



УДК 766/ 7.091

## MODERN TRENDS AND CHALLENGES IN VR/AR/MR- ENHANCED INTERACTIVE INSTALLATIONS

LIU Chengyang<sup>1,2</sup>, VASYLIEVA Olena<sup>1</sup>

<sup>1</sup>Kyiv National University of Technologies and Design, Kyiv, Ukraine

<sup>2</sup>Harbin University, Harbin, People's Republic of China

*liuchengyang@hrbu.edu.cn*,

*This paper delves into the evolving sphere of VR/AR/MR-enhanced interactive installations through a user-centered design lens, employing the "5W1H" design thinking framework to dissect modern trends, challenges, and user needs. By analyzing case studies, it identifies critical user expectations like immersion, ease of use, and educational value, alongside the core elements shaping these installations. Conclusively, the paper emphasizes the importance of prioritizing user needs and interdisciplinary collaboration in developing future immersive technologies, paving the path for a deeper, more intuitive user engagement across various sectors.*

**Key words:** *interactive installation, VR/AR/MR, 5W1H, design thinking, user experience design.*

### INTRODUCTION

User interactions with "computer graphics" open a new research gate in the general digital design area [1]. The virtual, half-virtual, and mixed environment creates different levels of experience in the design of interactive installations. The significant advancements in VR (Virtual Reality), AR (Augmented Reality), and MR (Mixed Reality) technologies allow for more sophisticated and immersive interactive installations in design, providing a fresh and engaging user experience. However, three categories of concerns were raised in light of the creation of VR/AR/MR-enhanced interactive installations: First, the modern trends in the design of interactive installations with the aid of VR/AR/MR technologies. How will the experience be different from the traditions of interactive installations? Second, the challenges faced by the designers of interactive installations. How do the designers balance the user experience and the application of new technologies? Third, the gaps between the modern trends and challenges in the VR/AR/MR-enhanced interactive installations. How could the designers direct the further development of interactive installations? In this paper, we prioritize the principle of user-centered design in the design and development of VR/AR/MR applications, which looks at the needs, preferences, and comfort of the end-user to clarify the reasons behind the modern trends and challenges. This approach is critical in ensuring that immersive technologies provide novel but also accessible and meaningful



experiences to a diverse audience. Using a framework in design thinking, we explore the questions in the three concerns with a framework of who, what, when, where, why, and how (5W1H).

### **PURPOSE**

Based on the design thinking framework “5W1H”, this paper want to gather factual information in the design of VR/AR/MR-enhanced interactive installations. Through an examination of recent advancements and case studies, we seek to highlight the potential of VR/AR/MR in transforming user experiences and pushing the boundaries of digital interaction.

### **RESULTS AND DISCUSSION**

Discussing the main stakeholders involved in VR/AR/MR-enhanced interactive installations requires the analysis of typical interaction design product design and development. Traditionally, it includes designers, developers, users, and content creators. In the path of user-centered design methodology, the first step of design is to analyze the users' roles, needs, and expectations. In the ten case studies, the authors analyzed various users' needs and expectations, including immersion and realism, intuitiveness and ease of use, interactivity and engagement, personalization and flexibility, educational and informative value, comfort and safety, social interaction, content quality and diversity [2]. On the other hand, the stakeholders interact with each other and the technology fosters a successful user experience in the design of VR/AR/MR-enhanced interactive installations. Of the top expectations, users expect a high level of realism in VR/AR/MR environments, where the virtual world mimics physical laws and offers high-quality graphics and sound. At the same time, users also expect a seamless blending of digital content with the real world, enhancing rather than disrupting their natural environment.

To define the core elements that make up the installations, it is crucial to analyze the applications of interactive installations. In the article, the authors list five applications, namely, (1) modeling, designing and planning (2) Training and education (3) Telepresence and Teleoperation (4) Cooperative working (5) Entertainment [1]. To understand the “when” questions, it is important to discuss the significant milestones of the modern trends and how they impacted VR/AR/MR-enhanced interactive installations. An early milestone is the westwood experience by narrating using mixed reality [3]. Later, one author listed the key developments in the VR/AR/MR-enhanced interactive installations, including the 3D pop-up book, showing virtual furniture in Salone del Mobile, augmented furnishings, and animated textiles [4]. Recently, a project named “The Most Beautiful Room in the World” explored the boundaries of video VR/AR experience and the wedding chamber installations. To clarify the modern trends and predict future trends, it is necessary to understand how these developments evolve based on past trajectories. To understand the “where” problems related to VR/AR/MR installations, there are two levels of questions that need to be answered. First, where do these developments happen? Second, what kinds of environment VR/AR/MR installations are being utilized? The new trends of VR/AR/MR installations mainly are articulated in North America, Europe, and Asia. The environments include museums, educational institutions, retail spaces, and entertainment venues.



Seeking the reasons for modern trends and challenges of VR/AR/MR installations requires a systematic view of the previous sections. From the users' needs and expectations, we can deduce unique benefits that VR/AR/MR installations could offer will be valuable, for example, immersive experiences, enhanced learning, and increased engagement. Exploring these areas creates new opportunities for users and designers. In terms of the "how" part, many cases delve into the process of designing and implementing VR/AR/MR-enhanced interactive installations. [3][4][5] From conceptualization to deployment, the questions are related to design principles, user experience considerations, technical challenges, and best practices.

### **CONCLUSIONS**

This paper underscores the significance of user-centered design in shaping the future of VR/AR/MR-enhanced interactive installations. The exploration of modern trends through the "5W1H" framework reveals a dynamic evolution driven by technological advancements and user demands for more immersive, intuitive, and meaningful experiences. The challenges highlighted, primarily around balancing technological integration with user comfort, pave the way for future research and development in this field. Furthermore, the diverse applications across different sectors underscore the versatile potential of VR/AR/MR technologies in transcending traditional boundaries and enhancing user interactions. Moving forward, designers and developers are encouraged to prioritize user needs and leverage collaborative, interdisciplinary approaches to navigate the complexities of modern interactive installations.

### **REFERENCES**

1. Shah, M., Mehta, P., & Katre, N. (2017). A Review of New Technologies: AR, VR, MR. *International Journal of Computer Applications*, 171(7), 40–44. <https://doi.org/10.5120/ijca2017915122>
2. Akpan, I., Marshall, P., Bird, J., & Harrison, D. (2013). Exploring the effects of space and place on engagement with an interactive installation. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2213–2222. <https://doi.org/10.1145/2470654.2481306>
3. Wither, J., Allen, R., Samanta, V., Hemanus, J., Tsai, Y.-T., Azuma, R., Carter, W., Hinman, R., & Korah, T. (2010). The Westwood Experience: Connecting story to locations via Mixed Reality. *2010 IEEE International Symposium on Mixed and Augmented Reality - Arts, Media, and Humanities*, 39–46. <https://doi.org/10.1109/ISMAR-AMH.2010.5643295>
4. Kolstee, Y. (2013). Interactive AR Installation: Lessons Learned in the Field of Art, Design and Cultural Heritage. In W. Huang, L. Alem, & M. A. Livingston (Eds.), *Human Factors in Augmented Reality Environments* (pp. 257–273). Springer New York. [https://doi.org/10.1007/978-1-4614-4205-9\\_11](https://doi.org/10.1007/978-1-4614-4205-9_11)