ASD children and young communicate and interact with their environment, which is the main problem in autism. It's important to know how professionals use VR/AR and why it's beneficial. Establishing a structured framework is important for the use of VR/AR.

THE INTERVIEW

Our first step was to speak to the public who were meeting. This tool aimed to establish an initial contact and expand the relationship network for long-term study. The collection of information on the practices of certain children and young, their feelings and representations was used as a questionnaire. This is a semi-structured interview with a few professionals, including:

- A psychologist specializing in ASD and PDD.
- specialized educators at the ASD and PDD center

It was proposed to use VR/AR as learning tools in order to make these children and young more autonomous in their daily lives, these interviews for exploratory use had the advantage of allowing an overview of opinions and practices while by getting some answers to our questions.

RESULTS AND DISCUSSION

In this study, we intend to discuss with specialist education professionals the use of VR/AR to support children and young with ASD. Around 80% of respondents used an example of increasing concentration (Figure 3) where VR/AR was applied. This example helps to concentrate when eliminating a single object from our scene.

Figure 3: Concentration test

According to an analysis of the data, it also appeared that most professionals were interested in the application of VR/AR on children and young with ASD.

It therefore seems that our first hypothesis concerning the development of this practice in education is confirmed because the majority of those interviewed used VR/AR. They seem to take advantage of the interest of children and young with ASD in these resources and integrate them into their support [17].

The representations of professionals therefore seem to go in the same direction as the scientific literature. They are very open to the use of VR/AR with ASD, as evidenced by the participation of some of them in conferences and training on this subject. We have observed that AR/VR is a very important resource and will be the most used in the short term by professionals who primarily turn to these tools. Therapists and educators clearly appreciate the learning and therapy benefits of using this tool. These tools also allow you to develop skills. The professionals interviewed are aware that certain conditions are necessary for the use of VR/AR to be more beneficial. The TSA must be interested in its activity, establish a structured framework and adapt the tools to the needs of the person, among other conditions. We can consider that the different existing tools make it possible to work in different areas based on the application of VR/AR on pre-daily models. Our experiments highlight a series of applications adapted for children and young with ASD classified according to the targeted learning domain. Using their responses, we were able to establish a typology of applications used by professionals and note that they used VR/AR to acquire specific skills.

The results demonstrated that almost all professionals; using VR/AR to improve the emotions and recognition of emotional expressions of children and young with Autism spectrum disorders; are convinced [18].

Figure 4: Application of VR/AR, for learning and treatment of ASD Communicative skills

(Teaching respect for distancing during the corona virus pandemic)

CONCLUSION

The aim of this research paper was to investigate the practices and perceptions of therapists and educators regarding the use of VR/AR; to improve the emotions and recognition of emotional expressions of children and young with ASD. It is possible those professionals are very interested in this type of resource and that a number of them use it in their daily activities to develop specific skills, such as communication and social interactions.

We were able to obtain clear answers to our project (the application of VR/AR) from several professionals in this field. This is why the use of VR/AR in the context of caring for children and young with ASD is a rather widespread practice in the paramedical and educational fields. This research brought us enormous results with children and young with ASD and was very enriching. As researchers at the Tunisian university, I was encouraged to work with this audience. The study allowed us to see educational avenues adapted to the difficulties of improving emotions and recognizing emotional expressions in ASD. However, VR/AR can be a very interesting common thread [19].

REFERENCES

[1] Fridhi, A., Benzarti, F., Frihida, A., & Amiri, H. (2018). Application of virtual reality and augmented reality in psychiatry and neuropsychology, in particular in the case of autistic spectrum disorder (ASD). *Neurophysiology*, *50*(3), 222-228.

[2] Fridhi, A., & Bali, N. (2021). Science Education and Augmented Reality: Interaction of students with Avatars Modeled in Augmented Reality. *International Journal of Environmental Science*, *6*.

[3] M. Billinghurst, A. Clark, and G. Lee, "A survey of augmented reality," Found. Trends in Human–Comput. Interact., 8, Nos. 2-3, 73-272 (2015).

[4] S. Cobb, L. Beardon, R. Eastgate, et al., "Applied virtual environments to support learning of social interaction skills in users with Asperger's Syndrome," Digital Creativ., 13, No. 1, 11-22 (2002).

[5] T. R. Goldsmith and L. A. LeBlanc, "Use of technology in interventions for children with autism," JEIBI, 1, No. 2, 166-178 (2004).

[6] S. Parsons, P. Mitchell, and A. Leonard, "Do adolescents with autistic spectrum disorders adhere to social conventions in virtual environments?" Autism, 9, No. 1, 95-117 (2005).

[7] . E. Klinger, R. M. Marié, and I. Viaud-Delmon, "Applications de la RV aux troubles cognitifs et comportementaux," Chap. 5 du volume "Applications de la réalité virtuelle," in: Le Traité de la Réalité Virtuelle, Vol. 4, P. Fuchs, G. Moreau, et al., Les Presses de l'Ecole des Mines de Paris, Paris (2006), pp. 121-158.

[8] Fridhi, A., Bali, N., Rebai, N., & Kouki, R. (2020). Geospatial Virtual/Augmented Environment: Applications for Children with Pervasive Developmental Disorders. *Neurophysiology*, *52*(3), 239-246.

[9] S. Parsons, P. Mitchell, and A. Leonard, "The use and understanding of virtual environments by adolescents with autistic spectrum disorders," J. Autism Dev. Disord., 34, No. 4, 449-466 (2004).

[10] S. Parsons and P. Mitchell, "The potential of virtual reality in social skills training for people with autistic spectrum disorders," J. Intell.. Disabil. Res., 46, No. 5, 430-443 (2002)

[11] D. Moore, Y. Cheng, P. McGrath, and N. Powell, "Collaborative virtual environment technology for people with autism," Focus Autism Other Dev. Disabilities, 20, No. 4, 231-243 (2005).

[12] D. Strickland, D. McAllister, C. Coles, and S. Osborne, "An evolution of virtual reality training designs for children with autism and fetal alcohol spectrum disorders," Top. Lang. Disord., 27, No. 3, 226-241 (2007).

[13] G. Herrera, F. Alcantud, R. Jordan, et al., "Development of simboli play through the use of virtual reality tools in children with autistic spectrum disorders," Autism, 12, No. 2, 143-157 (2008).

[14] E. Klinger, R.-M. Marié, and P. Fuchs, "Réalité virtuelle et sciences cognitives: Applications en psychiatrie et neuropsychologie," Cognito, 3, No. 2, 1–31 (2006).

[15] Fridhi, A., Bali, N., Rebai, N., & Kouki, R. (2020). Geospatial Virtual/Augmented Environment: Applications for Children with Pervasive Developmental Disorders. *Neurophysiology*, *52*(3), 239-246.

[16] Fridhi, A., & Bali, N. (2022). Augmented Reality in Sports Education and Training for Children with an Autism Spectrum Disorder. *Neurophysiology*, *54*(1), 73-79.

[17] Bali, N., & Fridhi, A. (2023). Impact of augmented reality on sports performance of disabled. *Romanian Journal of Rheumatology/Revista Romana de Reumatologie*, *32*(1).

[18] Bali, N., Fridhi, A., & Hassen, Z. (2022). Coronavirus: introduction of the application of augmented reality to help children with disorders to overcome the phobia of contamination facing an indefi nite end of the pandemic. *Romanian Journal of Neurology*, *21*(2).

[19] Bouajila, A., Jebahi, A., & Fridhi, A.(2023) Use of Augmented Reality in Education. International Journal of Innovative Science and Research Technology, Volume 8, Issue 9, September, 2023.