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The Role of Artificial Intelligence and Virtual Reality in Improving User Experience in Interior Design

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Abstract*— The following article tries to look at how AI/VR technologies can be integrated into interior design processes, and how they can have a profound effect on user experience and traditional design processes. It also addresses the gaps and its opportunities in understanding the transformative impact of integrating AI and VR technologies into interior design and their pervasive impact on user experience, particularly on the professional and educational traditional design processes. In addition, the synthesis emerging from this study seeks to highlight the evolving role of these technologies in reshaping traditional design processes, decision-making mechanisms, and user experiences in interior design careers. In relation to these a general evaluation of common AI platforms highlights the need for a deeper understanding and development of user experiences and interface variations. In overall, it is underlined that AI and VR could very well enable students, interior designers, and educators to adapt to more advanced ideas, fostering creativity and critical thinking. Acknowledging the small number of studies that have been carried out predicting the future of the industry only, but not specifically addressing the interior design industry, educational environments, and its career prospects, it is important to focus on the future of the interior design profession as well as its upcoming education curriculum outlines. Therefore, the following analysis aims to provide and combines new insights into the practical applications of AI and VR integration in interior design, offering specific observations on how these technologies enhance users' decision-making processes and improve the quality of interior designs through improved spatial visualisation and interactive experiences. The study also aims to suggest that the integration of AI and VR in interior design is crucial to remain innovative, up to date with the industry, increase the new generations user satisfaction and prepare professionals and students for the evolving landscape of the industry. In conclusion, the research attempts to close existing gaps in the literature, contributing to the understanding of the dynamic interaction between artificial intelligence, virtual reality, and interior design paving the way for innovative developments in this field.

***Index Terms*— Artificial intelligence (AI), Interior Design Career, User experience (UX), Virtual reality (VR)**

I. INTRODUCTION

The research question at the core of this paper is how the integration of AI and VR technologies into interior design has a transformative impact on the user experience in traditional design processes as well as in the educational curriculum. Specifically, the study seeks to understand the impact of this integration on traditional interior design processes and how it affects the user experience in decision-making and the required design process. Within this framework, a conclusive hypothesis suggests that the integration of AI and VR technologies into interior design processes may require significant technical and intellectual changes in the professional and educational environment and design. The subsequent hypothesis suggests that this integration shift will lead to changes in interior design careers and education in terms of user experience, with its diversity of design outcomes and accelerating effect.

It can be observed that in recent years, AI has become an indispensable creative partner for designers. AI's role in design is not only limited to streamlining processes but also extends to offering fresh perspectives on aesthetics too. By integrating AI, designers are ushering in innovative possibilities across various design disciplines, including architecture, interior architecture, and art [7]. As AI's role expands, it inevitably raises questions about its impact on interior design careers and its educational curriculum. AI seems to be no longer just a tool but an active collaborator, revolutionizing the industry. The integration of AI into interior design education could to equip students for a new technology-rich future. If so, it is indispensable that professionals and educators must adapt to this shift, prioritizing AI knowledge and programming skills in all professional and educational phases. Embracing a world of interdisciplinary teaching, AI & VR technologies prepares students for the dynamic nature of the developing industry, making AI a trans-formative force that fosters creativity and prepares the field for a technology-driven future [1]. Moreover, not only professionals but also design students are also reaping the benefits of AI. For example, recently AI applications like Mid-journey and Dall-e have enabled students to gain in-depth insights into the intricate world of interior spaces [2]. These tools have proven highly productive, enriching students' understanding of design elements, spatial functionality, and the creative process itself.

The most essential factor of VR is aimed at visual design which will affect the design approach and analyzes in many aspects. For example, while performing real-time rendering

in a virtual environment the VR creates a combination with the given interior design that allows and improves the user's visual and sensual interaction with the space. In overall, artificial intelligence-supported interior design includes a lot of feature options and possibilities to experiences spaces. Features that provide convenience and decipherability for the user also increase the consistency between the user and artificial intelligence and the quality of the interior designs that come out of the artificial intelligence system [3]. The current introduction of VR technology in interior design started to revolutionized the way customers experience interior design services. Clients seek more and more immersive and realistic spaces, which traditional design often struggles to deliver. In this context, VR technology adds a new dimension, allowing users to step into virtual representations of their future spaces [4]. The combination of AI with VR, also enriches the user experience, offering immersive 3D environments where users can explore and interact with their designs. The increasing integration of AI in computer-aided design, particularly in interior layout planning, highlights the development of an AI-powered interactive system for managing indoor and three-dimensional spaces [5].

Furthermore, AI analyzes various user requirements and functions to determine factors such as sizes, materials, and styles, aligning the layout with customer preferences. Thanks to the present-day features provided by artificial intelligence, the user can realistically experience interior design and elements such as room layouts, materials, furniture, and lighting. Therefore, the integration of AI and VR is reshaping interior design, enhancing user experience (UX), and creating a profound connection between design and its lifestyle. Overall, AI seems helping to create immersive-sensual environments where users can interact and manipulate elements in the virtual space [6]. By considering all these observations, artificial intelligence gives the user options instead of a definite result. Options which help interior designers to support more effectively realistic outcomes and choices.

II. EVOLUTION OF AI IN INTERIOR DESIGN

As stated earlier, interior design and other design disciplines have undergone significant transformation in recent years with the emergence of AI Technologies [10]. However, with the emergence of artificial intelligence technologies and their involvement in interior design processes, a new era has begun. It was generally based on traditional design methods in interior architecture, such as drawings, physical models, concept boards, etc., which revealed the designer's ideas [8]. Thus, design processes developed with traditional design methods in interior architecture have begun to be replaced by artificial intelligence-supported methods. [7] From this aspect, during the phase of the decision-making process, the issue that is more important is not only giving results but more creating flexible design results. Hereby, it is also observed that the accuracy of the artificial intelligence decision-making mechanism works effectively only when the process is consistent. The machine meets the user's requests, but if the user decides what they want and gives the appropriate prompts, AI can give the result close to the request. Previous studies indicate that since the machine has a limited ability to interpret, it should ask the machine to decide exactly what the user wants by expressing it correctly to the machine [7].

Until now the literature [8], usually refers to the interfaces of most common AI platforms (Midjourney, DALL·E 2, and Stable Diffusion) its differences and that its platforms that offer different options for accessibility, user interaction, and community collaboration. Furthermore, these studies draw the attention to the interface differences of existing artificial intelligence art platforms, which can positively and negatively affect the user experience in terms of architecture and design applications. In these analyzes the AI platforms are discusses by its sufficient and inadequate aspects and the ability to present and develop ideas, visual sketching, image combination, collage creation, plan creation, technical drawings, animations and creation of structure-style variations. According to these findings [8], it is emphasized only technically that the effectiveness of artificial intelligence in comprehending and fulfilling requirements varies depending on the complexity of the given task. Additionally, it is mentioned that design details, complex requests and technical issues may fail to deliver exactly what is desired. The focus of recent research underlines until now the uncertain and complex results resulting from user experiences that may lead to support in the development of these platforms by training different data sets to artificial intelligence [8].

According to the critical part of some research it is assumes that artificial intelligence will replace human intelligence in many professional disciplines, such as interior architecture in the field of design, and that some professions will disappear [1]. Radically in the professional field as well as in education, we can say that this will show the integration, development, and use of artificial intelligence within the time design field.

A. Enhanced Creativity in Design Education

Somehow in certain institutions artificial intelligence is tried to be integrated into educational fields such as art design-oriented architecture and interior architecture by getting incorporated in design curriculum, contributing as a collaborative tool in both the learning experience and the design process itself [9]. It is mentioned that students can harness the power of AI to explore more advanced ideas, styles, and spatial results.

As discussed in several research papers, artificial intelligence may offer strengths for students within the scope of interior design education by improving the learning experience and the process itself. As an auxiliary tool in the creative design process, it allows students to explore design options. In a recent paper by Khalil, Raza, & Venaik using AI

in interior design education they offer an opportunity to choose between different options and it allows students to understand the importance of balancing diverse ideas in interior design and helps them develop a conscious design approach [7]. As an AI output, the architectural design in its abstract framework shows also the compatibility with the "real" space, so that the conversion of the real space into holistic projects helps the students evaluating a project as well as it underlines the supporting role in education. In a world that has evolved and is evolving very fast into an order dominated by technology and automation, the use of artificial intelligence in interior design education is vital and prepares students for a technology-oriented world [7].

Furthermore, while artificial intelligence applications enhance as an innovative tool by integrating into art and design education, they not only present several opportunities but also challenges. By encouraging students to incorporate artificial intelligence tools into their creative processes, positive effects on their production processes are mentioned, as emphasized by Ceylan [9]. Here, artificial intelligence tools provide students with unique, numerous, and fast design ideas, enhancing their ideas and creativity in the design process. AI applications helping students develop critical and original ideas can also contribute to reducing plagiarism rates. As a result, artificial intelligence applications promise promising effects on students by improving their creativity and originality and accelerating their design and concept processes. [9].

Additionally, educator's express concerns about the potential threat to students' originality and academic development when they observe rapid and facile learning facilitated by artificial intelligence tools, as noted by Fathoni [10]. Also, the study emphasizes that is also crucial that educators are constantly informed of the current developments in the integration of artificial intelligence technologies, which are being developed day by day, into education. At the same time, artificial intelligence applications that offer fast and easy results also cause students and designers to move away from and/or question traditional ways of design thinking and design sensing. Despite these challenges, the integration of artificial intelligence-based solutions in education offers hope for preparing students and educators for the rapidly changing digital world. It helps provide the necessary skills for developing artificial intelligence technologies by promoting a new way of seeing originality, innovation, sustainability, and academic integrity in the field of each art and design education [10].

III. VR'S ROLE IN INTERIOR DESIGN

Considering the study of Kim & Hyun, virtual reality technology provides a more realistic spatial experience by allowing users to directly experience 3D spaces [11]. In spatial design processes, VR technology can improve user experience by providing a more satisfying and immersive environment in terms of spatial perception and design concept development. Unlike traditional design processes, the use of virtual reality (VR) in design processes can increase the level of perception and decision-making process by creating a perception of space close to reality in users. Kim & Hyun emphasize that user experiences show that the users are more satisfied with the design experience in VR, and this is because the users are impressed by the increased realism and persuasiveness of the designs created in the virtual environment [11]. Although the design process is longer compared to VR user experiences, the design experience in VR is more satisfactory for users compared to the traditional environment. VR technology provides a more realistic and immersive interaction for user experiences, making spatial relationships more understandable [11].

Based on the given literature it can be observed that VR has a visual developer effect. While performing real-time rendering in a virtual environment, VR provides an interior design which allows and improves the user's interaction. Additionally, artificial intelligence-supported interior design includes a lot of feature options. Features that provide convenience and decipherability for the user also increase the consistency between the user and artificial intelligence and the quality of the interior designs that come out of the artificial intelligence system. The features provided by artificial intelligence to the user are important factors for interior design, such as room layouts, materials, furniture, and lighting [4].

As mentioned by Du & Zhu, the usage of VR in interior design will also affects the traditional structure of design thinking and the educational design principles like balance, unity, hierarchy, ratio-proportion, conformity, contrast, and dominance [12]. Moreover, they mentioned that VR may provide the opportunity to determine how the interior will look before the application and to correct possible design errors in advance without the cost of implementation. The projected corrections lead up to the proximity of the design to the desired result and the formation of possible new ideas in the design. The per-implementation presentation of the indoor project with virtual reality makes a positive contribution to the future of the project [12].

A. VR-Supported Interior Design Education

Considering a recent paper by Collins, Greer, & Meggs, VR in interior architecture education seem to increase the ability of design students to think independently [13]. Virtual reality seems to increase interaction between students and supports learning through teamwork too. In fact, the virtual environment is also an infinite world of creation, in which the development and combination of two "creative minds" seem to provide a larger infinite freedom of choice.

In the sense of all the above-mentioned ideas and observations, the VR technologies could create a more decentralized student-centered learning environment in interior design education.

IV. DISCUSSION

The given paper proposes that the emergence of Artificial Intelligence and Virtual Reality technologies and their integration into the field of architecture and interior design, professionally and educationally, indicate a significant upcoming change in the traditional design processes for all users. These technologies are providing not only new creative ideas patterns, but also realistic experience opportunities for design users.

The article has focuses on the general effects and possible consequences of the integration of these technologies into interior design careers and education as their role in the field of interior design expands.

As we have mentioned, Farag, notes that the limited number of publications that have been conducted only predicts the future of industries in general, without reference to the interior design industry and career prospects in particular [1]. In particular, these studies lack specific references to the interior design sector and do not address the future prospects of careers in this particular field. Therefore, paper has explored, suggested and emphasized the major gap in the existing literature and highlights the need for further exploration and dedicated research into the distinctive aspects of the interior design industry and its preliminary education.

As mentioned above the impact of artificial intelligence on interior design careers has already an active collaborator in interior design processes. Nowadays, several interior designers are working with artificial intelligence to generate various ideas and speed up the process in their design processes. Several research highlights the impact of artificial intelligence on the design decision-making process but also emphasizes the importance of open communication between the user and artificial intelligence to provide harmonious and consistent results that meet user expectations [7].

Additionally, through evaluation of the most common AI platforms such as Midjourney, DALL·E 2, and Stable Diffusion, it has shown that further studies are needed to understand and draw conclusions based on user experiences in the interface differences between the platforms [8].

Until now this study offers a prelaminar innovative viewpoint on the findings, demonstrating that teachers and students could monitor and develop artificial intelligences and its evolving impact. Also, the review demonstrates that the integration of artificial intelligence into education brings with it both opportunities and questions in the academy. AI and VR technologies accelerates and improves the design processes of artificial intelligence by helping students not only to develop new creative ideas, but also requires new teamwork structures, responsibilities, and decision-making patterns.

Finally, we can conclude that the usage of Virtual Reality technology and its integration into the field of interior design in recent years designate a particular replacement in the design processes of users. With the virtual technology, creative ideas and realistic experience opportunities were provided for users. The study tried to focus on VR's role in interior design and education as their role in the field of interior design in terms of supportive effect. The findings show that within the vast possibilities of creation the interior design students must learn to focus more on their needs (philosophical and functional) and to learn already in the early stage of education being able to evaluate independently when they apply virtual reality in their coursework. In the professional life, VR and AI saves time and money and it is also useful while giving the customers a prelaminar sense of the interior space.

V. CONCLUSION

These synthesized findings reveal that the integration of AI and VR into interior architectural design is an innovative phenomenon which is rapidly developing day by day. While this research offers opportunities for creativity, innovation, and fast design processes, it also draws attention to the integration of artificial intelligence in traditional design and education fields in interior architecture in terms of user experience.

As AI and VR technologies continue to develop, artificial intelligence will have a major transformative effect in reshaping interior design processes and the educational environment. An effectively working AI and VR system is dependent on the quality, real data we use to develop interior designs, and how the boundaries of the interior design process are drawn depends on the talent, flexibility and imagination of the interior designer. Although floor plans and renderings are partly part of this work today, soon interior design will become one of the main pillars of it.

After all, it is seen that there is challenging research and teaching ground out there for design curriculum and more detailed future studies in this field will underline its possible opportunities and developments in all aspects of design and life.

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