Proceedings of the 2023 International Conference on Machine Learning and Automation
DOI: 10.54254/2755-2721/34/20230295

From a new product: Apple Vision Pro–Impact of VR technology development on VR gaming

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Abstract. Apple vision pro renewed interest in VR technology. Whether academia and communities all have many discussions. In this article, three main questions could be discussed after the selecting of some data. The first is how it is being applied in the future. The second is what experience does this current application provide to the user. The last question is what direction could be taken in the future. This research may answer some of the doubts and bring some thoughts to the table.

Keywords: Apple, Head-mounted display, VR technology, New product.

1. Introduction

With the rapid development of Internet technology and digital technology, people have higher requirements for the service experience of games, and the emergence of three-dimensional games has received public attention, most of these games use virtual reality three-dimensional scenes. The most important feature of this technology is that it creates a virtual environment by imitating the user's senses of smell, hearing, sight and touch, and allows the user to receive the sensations of a real environment and to interact with the things in that environment, ultimately giving the user the impression that everything in the environment is real [1,2] As Albert describes, one of the keys aims for VR technology in game is to perceptually replace the external world with that of a virtual world to create a specific user experience.

With the current development, developers are aiming to reach the level of the movie *Ready Player One*, and there are some achievements. Such as the British company Teslasuit has developed a VR bodysuit. The Tesla Suit VR smart suit, which transmits sensations in the form of bioelectricity from the nervous system to the brain with the help of electrical muscle impulse technology. This allows the sensation of pain and temperature. Others like Facebook Oculus Go, HTC HTC Vive Pro.

However, the Standalone VR all-in-one like Facebook Oculus Go 、HTC HTC Vive Pro are not at all as immersive as the VR devices used with the pc. Some VR omni-directional treadmill like Virtuix Omni, which makes experiencers' experience odd and uncomfortable [3,4] From Kyle's research, he considers that omnidirectional locomotion platforms have been posed as a viable solution to create the feeling of walking, but the feedback from those who experienced it is that most of the approaches have lacked a bearable, intuitive, and ergonomic VR walking experience. In other words, it is impossible to achieve a high level of immersion and interactivity in the game with the current state of technology.

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Recently, Apple has held its latest launch event. A new product called Apple vision pro improves many of the shortcomings of the previous product and it also opens up endless possibilities for the development of VR games. This article hopes to analyze Apple vision pro to point out the future direction of VR games and the areas that need improvement.[1]

2. Research method

VR technology and VR game have been attracting attention for a long time, but past VR products have always had many unbearable drawbacks. As a heavy gaming fans and VR technology obsessives, every new technology or product is of great interest to me. Consequently, the new product: Apple vision pro become the research object. As this is a new product, the way that researchers can access to this product is not much. Therefore, trying the best to find some objective and technically sound reviews or experience videos on YouTube or Bilibili (the biggest long video sites in China) is a necessary way. 5 videos on Bilibili and 8 videos on YouTube are watched which could be considered rigorous and objective. Then, the results of their assessment and the actual experience are distilled into a few concise aspects. In addition, in order to enrich VR gaming experience for researchers and to provide a more reliable basis for the arguments, I went to my friend's home who has a home VR equipment and use this to experience a famous 3A game (high-cost, high-volume, high-quality single-player game) <<*The Elder Scrolls*>>.

As mentioned above, there are not many opportunities for me to do survey offline. Thus, our researchers spared no effort to collect information and resources on the Internet. We searched on YouTube using keywords "Apple vision pro". After watching all these videos that be selected, I compared all the feelings, the evaluations and other views that come from those content creators. Then, I have synthesized these thoughts into some points to the Apple vision pro. More importantly, Using Google scholar to find articles that Focus on VR technology and gaming. 31 articles such as **Virtual reality technology and game enjoyment: The contributions of natural mapping and need satisfaction** are adding and supporting my views as far as possible. To better collect those viewpoints in articles, Using Nvivo to help the research to find similar opinions from different authors and articles. This greatly help us save time in analyzing the articles and make me have more time to polish the ideas.

For these 31 research articles, most of them come from the **ScienceDirect** and others come from websites like web version of **Diabetes Science** and **Technology or Springe**r. The articles that chosen for research have text only and charts or other images are not essential for our research and analysis. The first step for the text analysis is collect these articles. Fortunately, most of articles can be downloaded from websites directly, however, some articles need to pay to browse and others need to copy manually and save to the Word documents. This costs around two hours to finish it all. After choosing and saving all the texts that are useful for the analysis, the second step is to categories these articles according to similar research subjects, which spends approximately 30 min to go through them again in general terms and classify. The third step costs almost 1 hour is to use keywords to search similar points between every well-categorized articles. And the final step is to refine these ideas, it means to remove the dross and take the essence and synthesize them into views that would be mentioned in this article. These views support some thoughts and would be further discussed and the more important thing is these views provide some dimensions that can use to evaluate the Apple vision pro.

3. Result

From the research above, there will be some research results to show. The first part is the result of 31 articles analyzing. To summarize from these articles, I choose some top mentioned key words and dimensions that use them to evaluate the VR game. **The Table 1** shows the keywords that I purify from these articles. We divided these dimensions into six part and the first part is a intuitive problem: price. The expensive price of VR devices is not only because they include the newest technology, but also because the materials that they need are also high precision and top quality. The second dimension is the portability. Nearly all the articles mention that the devices that we develop now, whether you are head-mounted display (HMD) or VR body suit, are heavy, which be reflected in feeling tired when wear

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them a little bit longer. The third part is about perceptual capture of the human body and related functions. The capture of your action, including the tiny move of your fingers, every shake of your eyes and even your emotions and haptics. Something like capturing emotions and haptics are very difficult to achieve, but they are also very important for VR technology and VR gaming. The fourth part I want to talk is the Clarity or we can say as vision part. Clarity problem is also an important proportion of the total number of stations and it especially comes to articles which their topics are related to head-mounted display. Problem like frame can be very common to all the head-mounted display. Our human eyes inevitably see black border when wearing something close to glasses, so that is big shortcoming for HMD. In addition, clarity of these devices, such as Facebook Oculus Go, are not even close to the clarity of some regular TVs. Another heavyweight dimension is the interactivity. The sensitivity when we try to access the interaction interface, designing of interaction interface or the way of how to interacte are prominent part of VR gaming. The biggest diffidence between VR game and other normal game could be the interaction method and VR gaming makes marvellous experience to players when interacting with virtual reality world. The last part is a concept that encompasses many aspects: realism. The development of VR technology is aiming to let people to experience another “real world”. Therefore, nearly all the part in VR technology is trying to make virtual world become more realistic. The realism does not means the virtual world need to get close to the real world, but it intend to create another world that we may see in the films.

After watching those experience videos, researchers consult those feeling and summarize in the dimensions of VR technology that selected from articles. Then, selecting these evaluations into four part and having both positive and negative summaries to them (**Table 2**). The external feel of the wearer is the most intuitive feeling of this new production. Nearly all the experiencers send back information that because of the better use of fixed straps and another retaining strap on the head, wearer feeling more comfortable than past head-mounted display. Another positive point is Apple vision pro has great heat dissipation. This is reflected in when wearers wear it for long time, they don't sweat around their eyes. However, the Apple vision pro still cannot sovle the problem that straining of the head and cervical spine after prolonged wear. The second view will on the vision part. Comparing to the previous devices, what we can see is very clear and the viewing experience is comparable to using a 4k screen.[3] From what Ethan Waisberg describe on June , 2023, Apple vision pro not just have a single 4K screen, but outputting the screens into the user's eyes using two small, high-resolution displays. It is the clearest head-mounted display on the market today. But Apple vision pro still have many to improve. One of the shortcoming is when users turn their heads around or just trun the camera shot to somewhere dark or is lack of light in virtual world, what they see would become vague. In addition, though Apple vision pro spare their best effort to increase resolution, it is impossible for them to let the field of view be maximized as with the human eye.Next, the only part without negative feelings is the audito part. We could glad to say that Apple vision pro do nearly prefect soundscape even though it does not have In-Ear headphones. When wearing Apple vision pro, people could not only apparently hear the sound in six directions, but also distance of sound can be clearly distinguished. Apple vision pro is good at masking the noise of the real world and better integration of people into virtual environments. The last part would still be the interaction. In reality the invitees had a very limited experience, but they told us that the capture of finger action when interact with hovering UI interface is very sensitive. Furthermore, the technology of capture of the movement of eyeballs is very mature on the Apple vision pro. The bad aspect is the interaction icons are noticeably blurred and vignetted when the finger is near. This inevitably makes it seem like it's not real enough. The development of the interaction interface and limited interaction method is hard to support a big VR game at the moment. In a word, Apple vision pro is a great but not perfect product.

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Table 1. dimensions of VR technology

Price (Expensive, Costs, Materials)
Portability (Heavy, Makes people feel tired, Stationarity)
Clarity (Resolution, Light and Shadow,
Perceptual capture of the human body and related functions (audito, Haptics,action, Emotions…)
Interactivity (Sensitivity, Interaction interface, Interaction methods….
Realism (Sense of distance, Sense of orientation and other things above)

Table 2. The feeling of experience Apple vision pro

Good feeling	The external feel of the wearer	Fixed straps are more comfortable. Good heat dissipation
	vision	Very clear compared to previous devices. The viewing experience is comparable to using a 4k screen. The clearest head-mounted display on the market today
	audito	Despite the lack of in-ear headphones, the sound is very clear and has a very realistic sense of direction.
	interactiveness	Very sensitive to monitoring and capturing finger and other movements
Bad feeling	The external feel of the wearer	Heavy, straining of the head and cervical spine after prolonged wear
	vision	The field of view cannot be maximized as with the human eye, and there is a noticeable blockage and black circle around the screen
	audito	no
	interactiveness	The interaction interface still feels very unrealistic, and the interaction icons are noticeably blurred and vignetted when the finger is near

4. Discussion

From the results above, we can find many interesting statements. In this discussion part, I would compare with the movie *Ready Player One* and make some observations. *Ready Player one* is directed by Steven Spielberg, which tell a story that in 2045, the disappointing real world on the brink of chaos and collapse has pinned its hopes for redemption on the Oasis, a virtual gaming universe created by the brilliant James Halliday by wearing VR equipment, people can enter a virtual world that is in stark contrast to reality.

In this section, I still classify comparison into four parts. Firstly, we need to know that Apple vision pro is just a head-mounted display (HMD). But in the movie, we also have Tactile Gloves, Emotion Controller, VR body suit and VR Omni-directional Treadmill. Therefore, it is impossible for just a head-mounted display to realize so many functions in VR game. Moreover, we can see that when they wear these devices, they can play it very long in the movie., This means that these devices have less burdensome to the human body. However, even though there have been so many products in the past, including the Apple vision pro, the problem of portability still can not solve. For VR gaming, a short using time like less than 2 hours in Apple vision pro for common players is not enough.

The second part is the vision. The most important of this is the clarity problem. Apple vision pro do better than past equipment, but still far from feeling a virtual world that is even remotely close to reality. The technology today is difficult to have resolution and clarity that rivals the human eyes. For example, imaging that if you immerse yourself in a “real world”, but it is a lot fuzzier than your real world. How would you feel. You may not only feel tired may see something not clear for long time to your eyes, but also the unreality will follow. This defeats the purpose of the virtual world. In the film, watchers cannot directly feel how real the Oasis is. But we could sense from their words and moods and behavior that they were very much immersed in the game and what see are very clear.

The third part is the audito. As stated in the paragraph above, Apple vision pro has great hearing experience. As far as the present situation is concerned, Apple vision pro do it right. From the information that experiencers send back, they feel like they're there when watching a movie or playing

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a game because of realistic sound effects. In addition to direct auditory nerve access to the system, Apple vision have nearly nothing to improve on the auditor part in current technology.

Last one is interaction. Interaction arguably the most difficult to realize. Apple vision pro improved interaction with virtual environments, but still cannot comparable to the film. Even if other parts are excluded, only the head-mounted display have many interaction methods in the film. We're glad to know this new product has facial scanning and eye tracking capabilities, even though the contours of hits scanned face and its expression appeared to be very stiff. For head-mounted display in the film, we can at least observe that it can send different signals to the system for different gestures and movements, but for the Apple vision pro, at least from the features shown so far, only the interaction of fingers and eyes with the virtual environment can be represented. Another point is human-to-human interaction. In line with current trends, multiplayer or online network games should be a great develop way which can reflect the strengths and features of the game. However, Apple vision pro do not such function and there's no such online game on the market either. The Oasis in the film create a environment or society that everybody can socialize and interact with each other, so VR technology still have much to improve in human-human interaction.

5. Conclusion

The launch of Apple company in sixth of June, 2023, bringing great surprise and shock to people. The Apple Vision Pro, as the most high-profile new product, sparking a discussion on VR technology and head-mounted display (HMD). It improves on many of the shortcomings of previous technology products. Though this new product is not yet officially on the market, we can get a feel for his features and strengths and weaknesses from his promotional videos, hands-on demos, and the experiences of some of the invited testers. After the research, we are glad to conclude that even some parts of creation of Apple Vision Pro have already reached the level of a real VR game shown in science fiction films. For example, the stereo surround sound performance is truly immersive, even though it does not have a traditional headband or in-ear headphones. However, as a multifunctional HMD, Apple vision pro technically cannot realize a VR game fully. It is not only because here's not much you can do as a standalone headset device, but also because it is only a small step for VR technology and people have much to do to reach the high level in science fiction. Smoother and more logical interactions, a visual experience closer to the real world and with unlimited possibilities for social features and human interaction, Apple Vision Pro or the VR technology have many aspects to improve. When the Apple vision pro come out, people are all talking about whether we have realized what the future world describes. The breathtaking of Apple vision pro is a real shocking to people. But in addition to a vision for the future, people need to know that there's still a long way to go to have our own Oasis. In other words, the scene in the film is still far away. Let alone realize what happened in the Matrix.

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