



## **Update Research of Virtual Reality Technology on Children with Autism**

**Juan Liu<sup>1</sup>, Zhaoyu Yang<sup>2</sup>, Wenyan Jiao<sup>3</sup>, Yonglin Liu<sup>1</sup>, Xuchun Meng<sup>1</sup>,  
Dan Wang<sup>1</sup>, Wenlu Han<sup>1</sup> and Fuyong Jiao<sup>2\*</sup>**

<sup>1</sup>*Department of Child Health Care, Shenmu City Hospital, Shaanxi Province, China.*

<sup>2</sup>*Children's Hospital of Shaanxi Provincial People's Hospital, China.*

<sup>3</sup>*Department of Psychology, Shaanxi Provincial People's Hospital, China.*

### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors JL, ZY and FJ designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors YL and XM managed the analyses of the study. Authors WJ, DW and WH managed the literature searches. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/IJTDH/2020/v41i2430423

#### Editor(s):

(1) Dr. Shankar Srinivasan, Rutgers - School of Health Professions, USA.

#### Reviewers:

(1) Mohammed Nader Shalaby, Suez Canal University, Egypt.

(2) Hazel Vera D. Tan, University of Santo Tomas Hospital, Philippines.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/64898>

**Systemic Review Article**

**Received 27 October 2020**  
**Accepted 30 December 2020**  
**Published 31 December 2020**

### **ABSTRACT**

Autism, is a neurodevelopmental disorder characterized by communication, communication disorder, narrow interest and stereotyped behavior. Existing studies have shown that VR (Virtual Reality) technology may have some unique advantages in interfering with children with autism. VR technology refers to the construction of an artificial, realistic, and multi-sensory virtual world through computers and other devices. In the aspect of auxiliary diagnosis, VR technology provides a unified observation standard through the manual foot movement and eye movement data of children in the virtual environment. At the same time, it can reflect the clinical characteristics of children according to the performance and response of children to complete tasks in virtual environment, and VR technology will be presented to children in the same environment as usual, which can better reflect the performance of children and adolescents in the real-life environment. In this paper, the application of VR technology in auxiliary diagnosis and rehabilitation training of children with autism is briefly reviewed to provide new ideas for clinical rehabilitation treatment of children with autism.

*Keywords: Autism; VR (virtual reality) technology; rehabilitation treatment; children.*

## **1. INTRODUCTION**

Autism, also known as autism and autism spectrum disorder (ASD), is a neurodevelopmental disorder characterized by communication and communication disorders, narrow interests and stereotypical behavior. So far, experts around the world have not found the cause of ASD, so there are no targeted drugs. However, it was found that children with early diagnosis and rehabilitation treatment can significantly improve their symptoms. At present, the clinical diagnosis of children with autism depends on the experience of doctors and the observation of children's specific symptoms in outpatient department. A diagnosis is also difficult to grasp the condition of children. Excessive treatment and treatment delay often occur. The rehabilitation treatment of autism is still in the stage of exploration and development. VR technology and the existing rehabilitation intervention methods are combined to explore the rehabilitation treatment of children with autism.

## **2. APPLICATION OF VR IN AUXILIARY DIAGNOSIS OF AUTISTIC CHILDREN**

### **2.1 ASD Evaluation**

Classroom is used to observe and evaluate the response of ASD children in the classroom. The use of virtual roles is of great value in the experimental paradigm of social cognition, especially to the emergence and cognition of non-verbal acts. For example, some scholars use the virtual role of VR in the study of functional magnetic resonance (fMRI). The subjects can complete the social interaction in VR when they perform functional magnetic resonance scanning, in order to explore the brain imaging features related to the symptoms of social damage of the subjects. [1,2]

## **3. APPLICATION OF VR TECHNIQUE IN REHABILITATION TRAINING OF CHILDREN WITH AUTISM**

### **3.1 Social Communication Rehabilitation Training**

At present, the foreign researchers have established a virtual reality system, which can ascend the social intercourse ability of children

with autism. That system is composed of simulated virtual characters to tell situational stories, as well as produced realistic virtual scenarios related to the story. The aim is to bring autistic children into virtual social situations, finally, testing whether autistic children acquire the corresponding social communication ability by asking them to answer social questions. The stories selected were closely related to the life situations of children with autism., such as favorite sports. The questions were divided into three levels of difficulty: low, medium and high. Finally, it was found that 75% of the children with autism participating in the experiment could successfully answer the social questions set by the system. For example, the first thing they could do when talking with new friends was to "introduce themselves", indicating that VR technology can improve the social interaction ability of children with autism. [3,4,1,2,5 ]

### **3.2 Cognitive Rehabilitation Training (Such as Facial Expression Understanding)**

"Happiness and sorrow" are the basic expressions and emotional expressions of people. Many people like to read other people's inner feelings and all expressed thoughts through facial expressions. However, it is extremely difficult for children with autism to understand facial expressions. They cannot accurately read facial expressions, recognize facial expressions, and understand the emotional expressions behind each person's facial expressions. VR technology simulates the internal structure of the virtual world, enabling children with autism to experience various stimuli in the virtual world with a very natural mood, understand the different meanings expressed by various expressions, and improve their ability to understand expressions in the real environment [4,6,7,5].

### **3.3 Rehabilitation Training of Life Skills (Such As Ride)**

VR technology is used to simulate the real driving environment, gradually guide children with autism to interact with the virtual environment, acquiring the driving rules and key skills, and providing generalized (virtual) scenes to improve the generalization ability of children with autism. Results of a single study of three children with autism showed that their test results

increased by an average of 44.7%, effectively improving their ability to ride a car. [8] In a collaboration between the School of Computer Science and Computer Engineering at North Carolina State University and the University of North Carolina at Chapel Hill, two children with autism were trained to cross the road. The results showed that children with autism could recognize everyday objects in a virtual environment and gradually acquire and complete skills training tasks for crossing the road. [9] In another study, researchers used VIRTUAL reality technology to test two children with autism to see if they could line up and sit in the right seats in a virtual environment, in a or on a bus. Three months after the end of the experiment, the two children with autism were asked whether they could properly transfer what they had learned from the virtual situation to their real life. The results showed the virtual reality learning helped. Chari TOS et al. (2006) used VR technology to simulate the scene in which children with autism. were sent home, and asked the facilitator to record the responses of the subjects. Studies have shown that virtual reality is helpful for the subjects to transfer the daily life skills learned in the virtual situation to real life.[13,14,15]

### **3.4 Rehabilitation Training for Core Autism Defects (Such as Face Recognition)**

Another study supports this idea showing that children with autism have higher recognition rates for virtual people and lower recognition rates for real people's faces. This further inspires us to use VR technology to carry out rehabilitation training for children with autism, because compared with normal people, they are easier to understand and accept virtual characters [4,7,10,8].

### **3.5 Other Functional Rehabilitation Training**

Other related functional aspects, in this section, are mainly used to teach exercise to children with autism. So Finkelstein and others invented the Astrojumper mini-game, in which users were forced to avoid characters appearing so that they could exercise. Herrera and others have created a series of educational games in which children can exercise. [11,12]

## **4. CONCLUSION**

From a broad point of view, virtual reality technology refers to a realistic and multi-sensory virtual world by simulating the three-dimensional world. In short, in virtual reality, the three-dimensional environment simulated by computer can be either the simulation of the real environment or the three-dimensional environment of the virtual imagination. It comes from not only the physical space of reality, but also the reaction of an inner space. The essence of virtual reality is to "reflect the achievements in the human mind to a place with sensory space through some technical means." It is the product of expansion from the perspective of time and space on the basis of the real world. The virtual reality of broad angle is not only as a human-computer interface, it is more important to simulate the internal structure of the virtual world, using the technical means of human-computer interaction to reflect the environment that exists in the real world. The operator can feel the stimulation of the perceptual organs in the virtual world through an extremely natural way, and can feel the stimulation of the perceptual organs in the virtual world, and can also exist in the virtual world. To help children with autistic improve their living conditions, we cannot do without the help of new science and technology. Existing studies have shown that virtual reality technology might have some unique advantages in interacting with them [5,9]. Supported by Department of science and technology of Shaanxi Province (International Cooperation) in 2020 (Project No.S2020-YF-GHMS-0071).

## **CONSENT**

It is not applicable.

## **ETHICAL APPROVAL**

It is not applicable.

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

## **REFERENCES**

1. Parsons TD, Carlew AR. Bimodal virtual reality stroop for assessing distractor inhibition in autism spectrum disorders.

- Journal of Autism & Developmental Disorders. 2015;46(4):1255-1267.
2. Georgescu AL, Kuzmanovic B, Roth D, et al. The use of virtual characters to assess and train non-verbal communication in high-functioning autism. *Frontiers in Human Neuroscience*. 2014;8(8):807.
  3. Yuxin Wang. Application of virtual reality technology in rehabilitation and upbringing of children with severe disabilities. *Modern special education*. 2019;000(005):50-52.
  4. Bin Yu, Ke Zhu, Kaiteng Wu. Design of treatment system for autistic children [J]. *Computer knowledge and Technology*; 2019.
  5. Xinyu Yu, Dongfan Chen .A summary of the application of modern technology in autism rehabilitation. *Special Education in China*. 2016;3.
  6. Qing Sha. Research and application of intelligence rehabilitation classroom for autistic children aged 0-6 years; 2019.
  7. Shuhua Su, Huixian Hu, Fuca Zhao. A review of emotional intervention in children with autism spectrum disorder based on ICT. *Chinese Special Education*. 2019;000(004):47-53
  8. Cunliang Fu, Dawen Xu. Bus training system for autistic children based on virtual reality. *Computer Simulation*. 2019;036(006):209-213,231.
  9. Strickland D, Marcus LM, Mesibov GB et al. Brief report: Two case studies using virtual reality as a learning tool for autistic children. *Journal of Autism and Developmental Disorders*.1996;26(6):651-65.
  10. Bin Yu, Ke Zhu, Kaiteng Wu et al. VR game therapy for autistic children. *Computer Knowledge and Technology: Academic Edition*. 2019;015(011):219-220.
  11. Finkelstein SL, Nickel A, Barnes T et al. Astrojumper: Designing a virtual reality exergame to motivate children with autism to exercise. *Virtual Reality Conference. IEEE*. 2010;267-268.
  12. Herrera G, Casas X, Sevilla J et al. Pictogram Room: Natural Interaction Technologies to Aid in the Development of Children with Autism. 2012;8:39-44.
  13. Wenbin Guo, Qian Zhang, Kun Zhang. A review of the application of virtual reality technology in vocational communication skills training for people with autism spectrum disorders [J]. *Modern Special Education*; 2019.
  14. Zhi Wang, Jing Tian, Ziqiao Zhu. A review of the application of virtual reality technology in anxiety disorder intervention in autistic pedigree disorders [J]. *Are you my friend? Modern Special Education*. 2019;0A.
  15. Michnnl PD Aierendro, Jeftey R Galvn, Donw M D'Alaeds, William Erkcoen, Teresa A Chai. The virtel hopital the diptal I hover fum drsm tarealsty. *Acadmic Radiebogy*. 1995;1(6):75-50.

© 2020 Liu et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
<http://www.sdiarticle4.com/review-history/64898>