A Comprehensive Survey Study on the Characteristics of Virtual Reality Game

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Abstract

This article takes the comparison between virtual reality games and conventional games as an example. It not only analyzes the differences in infrastructure or hardware, but also aims to clarify the differences through in-depth study of the internal nature (that is, the impact of virtual reality on human psychology). And through the existence of online status, it will be divided into social existence and spatial existence, and the factors forming these differences will also be analyzed.

Keywords: virtual reality, interactive games, VR games, immersion

I. INTRODUCTION

Virtual reality signifies cyberspace in three-dimensional, graphic, or image realized through the computer. Virtual reality technology enables people to indirectly experience situations that cannot be realized in the reality due to spatial and physical limitations by utilizing human's five senses (vision, hearing, sense of touch, etc.) through virtually establishing space and object of human's imagination in cyberspace. Through technology, we get to experience the world inside a virtual reality and feel as if we are part of it. The purpose of realizing the virtual reality technology is for the users to experience a virtual world similar to the real world.

According to the definition of virtual reality, the core elements are flow and interaction.

Virtual reality means, as the name suggests, that users can experience a virtual, fiction environment that is different from the real world. It means that by using this technology, users can visualize any imagination free from physical law or the odds of existence, enter into the computer model realized by a computer that is set similar to, or furthermore the same as the real world, and experience and interact with the world defined within the model. However, it was ascertained that the definition of the virtual reality could depend on researchers, which the cases are listed below:

First, virtual reality refers to the technology that grants users an indirect experience of an additional situation that feels similar to how they feel in the reality, by enabling them to feel human sensation—such as vision, hearing, the sense of touch, and more—within the cyberspace built similar to the real world. The related terms are fidelity, immersion, telepresence, cyberspace, realtime rendering, etc.

Secondly, the core elements of virtual reality are immersion and interaction. The elements within the virtual reality are heightened by the sensory feedback that stimulates the human's five senses, and the sensory feedback here refers to delivering sensory feedback after users' input or behavior. The vividness and interactivity realized by these technologies provide a sense of reality within the virtual reality and increase the sensation of immersion. A sense of reality refers to feeling 'the sense of being inside the virtual reality' when a person is physically located in another place.

Thirdly, virtual reality was defined in the perspective where reality refers to the interaction between humans and computers. Virtual reality integrates computer graphic, various displays, and data input technology into one to make users feel as if they exist in the virtual world, and the users, too, actively participate in the world created by the computer, being beyond their role of external observer to the data and images displayed on the computer screen.

Fourth, virtual reality is a generic term of all sorts of technologies that make the user immerse into the virtual world, at the same time enable a seamless interaction between the virtual world and the real world, and a theoretical background required for the technology by providing various sensory channels created by a computer.

The article aims to closely examine what kinds of characteristics of virtual reality the games created based on the definitions explained above reflect, and compare their differences to the regular games.

II. The Classification of Virtual Reality Games

II.I Immersive VR

A virtual reality that makes users fully immerse into the virtual reality. This type involves special equipment called HMD (Head Mounted Display), which is attached to the user so that he/she can fully focus on the virtual reality. The immersive VR shows a higher sense of experience than other forms of VR – the reason being that the special equipment HMD traces the movement of the user, displays the exact coordinate to the virtual reality, and therefore makes the surroundings of the virtual reality to change according to the user's movement. This is why users are more likely to feel as if they are actually inside the virtual reality.

II.II Desktop VR

Desktop VR refers to virtual reality that users generally experience, and mostly through computer screens. The desktop VR enables users to feel the virtual world using a three-dimensional image displayed on the computer screen, as well as devices such as a mouse, joystick, and data gloves. To increase the visualization of the image, users often wear simple goggles or glasses such as the product from Crystal Eyes. The most common example of it is game, and it is also expanding its range of usage to professional fields, such as industrial design, engineering, architecture, and data visualization. The desktop VR's advantage is its affordability and simplicity of requiring a computer monitor only, but it lacks a sense of reality compared to the immersive VR.

II.III Augmented VR

Augmented VR refers to the virtual reality that increases the sense of reality by adding the virtual effects to the real world, and aims to provide abundant information about the real environment. The word augmented reality can be quite unfamiliar, but in fact, it can be easily experienced by using smartphone apps. An app called 'OVJET' is one example. When the user scans the surroundings using the smartphone camera, additional information about the buildings that were captured appears on the screen. Another example is the helmet of helicopter pilot, which shows the shape of objects that cannot be distinguished with naked eyes, along with the actual topography.

II.III Computer-Assisted Virtual Environment-type VR

It is a virtual reality where a computer-generated virtual world is similar to a room projected on the front and surrounding wall and is used for training the pilots who are required to scan through different directions [1]. CAVE is appropriate for providing a group experience where multiple individuals need to experience the same thing all at the same time.

II.V Projected VR

It combines the image of the user so the virtual world and the user can see himself/herself located inside the virtual space. It can reflect every single movement of the user by using a special device, which enables the user to observe his/her movement followed by the reaction accordingly. The soccer game that makes the user block the soccer ball in front of a large-sized blue screen can be one of the examples. This type of VR is commonly supplied to the public but the sense of reality that users can feel is low.

III. The Materialization of Virtual Reality Games

III.I Virtual Reality based on 2D Image

III.I.I Panorama IVR (Panorama Image-based Virtual Reality)

A panorama technology grants users an effect as if the user is located in a certain place and is looking around the surroundings. The user can look up, down, left, and right using a device, and this virtual reality production technology also enables the effect of moving space to space, as well as zooming in and out to a certain spot.

III.I.I Object IVR (Object Image-based Virtual Reality)

It is a technology that enables the user to examine from an objective spot with the object in the center. It can examine all 360° of the object, and it can also be zoomed in to the point where the texture or size of a certain part of the object can be seen. This technology is commercialized mainly in the online automobile sales website.[2]

III.II Virtual Reality based on 3D Image

III.II.I VRML (Virtual Reality Modeling Language)

VRML is a file format used to express the interactive 3D object and the world. VRML was designed to be used on the internet, intranet, and local client system. Also, VRML can be a common compatible format, which is used to integrate 3D graphics and multimedia. VRML can be used to create visual representation multimedia presentation of engineering and science, webpages with entertainment and education purposes, and virtual worlds.

These VRML can express multimedia hyperlinked to other media, such as text, sound, movie, and image, as well as both static and dynamic 3Ds. The VRML browser can be used not [1] only as a writing tool to create VRML files but also in various platforms. The VRML supports an expansion model that enabled a dynamic 3D object, which was defined by developing an interoperable expanded form based on the standard in the permitted application business fields. It is used among the characteristics of 3D API (application programming interface), which is commonly used with VRML objects. The virtual reality with the 3D image is realized based on the actual image and three-dimensional polygon, which is hard to produce compared to the panoramic form but enables interaction between the users and contents and can provide an impressive effect when used in the websites that require shopping mall, game, exhibition, simulator, etc.

IV. Comparison of Virtual Reality Games and Regular Games

Based on the definition, classification, and realization method of virtual reality game stated above, the virtual reality game naturally shows numerous differences when compared to regular games. The article goes on beyond analyzing the infrastructure or the difference in terms of hardware and aims to make clear the difference by intensively looking into the effect of the inner nature, in other words, virtual reality on human psychology.

The biggest difference between VR games and regular games, as it is shown from its background, is the presence. In this article, the presence here will be divided into social presence

and spatial presence and will also analyze the forming factor of these differences.

M. Slater and M. Usoh state that the presence is defined as the status of a user inside the virtual reality does not recognize the difference between real and virtual and feels as if he /she exists in the real world. The presence here was classified as social presence and spatial presence.

IV.I Social Presence

Social presence was first introduced by J. Short, E Williams, B. Christie, etc., who claimed that it is emerged by communication. D.R Garrison and T. Andreson defined social presence as users expressing them emotionally and socially. They asserted that it represents the community as an element that maintains and forms within the virtual space.

Fig. 1. The list of commercial VR games

IV.II Spatial Presence

Spatial presence, which is conveyed by creating a virtual world different from reality through a computer or device, is a concept similar to a game. Spatial presence is used as a factor to explain the presence within the virtual environment, and it also means that it moves the user to a virtual physical space. Spatial presence can be defined as granting a feeling as if the user is moving to a virtual space from reality, or as if he/she is existing in the virtual space.

IV.III Presence Forming Factor

Technical and content factors can be examples of forming social and spatial presences.

First, they are associated with the form of the virtual world, such as whether the sense of reality and sensitivity can be delivered to the user in terms of technical infrastructure. The ease in wearing equipment and in moving around can affect a great deal to the presence and on the contrary, if the technology applied to the virtual reality is inconvenient or complicated, it is difficult to apply the presence. In the gaming field, the factors of presence are mostly realized through technical elements. Elements that realize the game, such as sound and graphic, also increase the presence and enhance immersion.

Another example is the content. The contents factor that affects the presence is broad and diverse and it is because it involves elements such as virtual environment, character, and event, etc. provided by the virtual world. The more people use content along with VR and the more socially and emotionally realistic the contents are, the more they can feel the presence. It was proven that 2D graphic derives presence when it projects contents with a positive connotation when a 3D graphic generates a higher presence when projecting contents with a negative connotation. Based on the findings above, the ease of medium equipment for technical factor, and multimedia elements such as realism graphic and sound—i.e. background similar to the reality—are known to increase the presence. If there are many people that use the same contents or if the content is socially realistic, it also helps to increase the presence. It was also proven that 2D graphic derives presence when it projects contents with a positive connotation when a 3D graphic generates a higher presence when projecting contents with a negative connotation.

V. CONCLUSION

Every human being is living as one of the members of billions of people on Earth, and the reality is beyond one's control. To escape from the limited time, space, and environment in reality, we have used the technology called 'virtual'. In the past, virtual reality technology was mainly used in games and entertainment, which was prone to lead to side effects such as game addicts or social maladaptation, etc. However, as the virtual reality started to play a part in all parts of human's everyday life, such as architecture, medical science, training, sports, game, communication, network, etc., these days, the virtual technology, the technology no longer remained as independently apart from the reality, but rather became the form of mixed reality, such as augmented reality. In other words, it's no longer about separating reality from virtual ones, but it's more about embracing both reality and virtual reality.

At the same time, the current state still lacks the understanding of the virtual reality field, as well as manpower to collaborate in various fields or to develop and manage contents. Also, while the expenses for technology development increase, the profit model that uses virtual reality is still unclear, not to mention the fact it still lacks successful commercialized models. Moreover, the competition with leading international technology, legal systems that are yet to reach the technology development level, and general indifference about the unpublicized topic could serve as a threat to the virtual reality field [3].

Nevertheless, Korea, as a leading nation in terms of IT infrastructure, can respond to technological advance and possesses world-class modeling and rendering technology required in establishing large-capacity virtual environment, vast online environment establishment, and management know-how, which makes it more advantageous in establishing large-size virtual reality world compared to other countries. As various new businesses are in progress, the virtual reality world is one step closer to our everyday life.

In the fast-growing virtual reality market, the virtual reality game has shown its potential in alternating the regular games in the media. With this background, the virtual reality game is showing a clear advantage that differentiates itself from the regular game.

This article has analyzed the concept and definition of virtual reality as well as its way of classification and realization. The article was aimed to go beyond the technological factor compared to the regular games and analyzed the internal factor as well. Ultimately, the virtual reality game shows a fundamental difference to regular games in terms of 'presence' and the initiating causes for the difference were technical and content factors [4].

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