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Research on Interactive Design of Children's Public Space based on VR Technology

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Abstract. Children's public space is one of the important standards of the society reflecting the completeness of children's growth environment. It is the mainstream of public space development to connect VR technology with children's public space in the new era. Through the analysis of the public space which had direct interaction with the group activities of children, from the perspective of multiple sensory experiences, some interactive design principles of children's public space were summarized under the condition of VR technology and a new model of children's public space were redefined. It will be beneficial to realize the emotional connection of children's new dimension, and will promote their enthusiasm for exploring unknown things and the unique creativity of self-space.

1. Introduction

In 1989, the United Nations General Assembly adopted the Convention on the Rights of the Child, (CRC), to address the lack of representation of children as subjects of society. The Convention requires that children be given the right to listen to their own views in all matters affecting them. As the creators of the future social, it is extremely important for children to transform the new spatial output mode based on the actual demand of children's growing up and provide children's public space following the trend of The Times. In the context of social informatization and intelligence, VR technology keeps growing. Integrating it into children's public space to construct an environmental base for understanding and perceiving the world will undoubtedly provide children with a new way of cognition and channels of understanding.

2. The Development trend of VR Technology in Children's Public Space

VR (Virtual reality) technology is a new era technology which integrates computer graphics technology, simulation technology, multimedia technology, sensor technology and other interdisciplinary technologies. It has four characteristics: multi-perception, existence, autonomy and interactivity. By creating a virtual environment on the multi-dimensional digital platform that makes it difficult to distinguish the real from the fake, the user can interact in the environment and achieve the sense of immersion. The development time of virtual reality technology is relatively short in China. However, due to the vast domestic market and the great development potential of the industry, a "VR boom" has been formed in China in recent years and some achievements have been made in the fields of medicine, industry and aerospace.

VR technology has also been gradually developed in the field of children. Xina Shengkang's latest product, VRREHA, is a more interesting and efficient product for attention training, which also becomes the first domestic institution to apply VR technology to children's attention training. In addition, VR technology has produced the effect of "1+1>2" in the application of discipline training,



quality education and campus culture construction. At present, more focus is on the development of output content under the application of VR technology, and other aspects of the development is also expanding. To realize the connection between VR technology and children's public space cognition, change the old single-output state and generate a new interactive mode, so as to provide a more standardized and reasonable space for learning and entertainment.

3. Analysis on the characteristics of Children's Public Space

3.1. Importance of children's public space reconstruction

Children's public activity space refers to the special activities for children to play games, rest, study and entertainment in accordance with the children's physiological and psychological behavioral characteristics [1]. The application of VR technology has brought new opportunities to the presentation of children's public space. The creation of diversified virtual world to create different beautiful environments has aroused the enthusiasm of children and improved the efficiency of knowledge output. VR technology can build multiple different types of virtual environments in a limited space, adapt to the needs of children's various scenes and generate interesting interactions. Moreover, virtual space is not limited by space. It only needs to provide appropriate and operable physical space, coupled with the virtual environment built by VR technology, which can give children a shocking world. This immersive interactive display enriches children's horizons and creates a more imaginative future.

3.2. Analysis of multi-sensory characteristics in children

3.2.1. Audio-visual cognition. Children's vision develops with age, so the objects that children can recognize should be the smaller the age, the larger the object they can recognize [2]. Children will pay more attention to objects with obvious contour, bright colors and prominent features in the environment. Therefore, it is particularly important to form a unified style in children's public space through the reasonable collocation of colors, objects and Spaces to give children a visual impact. This also greatly improves the duration of the target object in children's brain memory layer.

After the children's auditory development is completed, the capture and archiving of music is relatively clear. However, due to children's weak receptivity to sound, complicated music is not able to timely receive and make correct response. Moreover, considering children's innocence, children's music is mainly based on relaxed and cheerful types.

Auditory content is often presented with visual content. Through background music, sound operation, role communication, sound guidance, dubbing assistance and other aspects to cooperate with the picture, so that children's audio-visual effects are more harmonious.

3.2.2. Shape characteristics of objects. Childhood is a rapid stage of physical and intellectual growth. They have a strong perception of everything in the world, are full of curiosity and questions, and have a typical active behavior and knowledge-seeking psychology at this stage [3]. Children like to feel the presence and change of known or unknown objects by touching their hands or limbs. However, children's self-management ability is insufficient, which requires that children's personal safety should be fully considered when defining the activity space. For example, the hardware facilities in the interactive space should adopt the fruity and soft curvilinear devices as much as possible. In unavoidable places, it should take protective measures to reduce potential safety hazards, such as stairs, walls, table corners and play areas.

3.2.3. Role connotation designation. Children's psychology is dominated by emotions, which usually shows variability and uncertainty, but they will be curious and explore new things [4]. Children's acceptance of unfamiliar environment needs some time to accumulate. In order to reduce children's defensiveness and quickly integrate them into the relatively unfamiliar public environment, most of

them place familiar animated characters or lovely anthropomorphic images in the public space to convey friendly messages to reduce children's defensiveness and resistance.

4. Interactive design principles of children's public space under VR technology

In order to make children experience virtual environment more reasonably and efficiently in the public space under VR technology, we should start from the children's actual needs, not the actual needs just as adults think. Color, graphic language and text that are consistent with children's age characteristics are adopted for layout design. Meanwhile, safety, space use, space environment, space partition and other aspects should also be taken into consideration. Only in this way can effective combination be carried out and the overall effect of design be optimized[5]. By abstracting the characteristics of VR technology and children's sensory experience, this paper summarizes the interactive design principles that should be embodied in children's public space.

4.1. Public principle

Publicity is one of the basic characteristics of children's public space, which determines that the principle of publicity constitutes the primary basis of children's public space, aiming at enabling every child to enjoy public facilities equally and reasonably. Therefore, This requires a minimum design principle in the space design process to maximize the matching between available equipment and multiple types of children. For example, VR helmets and wearers need to meet different head sizes; Check children's cleanliness after wearing to reduce bacterial cross-infection; and spatial visual installations and virtual environments should also take into account the specific needs of children at different stages.

4.2. Children's nation principle

The principle of children's nation mainly refers to the relevant principles with children's characteristics and in line with children's use. The service role of VR technology should also be transformed into children, and the emphasis of development is on the multi-party characteristics of children. Therefore, from the basic use of color to the core of the virtual environment construction needs to meet the actual needs of children. For example, when designing a public space for children, both the appearance and content presentation of VR instruments need to adapt to the preferences of children in different stages. Color can choose to bouncing and bright colors to reflect the sense of ethereality, Also can match color and light to present the sense of technology and future content needs to be diversified. Construct different styles and levels of virtual environment to meet the multistage needs of children. Audio-visual combination is necessary. Multidirectional sound equipment can be installed to create a 360-degree surround sound environment, giving people an immersive sense of reality will increase the experience effect of children.

4.3. Interactive principle

Interactivity is one of the prominent characteristics of VR technology, which means that users interacting with objects in a virtual environment can have a real sense of entity that just like in the real environment through specific devices. In the virtual three-dimensional environment, children can communicate with objects in the environment and have different degrees of information reaction through wearing the instrument with the first perspective. Children's attention span is short, but through the two-way interaction with the content of the virtual environment, which can let children actively integrate into the environment and seriously feel the wonder of the virtual world.

4.4. Immersion principle

Immersion can make users feel "be in the world" through their own operations in the virtual environment, which is an important principle for users to immerse themselves and obtain satisfaction. Due to the limitations of objective conditions, only semi-immersion type can be realized at present. However, through 1:1 modeling between virtual environment and physical environment, steps such as

space environment construction, interaction setting and multimedia equipment installation can be implemented, aiming to create a more harmonious "collision" between VR technology and children's public space.

4.5. Autonomy principle

Children, assisted by specialized instruments, can achieve relative autonomy in designated areas. That is to say, objects in a virtual environment can trigger real-time operations, such as moving, running, waving, squat and other limb movements, in accordance with the laws of physical motion of the real-world ontology. By wearing data gloves and data clothing, it is possible to achieve a high level of 1:1 reduction. The independent operation of children in the playing process is beneficial to increase the fun of children's life.

4.6. Relative mobility principle

As VR technology cannot move freely that be completely separated from the reality. it moves within a fixed-size sensing platform, and with specialized devices connected to the children to prevent them from harm. Therefore, full consideration should also be given to the actual use of child-related equipment. Keep children safe by strengthening safety arrangements and checking equipment regularly.

5. Conclusions

Virtual reality elements are integrated into the construction of children's public space, aiming to make children's growth atmosphere level in line with the overall social development. The integration of VR technology into children's public space is conducive to stimulating children's interest, enhancing children's ability to think and control themselves, and enhancing children's reaction dimension and way of thinking. Therefore, the research on the interaction design of children's public space based on VR technology has important social exploration value and development significance. Through analyzing the design characteristics of children's public space to abstracted out the concrete application principle of VR technology in children's public space. Change the previous layout definition, content display and communication mode of children's public space to realize the new form with the characteristics of The Times and promote the structural development of children's public space.

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