Application of Human-Computer Interaction Technology in Laparoscopic Surgery

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Abstract. With the advancement of computer technology, virtual laparoscopic surgery has also developed rapidly on this basis. Following satisfactory clinical results achieved by 3D visualization technology, 3D printing technology, and mixed reality technology, human-computer interaction technology in virtual environments has real-time interaction. The advantages such as performance and real-time dynamic visualization have gradually entered everyone's field of vision, and have gradually been used in many medical fields. At present, human-computer interaction technology in virtual environment has been widely used in laparoscopic surgery training at home and abroad.

Keywords: Human-computer interaction design, Laparoscopic surgery, Virtual reality technology

1. Introduction
In recent years, with the rapid development of the medical industry, computer-based virtual reality technology has penetrated into various fields of medicine [1], virtual hospitals, virtual laboratories, virtual human bodies, visual medical care, etc. have appeared one after another, laparoscopy Surgery has become an important surgical item [2]. In order to cultivate more and better medical talents, virtual surgery-based virtual surgery, virtual endoscopy, and simulated interventional surgery have gradually matured [3]. Currently, more and more hospitals have carried out and are preparing to carry out this operation. Laparoscopic surgery is a brand-new surgical technique. The operation is difficult and the quality of the surgeon is high. It requires that in addition to a solid laparoscopic surgery foundation, laparoscopic surgeons must also undergo systematic training in laparoscopic surgery skills including theoretical learning, technical training, and clinical practice in order to carry out this operation safely and smoothly [4]. Among them, technical training is an important part of laparoscopic surgery system training.

At present, many studies abroad have carried out attempts to develop virtual laparoscopic surgery systems. Pan implemented a laparoscopic rectal surgery system based on force feedback, and targeted research on force feedback algorithms and deformation simulation [5]. Basdogan simulates the process of inserting a catheter into the gallbladder tube using laparoscopic surgical forceps. This study uses a homemade robotic device with force feedback to simulate the operation. Simple interaction with laparoscopic surgical forceps [6]. LAPAROS is a simulator using its advanced machinery and
equipment, which provides training at different levels of skills, and provides evaluation tools for tracking users' training for a period of time. Provides a simulation of the surgical procedure [7].

2. Human-computer interaction technology in a virtual environment

Virtual reality (VR) uses a computer to generate a simulated environment, immerse the trainee in the environment through a variety of sensing devices, and realize the natural interaction between the trainee and the environment. It is a computer system that can create and experience a virtual world. It is computer-generated and uses visual, auditory, and tactile effects on the user to create an immersive interactive visual simulation. It is a combination of computer graphics, image processing and pattern recognition, intelligent interface technology, artificial intelligence technology, multi-sensor technology, voice processing and sound technology, network technology, parallel processing technology, and high-performance computers [8]. It is immersive, interactive, and conceptual. Currently it is mainly used in medical fields such as clinical intervention, clinical diagnosis, medical training, and health care.

In the virtual environment, human-computer interaction technology can import patient images and models acquired through imaging equipment into a virtual surgery training system, make corresponding plans for the actual surgery, and practice before the surgery, so that more accurate pre-measurement and Estimate, predict the complexity of the operation. In summary, the virtual laparoscopic surgery training system reduces the cost and time of training medical staff, reduces the risk of surgery for unskilled personnel, improves the efficiency and quality of medical education and training, and improves the level of medical surgery. The status quo of equilibrium has special significance [9].

3. Virtual Laparoscopic Surgery

As we all know, 80% of the surgical errors are caused by human factors, which shows that the significance of surgical training is extremely important. Young surgeons need a lot of detailed training before they actually walk to the operating table. The internal anatomical structure of the abdominal cavity is complex, and young surgeons need to spend a lot of energy and a long learning curve if they want to master laparoscopic surgery. Virtual reality interactive technology can just provide an ideal training platform. Through the combination of a virtual three-dimensional image of the abdomen and the real world, the trained doctor can seem to complete a real laparoscopic surgery. The virtual reality interactive technology effectively increases the opportunities for young doctors to perform operations and training, which greatly eases the limited medical resources and the demand for surgical operations. At the same time, laparoscopic surgery is generally complicated and complicated. The high-definition camera on the virtual reality device can provide the perspective of the surgeon and present it to the young doctor in a three-dimensional and stereoscopic manner. The young doctor can communicate, learn and communicate with the surgeon in real time through the virtual reality device. It can make young doctors intuitively feel the steps of surgical operation, precautions during operation, speed up the acquisition of surgical information, and improve the efficiency of virtual reality surgery learning. The interactive technology of virtual reality reflects the vitality of laparoscopic surgery training. It is believed that with the popularity and application of laparoscopic surgery training simulators in the near future, more and more young surgeons will benefit from this and effectively shorten the abdominal cavity. The learning curve of laparoscopic surgery lays a solid foundation for the independent completion of laparoscopic surgery earlier.

4. Development platform

Unity3D is not only a professional game engine that can create 2D and 3D video games, but also a comprehensive development tool that can create architectural visualizations and real-time 3D animations[10]. Virtual reality belongs to the interaction of real-time 2D or 3D scenes. So the virtual reality function is also one of the projects that Unity3D can develop. Unity3D can make very small scenes or very large scenes. The production of human virtual scene models can be achieved with
3Dmax tools, and the texture of the models can be designed with Photoshop. This is a very heavy workload and requires a lot of work. Long time to make models. Unity3D has transcended the concept of a game engine and can be regarded as a software for virtual reality technology. Its interactivity is also very good.[11]

It is very common to use Unity3D for virtual reality technology, especially for some high-quality scenes, museums, etc. In large-scale real estate development, Unity3D, scene budget, and simulation of effects are also used[12]. Industrial simulation also uses virtual reality technology to reduce the error rate of real operations. Three-dimensional games are one of the important application directions of virtual reality technology, and have played a huge traction role in virtual reality technology. Virtual reality technology has been applied to all areas of society, and using Unity3D as a platform to implement it is a very convenient way. In the field of cross-platform gaming, which is becoming a trend at home and abroad, the Unity3D engine has clearly become the focus of attention of domestic and foreign manufacturers. One is that the engine has strong game design capabilities, gorgeous picture effects, and its picture effects are not inferior to unreal; the other is its cross-platform application function, which can realize the seamless coexistence of games on PC, PS3, XB360, IOS and other platforms. Today, dozens of PC-based Unity3D online games have emerged in the field of cross-platform games at home and abroad in less than a year, and there are hundreds of mobile games based on this engine, not only in the game field, but also in the The use of other fields also makes Unity3D a familiar software. It is widely used as a powerful tool for virtual reality. The future development trend of Unity3D will be very good. At present, there are few online games made with Unity3D in China. The gap needs to be filled by someone. Learning Unity3D will lay the foundation for work and employment. It is a very promising prospect to create your own employment opportunities in various fields.

Many companies are using Unity3D to make some small scene models, such as wedding scenes, libraries, etc. This is a simple application of Unity3D. Some large companies want to use Unity3D to simulate large-scale virtual reality with an area of tens of kilometers. Using virtual reality technology with Unity3D can be said to be a development trend. Unity3D has the advantage of other software that is highly interactive and can connect to databases Data transfer with the background, which also puts forward higher requirements for the writing of Unity3D programs. To complete the customer's needs, it is necessary to operate with actual benefits as the standard.

5. Functional test
During the continuous testing, the integrity of the code is adjusted. For example, during the virtual roaming, the position of the roaming camera needs to be adjusted to be more precise, or the camera will sink infinitely below the ground. The characteristics of system security analysis are easy to understand and easy to grasp. It is very important to choose a suitable analysis method among many analysis methods. In the long process of developing large software, some errors are not artificially made, but due to the mutual call of code In some places, wrong variables or other wrong things will be generated. This is unavoidable. We need to constantly check and update to reduce system errors. Minimize system bugs, reduce crashes during system interactions, check for symbols when entering characters, and report errors if there is no code detection system. Since scene roaming is not very accurate for virtual reality, and its security is relatively low compared to military aerospace, scientific research, etc., the system security analysis done in this work is to detect functions, and to detect collision functions. Collision detection should be added wherever possible, and collision detection should be removed where the objects can be passed. This application software is not a system and does not need to be tested with good accuracy. It is sufficient to implement functions without BUGs, such as lenses Is there any problem with the rotation-oriented, interactive system that should exist after the collision? As long as these can be successfully completed, the customer's needs can be completed, and the actual benefits should be used as the standard for operation.
6. Conclusion
Through this project, I found that Unity3D is not only software for making mobile games, but also software for making big virtual scenes. Virtual laparoscopic scenes are just implementations of small scenes. The operation is relatively simple and requires hardware. It is not high. I originally did other scenes and found that if there are too many models in the scene, it will affect the operation of the system. This may also be caused by the non-standard texture. Also worried about affecting the system. I am also trying to make the scene more detailed, because vision is the first impression to the observer, Unity3D can achieve a very perfect scene design, if you want to produce a large scene, it is time consuming.In short, Unity3D is a perfect software that combines models and code.

Although the application of human-computer interaction technology in laparoscopic surgery in the virtual environment has just begun, the medical industry has shown a vigorous momentum. It is believed that in the near future, with the continuous progress of virtual reality equipment, preoperative surgery teaching, The training system is becoming more and more perfect. The virtual laparoscopic training system will train us more excellent laparoscopic surgeons, and more laparoscopic surgery problems will be solved. Human-computer interaction technology in the virtual environment will affect the laparoscopic surgery. The development direction is an inevitable requirement in the context of the development of precision medicine, showing a very broad development prospect.

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