The Potential of Virtual Reality for the SDGs: Infrastructure Development through Content and Cultural Policies

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Abstract

Various studies and initiatives suggest that virtual reality can contribute to gender equality, education advancement, etc. While the use of emerging technologies requires the development of appropriate infrastructure, they can contribute to solving SDG issues relatively easily in developed countries. As the term "metaverse" has been used in recent years as a broader concept, it is important to create an environment that allows for-profit companies to utilize virtual reality as an activity related to ESG. To achieve these goals, we propose several policy measures. Policy makers and decision makers could effectively implement the above policy measures, especially by supporting the content industry and cultural aspects.

Introduction

Technology has always had an impact on cultural and artistic activities. Currently, various digital technologies are proliferating and their influence is manifesting on an unprecedented scale, rapidly and in more complex forms than ever before. In recent years, the term "metaverse" has been gaining social attention. Originally coined by the author Neal Stephenson in his science fiction novel "Snow Crash" to describe a fictional virtual space service, the term "metaverse" is now used to refer to large virtual environments and associated technologies in online spaces, although its definition is not necessarily clear [1].

In this study, we focused on the contents and cultural policies of virtual reality [1] (VR) within the metaverse and examined their potential for contributing to SDGs. We did not address NFT (Non-Fungible Token), which is a non-exchangeable token that allows the trading of data stored on a blockchain, or Web3.0, which is proposed as the next generation World Wide Web. As there are already research reports on the potential of the entire metaverse for SDGs, we introduce specific examples of VR utilization while making more detailed recommendations in this study [3].

Relationship between Technological Innovations and Cultural Art Activities in the VR Field

It is well-known that technological innovation and cultural art activities have a mutually influential relationship, and VR is no exception [4]. Figure 1 shows the relationship between them.

Figure 1. *The connections between artistic activity and digital technology [4]*
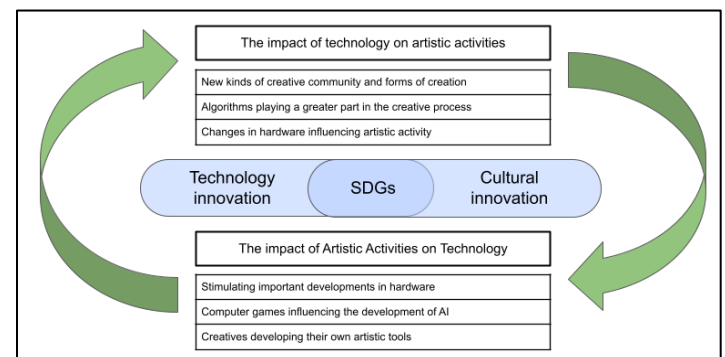
Below, we illustrate the relationship between technological innovation and cultural and artistic activities in the field of VR, along with specific examples (An Extension of [4]).

New kinds of creative community and forms of creation:

Digital technology has brought about new types of creative communities and cultures in VR space, making it easier for people with artistic skills to acquire technical skills [5][6][7]. In addition, there are new forms of creation based on online markets and platforms for digital design such as open source software, computer graphics, and 3D printing [8][9].

Algorithms playing a greater part in the creative process:

The further utilization of algorithms in the creative process is being promoted. For example, new technologies such as generative design and deep neural networks are contributing to the development of

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[1] A virtual 3D space built on the Internet that allows multiple users to participate and freely move around within it. Users can navigate the space by controlling an avatar, a virtual

representation of themselves, and interact with other participants. This concept typically applies to gaming environments or virtual event spaces [2].

advanced VR content and may have even greater influence in the future [10][11][12].

Changes in hardware influencing artistic activity:

The advancement in hardware has expanded opportunities for creative companies and artists to incorporate digital elements into their work and enter new markets [13].

Stimulating important developments in hardware:

The development of content is driving consumer demand for headsets and stimulating innovation and investment in VR hardware [14].

Computer games influencing the development of AI:

VR spaces are gaining attention as testing environments for AI, leading to the emergence of new applications for AI [15][16].

Creatives developing their own artistic tools:

There have been observed cases of technically skilled creators developing their own tools and developing VR spaces specialized for specific purposes [17][18][19].

In relation to the promotion of content and cultural policies related to virtual reality, the Japanese government, for example, has stated in the Basic Plan for the Promotion of Culture and Arts that "we will promote cultural and artistic activities utilizing digital technology to diversify expressive forms using metaverse". This indicates that it is also attracting attention from a policy perspective [20].

Specific examples of using VR for SDGs

Table 1 shows a list of the 17 SDGs and some VR initiatives related to content and culture that have the potential to significantly advance the core priority areas of the SDGs.

Table 1. VR Initiatives to Advance SDGs (An Extension of [21]).

Goal 1. End poverty in all its forms everywhere.
Deepening understanding of poverty to promote effective dialogue and policies [22]. Effective establishment of educational environments to escape poverty [23].
Goal2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
Utilizing VR technology and other digital tools to digitize agriculture can improve the productivity of food production [24].
Goal3. Ensure healthy lives and promote well-being for all at all ages.
Building a digital virtual world where social and economic activities beyond the limits of the real world can be conducted safely and freely, as well as providing therapy programs in VR spaces [25].
Goal 4.Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
Providing educational programs using virtual reality technology [26].
Goal5. Achieve gender equality and empower all women and girls.
Providing effective technology education programs for women using VR [27].
Goal6. Ensure availability and sustainable management of water and sanitation for all.
Providing effective VR tools for learning effective management methods for water resources [28].
Goal7. Ensure access to affordable, reliable, sustainable and modern energy for all.
Providing a workforce development program on renewable energy through VR technology [29].
Goal8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
Expansion of economic scale related to virtual reality [30].
Goal9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
Development of infrastructure as a national strategy. Acquisition of technical interoperability through virtual reality [31]
Goal10. Reduce inequality within and among countries.
Ensuring diversity of avatars in virtual reality spaces to achieve reduction of racial biases [32].
Goal11. Make cities and human settlements inclusive, safe, resilient and sustainable.

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| Provision of public services in virtual reality spaces [33]. |
| Goal12. Ensure sustainable consumption and production patterns. |
| Providing VR technology-based programs aimed at reducing food waste and decreasing post-harvest losses and other food losses in the production and supply chains [34]. |
| Goal13. Take urgent action to combat climate change and its impacts. |
| Using VR technology for eco-tourism to increase awareness of environmental issues and reduce resource consumption [35]. |
| Goal14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development. |
| Goall15.Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt & reverse land degradation and halt biodiversity loss |
| Using VR to Support Environmentally Sustainable Behaviours [36]. |
| Goal 16.Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels. |
| Utilizing VR in Criminal Justice Practice [37]. |
| Goal17.Strengthen the means of implementation and revitalize the global partnership for sustainable development. |
| Forming a global community related to VR [38]. |

Scientific and Cultural Artistic Potentials of Particular Interest

Encouraging the use of diverse avatars may promote the elimination of racial discrimination and gender equality. This is because the use of avatars with different characteristics from oneself can facilitate mutual understanding. For example, research has shown that using a black avatar by a white person can reduce implicit racial bias, and another study suggests that using an avatar of the opposite gender can deepen understanding of the opposite sex [39].

In fact, a report by the Japanese government shows that VR spaces are more easily liberated from gender, appearance, and social status, and are more likely to cross national and language barriers [40]. Large-scale surveys have shown that many male users are using female avatars, and in this case, there is a potential for a deeper understanding of women by men [41].

Figure 2. Gender in VR Space (Redaction of [41])
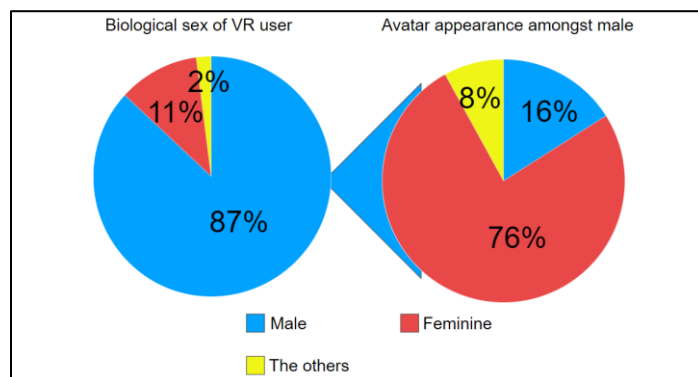
If the use of such avatars becomes more widespread, there is potential to create a society that respects and acknowledges each individual, regardless of superficial attributes such as gender, age, disability, or nationality.

Policy recommendations / conclusions

In order to maintain various examples and promote new initiatives towards achieving the SDGs mentioned above, a policy approach is essential. In this study, we present policy issues and options related to content and culture as follows.

Prevention of censorship by governments or platform operators

Preventing censorship by governments or VR platform operators and creating an environment where diverse content can be distributed is a crucial policy issue [42]. It is also important to establish the right to self-expression in digital spaces as one of the fundamental human rights. To achieve this, it is proposed to utilize partnerships and guidelines from the United Nations, such as the UN Guiding Principles on Business and Human Rights[2] and the Guidelines on a Principle-based Approach to the Cooperation between the United Nations and the Business Sector[3].

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[2] UN Guiding Principles on Business and Human Rights https://www.ohchr.org/sites/default/files/Documents/Publications/GuidingPrinciplesBusinessHR_EN.pdf

[3] Guidelines on a Principle-based Approach to the Cooperation between the United Nations and the Business Sector https://unglobalcompact.org/library/3431

Protecting Privacy in VR Spaces

In VR spaces, various illegal and harmful actions have been pointed out as possibilities [43]. There is a possibility that legislations will be enacted in each country to address various criminal acts that may occur in VR spaces. However, if VR platform providers are required to record all user behaviour, there is a possibility of invading privacy. It is necessary to discuss the deterrence of crime and the protection of privacy with appropriate stakeholders. Furthermore, if necessary, treaties and international guidelines related to privacy protection may need to be updated. This issue also raises the need to redefine the concept of "private" VR spaces to protect commercial and national interests [43]. Some countries with a high level of interest in VR have already started to take legislative measures. For example, in some countries, laws have been considered that would allow law enforcement agencies to order communication service providers to take technical measures to save user's VR space browsing history and block access to it [44].

Promoting VR Communities

As mentioned earlier, VR has great potential for achieving the SDGs. Therefore, it is proposed to promote the development of international frameworks for securing and educating a diverse range of talent, including not only engineers and creators, but also those in other fields such as collaboration, design, management, intellectual property, and legal personnel, to facilitate the promotion of VR communities.

Acknowledgments

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