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The future toward: Interactivity in wearable devices

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Abstract: *Wearable devices will bring a brand new development trend for all kinds of groups and industries, with somatosensory interaction to reach the contact and perception of human body and the world. With the emergence of the smart era in China, the interactivity of wearable technology reaches this step of real experience, from assisting people to fully interacting with users. This paper shows the specific meaning of wearable devices interacting with virtual reality from a critical development perspective, the principle of combining the two, and specific case studies. It explores the future development of wearable devices in terms of their universality and their impact on related fields with a developmental perspective.*

Keywords: *Interaction design; Wearable devices; Multi-disciplinary cooperation; Smart technology*

1. Introduction

The future is an era of technology, and interactive devices are an integral part of it. People are not only changing the world and developing technology, but technology is also changing people's lives. The gradual integration of virtual and reality is something that needs to be considered in the future. Virtual reality technology has emerged, but its application is not yet very widespread. In the future development of society, virtual reality technology can be expanded to various fields. With the development of virtual reality technology, wearable devices appear in the market. In this paper, we will critically analyze the future changes brought about by the interactive activities brought about by wearable devices. The specific meaning of wearable devices and virtual reality interaction, the principle of combining the two and the changes brought to the wearer, and the elaboration of the universality of wearable devices that can be applied to various fields in the process of continuous development. The changes and impacts of the development of wearable devices and virtual worlds on traditional businesses and venues, the future universality of wearable devices in solving problems in related fields and critical thinking about the impact on the human body itself. Safety also needs to be examined when critically looking at the social changes brought about by the interaction of wearable devices. Describe the multifaceted impact of wearable devices on future development in a holistic manner.

2. Interaction design introduction

Interaction design is the trend of current and future development. “Interaction design is usually described as being concerned with facilitating interactions with artifacts or between Humans through artifacts” (Karlgren.K, 2015). Interaction is not limited to the two sides of the interaction, so it is an important development direction for humans to interact with the virtual world in the future. It may have a two-sided effect on the relationship between people. Some characterizations of interaction design emphasize that interaction design not only should focus on interactions and Behaviors but should do so as well as independently of a particular implementation as possible (Karlgren.K, 2015). Interaction design emphasizes realization, solve the problems and enrich people's lives, and achieve the effect that could not be achieved originally with a simpler and more convenient way of interaction. The goal of interactive system design can be analyzed from the two levels of "usability" and "user experience", focusing on the people-oriented user needs. Interaction design can start from user experience, bring people a brand new experience, let people experience the life state that they have never experienced. From the point of view of usability can be used in many fields, bring them technological breakthroughs. Interaction design is a process of mutual feedback. Interactive products need to perceive the external environment and people's actions to feedback some information to people. “For interaction designers considering future situations this poses a challenge: From a designer's perspective taking into account the context of use of a proposed artifact means an inquiry into Situations that do not yet exist, namely the future situations of use” (Gedenryd, 1998). This is also consistent with the long-term coexistence of

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the future and humanity. Alan Cooper said the same thing in his UI Design interview: "The point is, it's good to have people do what they're good at. Let people do what humans are good at, and let computers do what computers are really good at." Attaching importance to interaction objects is conducive to making the relationship between people and interaction objects more reasonable, so as to get a way of getting along with people and interaction objects. Interaction design brings real professionalism to human beings and also makes people's life more convenient and colorful.

3. Wearable devices

3.1. Wearable devices and virtual worlds

The interaction between wearable devices and virtual objects is a general direction of future interaction design development. Virtual reality technology is a computer simulation technology that can create and experience the virtual world. It uses the computer to generate a virtual scene with 3d dynamic view, providing users with the simulation of vision, hearing, touch and other senses, so that users can immerse themselves in the virtual scene and form the virtual world in the eyes of users. Winograd pointed at the increasing importance of “designing spaces for human communication and interaction” that would require designers “to master the principles and complexities of interaction and interactive spaces” (Winograd T, 1997). Wearable devices are good for humans to interact deeply with the space shown by virtual reality. However, wearable devices are divided into two types. One is worn on the user and feedback information through the user's body state and movement. The other is represented by VR glasses, which make the planar scene vision 3D. The development of wearable devices in the future is to make users more immersed in touch, smell and other fields, and also to solve some problems and enrich people's spiritual life. The future of wearable devices are wearing clothes or accessories in the human body, through the ergonomic design of apparel design, combined with a virtual things, in the key parts of the wearable device equipped with virtual things that can be detected by infrared device, connect via Bluetooth, can detect the motion of the wearer. At the same time, wearable devices are equipped with tactile sensors, which are used to feedback the stimulation of human beings in the virtual world, making virtual things more tangible to users of wearable devices and making wearers more immersive. Perfect combination of wearable devices and virtual world objects can achieve the best interaction effect. At present, the existing wearable devices are far from achieving this effect. Only by giving play to the common effect of the two can the interaction between human and virtual world be better and more realistic. The current development of wearable devices is relatively limited, and it is difficult to wear. The practicability of wearable devices is relatively common in non-professional situations. This is also a problem that needs to be solved in the future development of interaction design, so that an interaction mode more acceptable to human beings can be carried out.

3.2. The state of wearable devices

Wearable devices are already gaining momentum.In the M2 Presswire, "Teslasuit Corporation has introduced a new product, the Teslasuit Glove, that uses haptic feedback technology to allow users to experience digital textures and gather biometrics from the user. Each fingertip of the glove is equipped with tactile sensors that allow users to naturally perceive virtual textures. Sensors are used in conjunction with motion capture and feedback systems to give the wearer a sense of space impact, resistance and vibration. In particular, the glove includes a pulse oximeter, which is specially designed to collect information such as the user's heart rate." Genres of pervasive games are admittedly classified as augmented/mixed reality, pure location-based, mobile and trans-reality games (Kasapakis V, 2013). Today's games already have this trend, live-action large-scale gun play games have emerged, but due to the area is too large, and security issues can not be fully guaranteed. Many game companies are also looking to change. Nintendo made a walking game that included sensors for both the player and their dog. All of these systems attempted to combine both movement and games (Smith Peter A, 2016).In the next five to 20 years, people are going to be playing large live action games in a much more accessible and interactive way. Enhanced interaction with virtual game worlds.The smart glasses and wearable electronics combined with VR compatible technologies are becoming more accessible, allowing users to smell, taste, and touch objects in the virtual world (Kasapakis V, 2021).

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4. Interaction process: wearable devices in the virtual world

Based on the development of modern technology, the possibility of enhanced interaction with virtual games is very high in the future. Wearable devices are light and flexible, and the only difference from normal clothing is a tiny infrared reaction device that can be built into the lining of the garment. Can imagine in the future world, while people with a large live-action game play, dressed wearable devices, computer games and Bluetooth connectivity, wearable devices that can appear in the computer screen several key anchor point, when the user wearable device of the infrared signal completely accord with anchor point in the game, you can enter the game scene. At this point, a virtual screen appeared in front of him, stating that the task was to compete against three other teams within two hours, each of which could attack each other until the last team found the final boss to win the match. Click “OK” to enter the game. At this moment, the user will actually feel the touch of the button through the tactile sensor at the finger location. The game scene changes, the system sounds a warning: during the period may encounter bad weather, geological changes, and unexpected enemies. The first scene to appear is a Tropical Rainforest, where the wearable device detects signals such as air temperature, humidity and flora and fauna through an infrared connection. It receives the influence of the external environment and sends a signal of heat and humidity to the wearer. People will get feedback on the interaction between wearable devices and the external environment through sensors. People can also sense wind resistance and air flow through tactile sensors. In the process of continuing to march encountered another team can choose to fight with it, if you do not choose to fight to detour, if the other side launched a strong attack must fight. During the fight, you can directly communicate with the opposite player face to face and even form an alliance. If both sides choose to fight, in the process of fighting, the arm is shot by the enemy, the gun will send interactive action to the wearable device, and the sensor of the wearable device will react to stimulate the nerve endings of the human body, making people feel pain and bleeding. Wearable devices can give feedback on the pain and penetration of the body, and people can see the outflow of blood and touch the blood.If you are killed by the opponent, you can choose to exit the game directly or swipe out the home page of the game, find and click the resurrection potion, non-game players will appear in front of the user and hand out the resurrection potion, open the bottle and drink it to continue. As you continue, the weather changes gradually until you reach the desert, where the wearable responds to the weather again and signals that it is hot, dry and difficult to move. Moving on leads to a fork in the road, forcing him to seek out non player character to help. During this process, the non-player can have a direct voice conversation with you and give you feedback on what you say, but when you ask him which side of the road is more comfortable, you get a picture of the environment and the number of enemies ahead of you each day. But you can also take out RMB or Wechat pay to directly purchase the tips to get the route to the final boss location. In this process, wearable devices analyze external stimuli and give feedback to change people's activities and then change the surrounding situation.

Unlike traditional point-and-click interaction, most of the interaction is through gestures, actions and voice. It is also a direct interaction between humans and the virtual reality world through sensors in wearable devices. At the same time, the interaction between wearable devices and virtual reality is completed, as well as the interaction between human beings and the surrounding scenes. There is already a foundation for this technology to be developed on a large scale. However, large-scale application of this technology will require further development of technology, and a gradual change of thinking process. The connection between reality and virtual world will be gradually enhanced, and wearable devices and virtual reality technology will also have a great space for development.

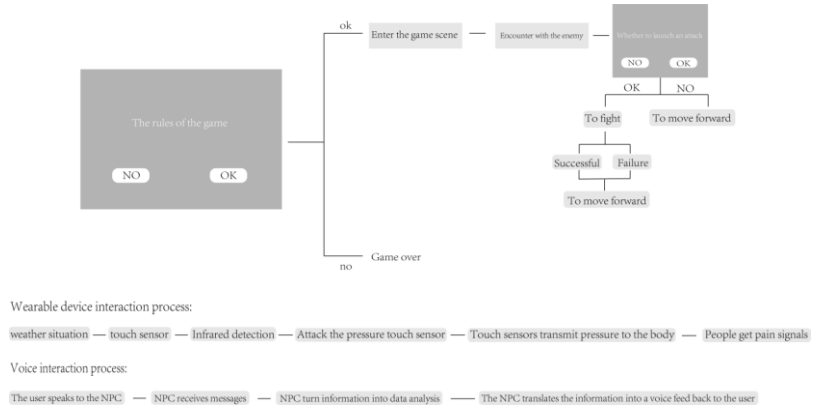

Figure 1: VR game flow show

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5. Application areas of wearable devices

The combination of wearable devices and virtual reality technology can not only be used in the field of games, but also has many utilization Spaces and a wide audience. “Non-touch interaction technologies are planned for many applications, from everyday entertainment and communication to traditional research fields such as geography, ocean, city, biology and clinical assist” (Lv Zhihan, 2015). “In medicine, for example, the noninvasive nature of wearable devices has made therapeutic procedures simple and has decreased the risk of infection, which was previously related to blood” (Seshadri, D. R, 2019). The convenience brought to people by wearable devices is obvious and there is a foundation for further development. Forensic students practice solution when the plane in the future, no longer need physical touch animals such as mice, frogs, but wearable equipment makes people in a touch of a virtual animals interactive instruction through the tactile sensors to get the real animal tactile feedback, the feedback on the solution of the plane want to get information, effective relief for fear of certain animals. In addition, in the future life, there is no need to go to the gym for exercise. You can download the simulated gym software and connect it with the wearable device through Bluetooth. After the connection, you can stay in the physical gym. Exercise with fitness equipment, such as lifting weights to exercise the upper arm muscles. When a person picks up a barbell, the infrared ray of the wearable device detects the object as a guide, and the tactile sensor will give pressure to the person. When the user feels that the weight is not suitable for him, he can issue voice commands: increase or reduce the appropriate number of kilograms. Tactile sensors readjust pressure to assist with exercise. In the future, the pace of society will be further accelerated, and people will be more cautious in the use of time. Wearable devices materialize the virtual scene of gyms, which greatly improves the efficiency of mechanical exercise and saves a lot of time for going to gyms or even making an appointment. Tourism is also a good direction to use. At present, 3D online maps are available to feel the domestic and foreign buildings. When wearable technology places people in the virtual scene with electronic devices, they can feel the local climate and the touch of the landscape, so that people can feel the scenic spots and historic sites without leaving home. Wearable devices are the development idea of future science and technology. People do not need to touch each other, avoiding some unnecessary contact and malicious harassment in interpersonal communication. “Wearable devices can make people's lifestyles healthier and more efficient” (Patel Mitesh S, 2015). Wearable devices shorten the distance between reality and virtual world, enabling people to feel the virtual world more effectively and satisfy their curiosity about the virtual world. It can simulate the environment outside the Earth, so that ordinary people can feel the difficulties of space life and understand the difficulties of space workers. Can also appreciate and feel different life, in the first person perspective of the interactive development of the game to experience the life of the game character, bring people some thinking. In the future society with serious aging phenomenon, there will be more and more empty nesters. Through wearable devices, people can feel in the same space with their parents or children during video calls, which can facilitate the company of the elderly and provide psychological comfort to the young. The tactile feeling of virtual things brought by wearable devices can be applied in various fields. Of course, wearable devices used in various fields are different. In the future development, wearable technology will definitely be more professional and targeted.

6. Impact of wearable devices

The combination of wearable devices with various fields has brought various impacts on different fields and also on human beings themselves.

6.1. Impacts on various fields

The development of wearable devices has changed the traditional mode of games or other fields, which is bound to have a certain impact on relevant enterprises in the future. It can be predicted that the space required for wearable devices to play games is much larger than that of today's computer games, which will bring certain challenges for the future. For game production, it is necessary to make clear their own positioning, whether to adopt virtual reality game-play, if the original game-play is bound to face the impact of virtual reality technology. If virtual reality is used, game production teams will not only need to be more specialized and hire better original artists, but they will also need professionals who specialize in virtual reality. And cooperation with major wearable device manufacturers is also an important part. The increase in cost is also a point that must be considered, and people's actual actions determine the floor area is very large. Specialized game experience pavilions are necessary. In order to

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attract more users, wearable devices should be provided free of charge. But at the same time, it also drives the development of entertainment venues and the richness of entertainment activities, promotes the development of short videos and other types of games, and even combines with the activities of script killing and escape from secret rooms. In the medical field, its wearable devices are more specialized and must be unified by the national standard without too much consideration of the cost. People who cannot hear can feel the sound of the world through bone conduction, and the accessories of the disabled can be very helpful. This is also the rise of an emerging field. Wearable devices themselves are a new industry direction and an important direction for future development, which can also drive economic development and slow down the recession of the real economy.

6.2. Impact on human beings

Wearable devices give users a very real virtual world. For users, it's another space world to escape the pressures of reality. In the long run, it's hard to predict whether users who regularly play virtual reality games will experience confusion and deviation in the distinction between real and virtual worlds. They may also rely too much on wearable devices and use virtual reality to escape problems in some emergencies. Sometimes, they may even forget that they have returned to the real world and touch something that cannot be touched, causing immeasurable consequences. More recently, research has explored and demonstrated other negative consequences related to VR, including reduced cognitive performance (Mittelstaedt, 2019; Szpak, 2019), physical fatigue (Smith，2019), eye fatigue postural instability , and physical discomfort.The nature of virtual reality is that dynamic 3D will give people a sense of vertigo, which is extremely harmful to people's health in the long run, hindering normal work and study, and bringing negative effects to the human body itself.

7. The safety of future wearable devices

In the future development process, the security of wearable devices is an issue of great concern to people. Wearable devices are relatively safe with the support of high-tech technology, but their risk factors are not eliminated. According to David Jacoby, "Hackers can break into wearable devices without even knowing it." This is very unfriendly to user privacy. In addition, the state has not issued standards for the quality and safety testing of wearable devices. The identification and elimination of potentially harmful chemicals in wearable products and the safety of lithium batteries, as well as batteries and infrared devices are all hidden dangers. When the user wears the public wearable device does not exclude the case that the information will be stolen by the business record. Wearable devices are also garbage that is hard to degrade, and there is still a lot of room for improvement in materials. Wearable devices are small and convenient. Wearable body clothes are no different from ordinary clothes. The built-in smart chips and sensors can collect our vital signs and monitor all kinds of sports conditions. Even independent network control of smart home, mobile payment and other scenarios.

8. Negative impact of wearable devices

Every coin has two sides, and wearable devices are no exception. Wearable devices can detect our body life at ordinary times, and when combined with virtual reality technology, they can make people immersive for planar scenes. In daily monitoring, it has a certain impact on the human experience. Although science and technology is developing at a high level, the oppression of the tactile sensor on the human body will also cause some unnecessary trouble. Long-term pressing on a certain part may cause some physical conditions. When combined with virtual reality technology, it may be difficult for users to disengage themselves from games or virtual worlds.Online game addiction is defined as a compulsive or uncontrolled use of online games, in a way that causes problems in other areas of the person's life (eg, failing school, family, or relationship problems).If users can't get out of the addiction to games, they may be confused between reality and the game world, resulting in academic neglect, family and interpersonal disorder. When users are addicted to large-scale gun-shooting games and cannot get rid of them, it is likely to cause unconscious illegal and criminal behaviors, which is not conducive to social security. With the appearance of a large number of virtual screens, the recognition of gestures is likely to be wrong, leading to privacy leakage, and one's personal belongings will be unlocked by others with gestures, thus revealing privacy. The combination of wearable devices and virtual reality technology is ultimately a network connection, which may be used by commercial spies to leak some confidential documents of enterprises or countries.

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9. Conclusions

Wearable devices are a direction of future development and may become a normal part of people's life, which will be of great help to the aging society in the future. Wearable devices are clothes or accessories worn on people. At present, ordinary clothes and accessories are different, but in the future, they will be very similar to ordinary clothes. Wearable devices will become everyday clothes. The virtual things that wearable devices bring to people is a major direction of development. Immersive experience of virtual world from touch, smell, hearing, vision and other fields. The interaction between the two can make people experience scenes and situations that they cannot experience in real life, and the interaction process is more convenient compared with the current interactive devices. Most of them directly interact through voice and gesture, and they are more intelligent and will not answer questions as often as the current mobile assistants. The application of wearable devices in various fields is universal, bringing great changes to many fields as well as challenges, especially for technical activities in some professional fields. The development of wearable devices is not perfect yet, and there are still more or less negative problems for personal health and society. The development of a new thing or field is bumpy, which needs to be solved by further development of science and technology, as well as more scientific researchers. Ordinary people hold an attitude of expectation towards future technology. Look forward to the future development of science and technology to bring people a better and convenient life.

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