Other applications in intervention with children autistic: virtual/augmented reality

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ABSTRACT

The intention of this research is to present applications belonging to the field of new information and communication technologies (NICT) in interventions with children suffering from autism spectrum disorder (ASD). Emphasis is placed on virtual/augmented reality (VR/AR) applications due to their educational potential for training children to handle real-life situations. These systems aim to reproduce in a controlled manner the complexities of a virtual environment (VE) or a collaborative virtual environment (VCE) in which several users can communicate with each other using their avatar. In addition, they have the ability to reduce these complexities according to the needs and difficulties of the child. In this research paper we are very aware that the application of these technologies requires very complex techniques and are difficult to access at this time in most of our schools, but we found it interesting to present them because they present means of great potential for the future to promote the communicative and emotional skills of children affected by autistic spectrum disorders.

Keywords: new information and communication technologies, interventions, autism spectrum disorder, virtual/augmented reality, virtual environment, collaborative virtual environment

INTRODUCTION

Virtual reality has been found useful in the context of psychology for the treatment of phobias [1] and in the field of autism spectrum disorders (ASD) still remains limited. Experimental studies in the context of communications and emotions are presented in the article by [2]. In this research paper, we will present the potential of collaborative virtual/everyday environment technology for working with children with ASD. We will analyze whether these understand the basic emotions represented by a 3D modeled object or an avatar. This paper presents an innovative approach and gives several observations to guide future studies in the field of virtual/augmented reality.

Other studies have also analyzed the topic of the effectiveness of virtual/augmented reality applied to treatment with ASD children. More specifically, [3] focused on learning social skills. On the other hand [4] are focused on learning imagination.

In this paper, the aim is first of all to explain the meaning of the word "virtual/augmented reality". The virtual environment is defined as a "computer-generated three-dimensional similation of a real or imaginary environment" [5]. Users of these environments can interact and be fully immersed in real time with the 3D modeled object or avatar. Therefore, in a virtual environment (VE), users can get direct answers according to their behavior [6]. In a collaborative virtual environment (CVE), several users can communicate with each other using their avatar. In (Figure 1), it is possible to observe the relationships that are created around the user in a system with its characteristics. If we have a single user, we are therefore talking about a virtual environment (VE) not a collaborative virtual environment.
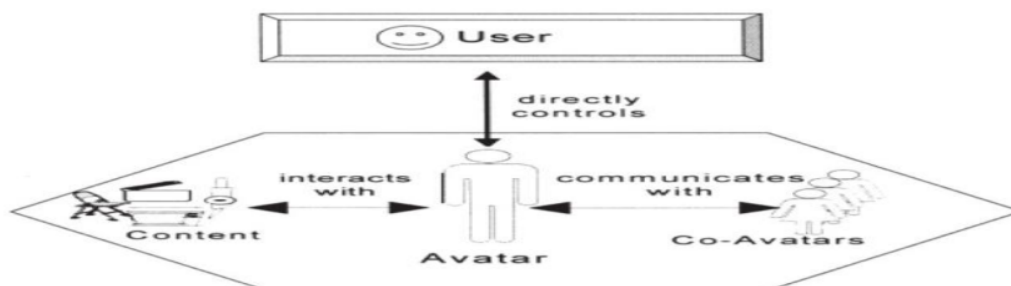
Figure 1: Virtual collaborative environment.

As stated previously, virtual/augmented reality presents several exploitable advantages for working with children with ASD. Indeed, it facilitates the control of our environment in complete safety such as learning ASD to cross the streets while respecting the green and red lights (Figure 2).

Figure 2: Virtual environment displayed on the visiocasque and used for teaching children ASD to safely cross a boulevard.

This can help increase the interaction of interlocutors as in real situations [7]. The virtual environment also offers great flexibility in the sense that social norms can be more developed between users to facilitate interaction and communication.[8] claims that 3D modeled objects and avatars can facilitate social encounters as well as communication processes between people. In addition, this communication can be simpler and less busy than face to face [9]. Indeed, ASD can play pre-real roles in a virtual environment well studied to imitate specific social situations [10]. Another important aspect is linked to the fact that interaction in virtual/augmented reality does not require direct ASD relational engagement with another person [11]. In addition, interactions and immersions remain slow and ASDs have more time to think about different ways of dealing with situations. Thus, virtual/augmented reality can be useful for increasing emotions and recognition of emotional expressions [12]. It is possible to imagine working with the facial expressions of the avatars in situations of the child's daily life (Figure 3).

Figure 3: example representing a "scenario using the modality associating a facial expression

On the other hand, by using the educational potential of virtual/augmented reality, we can have children with ASD interact with another avatar who is the teacher. It is also interesting to create situations to train yourself to anticipate events in the everyday world[13]. It is therefore a question of simulating events where social skills are required. In our experimental studies, EVC allows ASD to train in a pre-daily conversation, in a scenario and in role-playing games [14].

In this paper we claim that EVC users can express their emotions by choosing an appropriate facial expression for their avatar.

METHODOLOGY

With all the last consideration, we confirm that there are different commonalities with the presented software and applications. Indeed, if it is the teacher who chooses the exercises and constructs them, he or she can therefore choose representations of real people and situations familiar to ASD. This point takes up the consideration made previously linked to the importance of the personalization of our experimental studies and our exercises.

To the question of how children with ASD interpret VE, we have made some very important considerations. So we must pay particular attention to the characteristics of ASD because this environment has limits. In this case, VR/AR can be useful for teaching social skills. ASDs must understand that technology functions as a representation of real-world situations and interactions.

One of the first uses of VR/AR in the field of ASD was that of [15] who used a complete immersion system to teach two children the rules for crossing the street (Figure 02). It was observed that these experiences could be transferred to a real situation. Other studies have also been carried out to verify whether the technology of virtual/daily environments with standard computers and subsequently we attest that VE with these systems is more affordable and accessible for ASD.

VR/AR can be useful for working with the problem of ASD, because it can provide a large number of usable resources to establish a project adapted to the specific needs of a child in an ASD situation.

IMPROVEMENT OF COMMUNICATION BEHAVIORS

In order to promote communication behaviors and teach ASD children to interact in the real world, this is why we have developed a method to promote this ability [16]. An experimental study on a sporting exercise carried out at the higher institute of specialized education we observed the interactions of 10 ASD children with a high level between 09 and 12 years old (Figure 4).

Figure 4: Objective to be achieved

In our opinion, when ASD children interact with the avatar, they are able to develop better conversation. The analysis of their conversation confirmed an increase in the use of sports gestures related to the specific situation of the game while the use of this type of exercise was to a lesser extent when an ASD child played with a real peer.

EMOTIONAL SKILLS TRAINING

As part of our experimental study [17] we analyzed the ability of ASD children to interact with 3D modeled objects and avatars and to understand their emotional state. We wanted to observe the potential of an EVC with several children with ASD. The modeled objects and avatars used express four emotions. Different tasks were evaluated within this study including the recognition of facial emotions of avatars (Figure 3), the selection of the 3D model or the avatar presenting the emotion corresponding to a proposed situation and the association between the given avatar and a situation that could adapt to the corresponding emotion. It was

also observed that most children with ASD were able to correctly interpret the representation of emotion in the 3D model or avatar. These activities provide the prerequisites to be able to operate in an EVC with avatars expressing their emotions. Participants demonstrated good skills for children with ASD.

The authors therefore affirm that the foundations required to advance research in this area exist. Another interesting issue highlighted by the researchers relates to the required degree of realism of the avatars' faces.

In addition, the application of VR/AR on the animations could concern the entire body of the avatar, a fairly revealing clue for interpreting the emotion.

INCREASED INTERACTIONS AND VERBAL COMMUNICATION

VR/AR increases interactions and verbal communication with children with ASD. It is possible to cite our projects since 2017; these research projects study the educational and therapeutic role of the use of VR/AR with children with ASD. One of his first objectives was to study how VR/AR can become "games" while having a therapeutic role for children with ASD [19]. Furthermore, they aimed to investigate how to encourage ASD children to learn such an exercise (figure 05) and to remain engaged in interactions with these avatars.
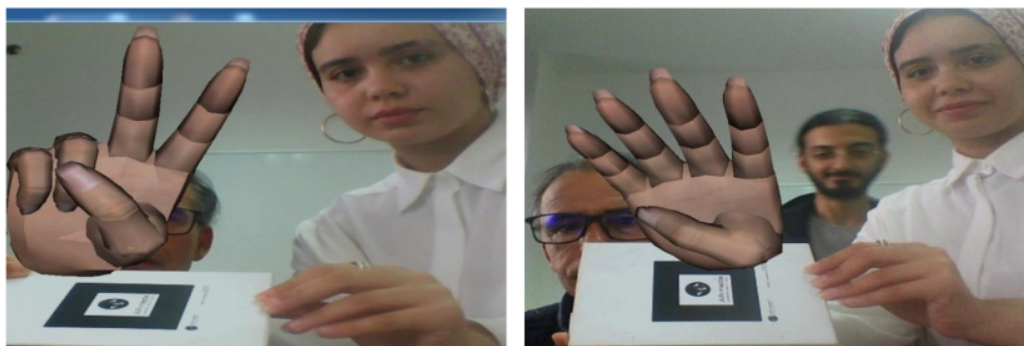

Figure 5: Increased interactions and verbal communication

In Figure 5 we wanted to demonstrate how the role of the VR/AR application is not to replace but to facilitate human contact [20]. Indeed, we can observe that children with ASD interact with each other thanks to this new technology which acts as an intermediary.

Following the results of the study with the application of VR/AR we decided to change some conditions: use a freer configuration and impose few constraints on the child's behavior and

the gestures allowed during interactions. With VR/AR we are able to simulate numerous expressions and stimulate the social interaction of people with ASD [21].

DISCUSSION AND RESULTS

Several research training skills development with the help of VR/AR reality have been carried out in recent years. Let's start with [22] who support in this regard the very promising use of VR/AR to help children with ASD. They also cite the need for further studies to understand how skills then transfer to the virtual world of everyday life. Such interesting experimental studies have been carried out in particular to analyze the possible interactions for ASD children inside a virtual supermarket [23], (figure 6 and 7).

Figure 6: creation of a commercial space

Figure 7: virtual supermarket modeled where there are consumers and traders

The use of the virtual environment (VE) can help to understand the symbolic object modeled [24]. According to this initial research, it is therefore possible to affirm that this environment can be beneficial for children with ASD. In addition, this system could be manipulated by

teachers according to the needs and difficulties of their ASD children. This manipulation could make it possible to gradually remove and introduce different difficulties to also promote generalization [25]. This system would allow, in the future, supervisory staff to access this environment and treat it according to the needs and difficulties of their ASD children. However, to be able to carry out this type of manipulation, this personnel must have technical knowledge suitable for this work. Currently.

Furthermore, we always confirm that the application of VR/AR on a virtual environment can realistically represent a pre-real social scenario. This may allow linking this theme to the area of study of this work and thus emphasizing the importance for the child of being able to train in social scenarios and allowing them to acquire skills in the areas of communication. and emotions. We can also create different contexts and class exercises to learn mathematics (Figure 8).

Figure 8: teaching mathematics to ASD children

Another essential point consists of the possibility of VR/AR to play an important role not only to facilitate communication and the transfer of knowledge between the therapist and the child with specific needs or ASD, as in our study but also to increase exchanges between the teacher and an ASD group.

SUMMARY OF OBSERVATIONS

Throughout this paper, we have observed that VR/AR can help improve the quality of life and social integration of people with ASD. Currently, there are no limits to the use of these technologies, such as the possibility of modifying the virtual environment according to the specific needs of each ASD child. A partnership between technicians, engineers, therapists and teachers therefore seems to be a necessary condition in order to bring together technical

knowledge and pedagogical knowledge and to optimize them as well as adapt them to the particularities of each child with ASD.

PERSPECTIVES ON THE USE OF NEW TECHNOLOGIES IN AUTISM

At present, it is important to consider VR/AR as an important tool for the care of children with ASD. We emphasize on this subject:

New information and communication technologies must be considered as tools at the service of ASD, by promoting its openness to the current means made available to it, and making it possible to understand its development and learning from a new angle. .

Currently, we have seen in this article that VR/AR is considered a real revolution in the field of special education. This technology represents a real revolution for people with ASD. It is "simple, easy to handle, direct, it offers a degree of ergonomics.

CONCLUSION

As part of this research project, we analyzed how the use of VR/AR contributes to improving the communicative and emotional skills of children with ASD.

We first presented the use of VR/AR with ASD children. We focused on the means to facilitate the difficulties of this population in terms of communication, recognition of emotions and social interactions linked to the contributions of VR/AR.

Different data sources allowed us to analyze the use of VR/AR aimed at improving these communicative and emotional skills. The various contributions from our interviewees provided us with different but relevant opinions in relation to the experiments.

According to the analysis of different data sources, it is possible to confirm that VR/AR allows the development of communicative skills thanks to several factors. These technologies can indeed contribute to the development of messages, the understanding of language and the association of images with words read by these devices. Additionally, we were also able to highlight the benefits of recent developments.

Regarding the factors promoting the emotional skills of ASD children, other dimensions could be identified. These include the ability to experience various emotions in situations that can be created based on the needs of ASD children. Then, the use of avatars significant for ASD was also highlighted, within different situations or games. This also allowed us to confirm the importance of being able to use these innovative technologies

Our thinking focused on VR/AR. We presented how these tools can promote communication behaviors with the introduction of virtual communicative partners, or how they can increase interactions and train emotional capacities in order to promote interactions and exchanges between people with ASD and supervisory staff.

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