BOOK OF PROCEEDINGS

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13th - 14th October 2023

ISSUES OF HOUSING, PLANNING, AND RESILIENT DEVELOPMENT OF THE TERRITORY

Towards Euro-Mediterranean Perspectives

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Issues of Housing, Planning, and Resilient Development of the Territory Towards Euro-Mediterranean Perspectives

Conference Theme and Rationale

Albania, along with other Western Balkan countries, has undergone significant economic, social, and political changes in recent years. As a result, housing, planning, and the resilient management of territorial development have emerged as critical issues. This is because these regions face significant challenges in providing affordable housing, addressing the impact of urbanization on the environment, fostering evidence-based decision-making on the territory, and bringing forth the commitments towards climate neutrality.

The organizers use the term "multi-modality" to define complex situations (in matters of territorial planning, management, architecture, housing, public space, technology, etc.) that have historically encompassed Western Balkans and Mediterranean cities in a logic of coexistence and value co-creation. A combination of knowledge and heritage that throughout time and history have given life to civilization in this region of Europe. The active involvement of Albania in the existing network of the Mediterranean Basin and the EU, through a joint action plan with UN / UNECE, and the Albanian and regional authorities, including reputable scientific bodies such as the Academy of Sciences of Albania, makes this conference even more intriguing to explore fascinating areas of research. The conclusions, to be considered as a stage for open innovation, will include recommendations for further scientific and applied research, projects, and events.

The geographical focus of the conference covers three dimensions: i) Albania; ii) the Western Balkans; iii) Euro-Mediterranean countries. POLIS University aims to focus on the above-mentioned research areas that are of common interest to both Western Balkans and Mediterranean cities, including, but not limited to: housing policies, urban history and architecture typology, innovation and digitalization in urbanism, energy efficiency, resilience and environmental sustainability, governance and smart technologies for city management, education and gender aspects in urban planning research.

In this regard the main aim of this international conference is to bring together scholars, policymakers, and practitioners to examine the pressing issues of housing, planning, and land development in these regions, in a context of transition fatigue, climate challenges and post-pandemic realities.

Issues of Housing, Planning, and Resilient Development of the Territory Towards Euro-Mediterranean Perspectives

Conference Aim

The main aim of this international conference is to bring together researchers, policy makers and practitioners to examine the urgent issues of housing, planning and land development in these regions, in a context of transition, climate challenges and post-pandemic realities.

Objective

-Consolidation of the cooperation network between Albanian and non-Albanian researchers, lecturers, managers, with the aim of participating in joint research projects at the regional and international level;
-Support of local authorities with contemporary data, on the state of housing issues, planning and sustainable urban and environmental management, as well as representatives of public and private institutions operating in this field.

The conference is organized by POLIS University (U_POLIS) in cooperation with the Academy of Science of Albania, and supported by other local and international partners.
In the framework of resilience, the main conference theme is devoted to Issues of Housing, Planning, and Resilient Development of the Territory from a Euro-Mediterranean Perspective, including Albania, Western Balkans and the Mediterranean Basin. This event aims to bring together academics, policymakers, researchers, experts, practitioners, and stakeholders from diverse backgrounds to discuss and address critical challenges related to housing, urban planning, and the development of resilient territories.

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Table of Content

Examining the Use of VR Technologies to Improve Architectural Visualization and Immersive Design
Experiences Virtual Reality for Architectural Visualization

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Abstract

When we think about architectural design what comes to mind is the final result, this being the visualization ofthe proposed structure, which enables architects to successfully present their concepts to customers, stakeholders, and the general public. Advancements in technology systematically keep transforming the way architects present their work, from traditional methods such as drawings, renderings and physical models to digital representation. Although these techniques offer useful presentation, they frequently fail to capture the real spatial experience and sense of immersion that buildings offer. Today, Virtual reality (VR) technologies offer an either further advancement, and are effective tools for improving architecture visualization and offering immersive design experiences. This paper will look into the potential of VR for architectural visualization as well as its effects on how architects communicate and make decisions.

By building immersive, engaging, and realistic virtual worlds that closely mimic the sensation of being inside a built location, virtual reality presents a potential to reduce this gap. The study evaluates the effect of VR on architectural vision from various angles. What are the benefits of VR? Does virtual reality truly capture an authentic spatial experience? This prompts the need to assess how VR can enhance design communication. This involves facilitating interaction and immediate input among stakeholders like architects, clients, and others. Additionally, it requires contemplating how VR can facilitate collaborative design procedures. One way it achieves this is by aiding architects in appraising design alternatives and experimenting with light conditions.

However, while presenting opportunities, the pragmatic application of VR includes many obstacles to its acceptance. These considerations encompass factors such as accessibility and the necessity for specialized knowledge and tools. The study also outlines fundamental principles and optimal approaches to effectively integrate VR into architectural visualization workflows. This is realized by conducting a thorough examination of existing literature and case studies. The investigation delves into various VR techniques and their real-time interactivity, along with their impacts on architectural design and communication. In addition, the human elements that influence VR experiences will be taken into account such as user comfort, presence, and the risk for cognitive overload. The results of this study demonstrate how virtual reality can revolutionize architectural visualization. Suggestions for architects, designers, and stakeholders include how to use virtual reality (VR) to improve decision-making, increase design communication, and provide more captivating and immersive architectural experiences.

Keywords
Virtual Reality (VR), Visualization, Architecture, Digital Tools, Spatial Experience

Introduction

Virtual Reality (VR) has emerged as an advanced technological field that is reshaping a multitude of industries, and the domain of architecture is no exception to its transformative influence. Characterized by its capacity to forge immersive and interactive digital environments, VR has led architects into a new era of visualizing and conveying design concepts. This research delves deeply into the applications of VR within the architectural domain, emphasizing its pronounced role in amplifying architectural visualization and creating immersive design experiences. By analyzing the assimilation of VR technologies into the architecture profession, this study seeks to illuminate the potential advantages, challenges, and far- reaching consequences of this technology-driven metamorphosis.

Within the realm of architecture, the task to create intricate design visions and spatial ideas to clientele and stakeholders has conventionally relied upon 2D drawings and static 3D models. Although these conventional depictions have yielded valuable insights, they often fall short in demonstrating the complexities in architectural spaces. This shortcoming can breed misconceptions, misinterpretations, and a deficiency of stakeholder engagement, potentially impeding the decision-making course and the overall triumph of a project.

With the invention of Virtual Reality, an innovative technology that has unfurled a horizon of opportunities, enabling architects to submerge their clients within a virtual dimension where architectural visions take tangible form. Through the adept utilization of head-mounted displays (HMDs) and motion- tracking controllers, Virtual Reality (VR) ushers in an unmatched ambiance of presence and interaction, enabling users to traverse and engage with architectural realms in ways that previously existed solely in the realm of imagination. With its prowess to replicate authentic lighting scenarios, detailed textures, and even ambient sounds, VR emerges as a practice that offers a genuine portrayal of conceived structures, elegantly improving the features of traditional static presentations.

The incorporation of Virtual Reality (VR) technologies into architecture has introduced a fresh dimension to the narrative of architectural representation. Architects and their clients are now afforded the opportunity to digitally explore architectural structures, gaining direct exposure to aspects like size, proportions, and spatial relationships. This interactive journey not only captivates clients' interest but also equips them with the capacity to form knowledgeable assessments regarding design complexities, materials, and spatial arrangements. This empowerment fosters a deep sense of engagement and cooperation during the design journey, amplifying collaborative efforts and cultivating a stronger connection with the creative evolution.

Beyond its role in visualization, Virtual Reality (VR) means a transformative stance in the realms of design iteration and exploration within architecture. It empowers architects to prototype and delve into a spectrum of design alternatives in real-time, thereby making easier and more efficient decision-making. This iterative design process is becoming crucial for enhancing the crative ideation and encouraging the exploration of unconventional ideas that could have eluded attention within the constraints of traditional design methodologies.

Furthermore, the potential of VR unfurls in the domain of collaborative design experiences. It creates an environment wherein multiple stakeholders, architects, and designers collaborate within a shared virtual realm concurrently. This real-time collaborative discourse overcomes geographical constraints, nurturing a seamless exchange of communication and feedback even for teams spread across global precincts. Harnessing the collective reservoir of expertise, this mode of interaction refines designs, mitigates concerns, and achieves consensual convergence more efficiently, resulting in architectural outcomes of heightened distinction.

However, using new technology like virtual reality in architecture comes with problems that need careful thinking. When architects start using VR in their work, they might need to spend a lot of money on special equipment and software. Also, changing from the usual way of designing things to using VR might mean that architectural companies have to train their staff a lot and provide them with extra help. It's really important to deal with these issues so that we can make the most out of VR's amazing possibilities. This could lead to a big positive change in how we visualize and design buildings, like a new era of creativity.

As Virtual Reality (VR) continues to make a significant impact on the field of architecture, it becomes essential to thoroughly explore its various uses and consequences. This paper work aims to comprehensively examine the many ways VR technology is being employed in architecture. It seeks to uncover the advantages, challenges, and potential future possibilities of integrating VR. By carefully studying real-world examples and instances of success, our goal is to provide strong evidence for the benefits that arise from incorporating VR into architectural practices. In doing so, we hope to inspire architects to embrace this transformative tool, enhancing the way designs are visualized and bringing about a new era of immersive experiences that hold remarkable potential.

Literature review

The integration of Immersive Mixed Reality (IMR) technologies has been acknowledged in various studies [2, 8, 9, 10, 11] as significantly beneficial across design, construction, and operational domains. These technologies have lots of benefits, like safety assessment, training people better, planning spaces more efficiently, and designing things to work well. They can also help with other important aspects like lighting, interior design, and managing buildings. But even though IMR has brought great ideas to architecture and construction, the arrival of Virtual Reality (VR) technology has opened the door to even more exciting possibilities. This new technology lets us experience things in an even more advanced and sophisticated way.

The use of Virtual Reality (VR) in the field of architecture dates back to the late 19th century, marked by early attempts that featured basic simulations employing low-resolution visuals [1]. As technological progress was made, particularly in terms of enhanced computer processing capabilities and graphics performance, VR underwent a transformation, facilitating the development of detailed applications in architecture. In the contemporary context, VR has become a key instrument in architectural design. Its usefulness has been increased by advancement of powerful Graphics Processing Units (GPUs), the availability of high-resolution Head-Mounted Displays (HMDs), and the evolution of real-time rendering engines, contributing altogether to its integration.

IMR is a larger term that includes a variety of reality technologies, from fully virtual to completely real- world scenarios. Within this spectrum, virtual reality (VR) is a technology that creates fully artificial virtual worlds in order to offer immersive experiences. VR is one of the layers of IMR, which also covers other forms of immersion. IMR technologies enable dynamic engagement in design and construction tasks, while VR's immersive characteristics encourage transparent communication and enthusiastic participation. According to Regenbrecht and Donath, "the component of communication which takes place in a computer-generated synthetic space and embeds humans as an integral part of the system".[2]

However, Portman et al. (2015) presented one of the most recognized definitions of VR, stating that VR is a computer generated and simulated environment where individuals can perceive an exceptionally realistic experience.[3]. In contrast to other visualization methods, VR shifts its users from being passive onlookers to active actors.

The level of immersion experienced by users in VR environments is influenced by various elements such as display resolution, user interface, field of view, and lighting realism [4]. Particularly, the ability of HMDs to deliver complete immersion plays a crucial role in establishing a sense of presence within virtual spaces [5]. Presence, in this context, refers to the extent to which users feel connected to the virtual environment, distinct from the physical surroundings. The term immersion is sometimes mistaken to describe the experience of presence. In fact, these terms refer to quite different things. The term immersion refers to the physical extent of the sensory information and technology characteristic of the sensory modalities, while presence is a perceptual parameter. [6]

Despite the growing interest in immersive technology applications in the architectural and construction sectors, there have been very few studies that have examined the major difficulties that come with their use and lack of results or information. This study conducts a comprehensive analysis of the available research data to close this knowledge gap and provide a better understanding of the state-of- the-art immersive technology use in the architecture and construction industry. It creates a general classification with a variety of dimensions based on a wide range of academic articles. The results of the search revealed these challenges:

1. Cost and Infrastructure: The initial cost of purchasing VR hardware and software might be high. Some of the most important infrastructural issues and challenges are device weight, display brightness, view angle, and device portability. [12][13][14]

2. Hardware and Compatibility: High-performance hardware, such as potent computers, graphics cards, and VR headsets, are necessary for VR systems to function properly. It can be difficult to make sure that various hardware components work together seamlessly and are compatible. It is crucial to address the issue of interoperability between different construction design tools, such Autodesk Revit, and VE game engines, like Unity 3D and Unreal Engine, in order to streamline the workflow of architecture and construction.

Many software providers have recently tried to close this gap via middleware, including Unity. These advancements need more polishing and iterations using middleware programs because they are still in the early stages. Additionally, the transfer of BIM models and their meta-data into the Unity game engine to offer an immersive experience has been simpler with the release of Unity Reflect. It is still difficult to create interactivity, which necessitates customized algorithms. [15][16]

3. Algorithm development: It might be difficult and time-consuming to create VR applications and simulations for architectural reasons. Specific development skills are needed to create a virtual environment that is interactive, educational, intuitive, immersive, and illustrative.

4. Learning Curve: The ability to navigate and engage with VR environments may be something that architects and other stakeholders need to master. The uptake and effectiveness of VR technology in architectural workflows may be impacted by this learning curve.

Collaboration is essential to overcoming these challenges. To reduce the initial high costs, improve device compatibility, and streamline procedures, stakeholders must engage closely with technology providers. In addition, nurturing skill development is essential to maximizing the potential of immersive technologies, particularly in the area of algorithm development. Finally, reducing the learning curve and guaranteeing a more seamless integration of immersive technology into architectural practices will be made possible by spending money on thorough training and user-friendly interfaces. The design and construction industry can take full use of immersive technology and stimulate innovation and efficiency in the built environment by understanding and addressing these issues.

Methodology & Tools

We conducted a thorough analysis of the most recent literature in order to uncover important insights and achieve our study goals. This required carefully analyzing a number of academic papers, studies, and real-world examples that provided light on the use of virtual reality (VR) in the field of architecture. Our goal was to gain a solid understanding of how VR is enhancing the way we construct architectural plans and interact with immersive environments by deeply engaging with this vast body of knowledge.

Through the implementation of surveys and engaging in interviews with professionals spanning architects, designers, and experts specialized in VR technology, we have acquired direct and first-hand information. This dataset, once acquired, will undergo a comprehensive analysis, delving deep into its results. This analysis aims to bring to light important conclusions concerning the tangible elements, advantageous outcomes, and potential obstacles entailed in the seamless integration of VR into the multifaceted procedures within the field of architecture.

We will closely analyze the data from the survey responses to uncover common themes, noticeable shifts, and connections between different pieces of information. This research project aims to draw firm and reliable conclusions about how valuable VR technologies are when it comes to showing architectural ideas visually and creating immersive design experiences. By blending the findings from the surveys with the information we gathered from reading existing studies, we want to gain a clear understanding of the role VR plays. The outcomes will shed light on the current status of using VR, pinpoint the places where it has made a big positive impact, and also bring attention to problems that need solving to make VR a more integral part of the field.

Conclusions and recommendations

The survey conducted among Virtual Reality (VR) users has shed light on diverse perceptions, experiences, and anticipations linked to the implementation of VR within architectural contexts. The investigation sought to unravel whether VR genuinely captures spatial experiences, and a significant 62.5% affirmed its effectiveness, further fortified by an additional 25% strongly agreeing (Figure 1).

Focusing on the realm of immersion, the survey uncovered crucial factors contributing to the sensation of being immersed in virtual surroundings. Around 52% attributed their immersion to top-notch visual quality, underscoring the crucial role of high-quality graphics. Field of view also grabbed attention, with 50% acknowledging its impact, followed by head tracking with the same value. Moreover, the liberty to move and interact, encapsulated by freedom of movement, was chosen by 23% of participants as a crucial enhancer of their immersive experience. (Figure 2)

The potential of VR technology in architectural design studios emerged with overwhelming positivity. A high group of 42.5% strongly agreed, while 52.5% agreed on the effectiveness of VR-based applications, indicating a widespread consensus on its valuable contribution. (Figure 3)

The survey further emphasized the educational value of VR, with a significant majority – 65% in agreement and 12.5% in strong agreement – advocating for its integration into academic instances. This endorsement of VR's potential to enrich teaching methods and educational contexts was noteworthy. (Figure 4)

Examining the question as to why VR is gradually integrating into architecture, the participants' responses exhibited a nearly equal distribution among a range of influential factors. These factors include challenges such as constraints within technical infrastructure, the complexity of learning curves, reluctance towards adopting change, noticeable gaps in practicality, insufficient awareness, and a lack of educational resources. Together, the fusion of these factors outlines the combined

obstacles that collectively prevent a smoother and quicker adoption of VR within the domain of architectural practice.

Derived from the study's insights and wider research landscape, it's evident that VR possesses transformative potential in architectural design studios. Meeting benchmarks, spanning design innovation, representation, and communication, VR emerges as a more dynamic, interactive, and captivating design process. Its role as a complement to established methods, rather than a replacement, is undeniable. This offers pathways for real-time rendering, parametric exploration, and sensory feedback, enriching architectural creation and communication.

To sum up, virtual reality won't take the place of the current screen-based design review process. VR, however, offers a useful addition to the conventional methods.

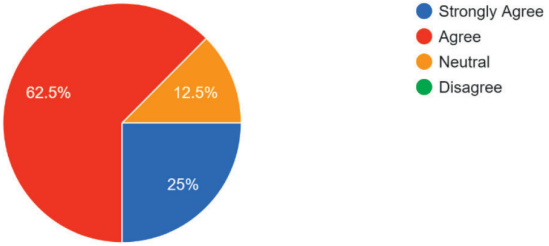

Figure 1: Does VR really encapsulate the real spatial experience? / Source: VR Survey

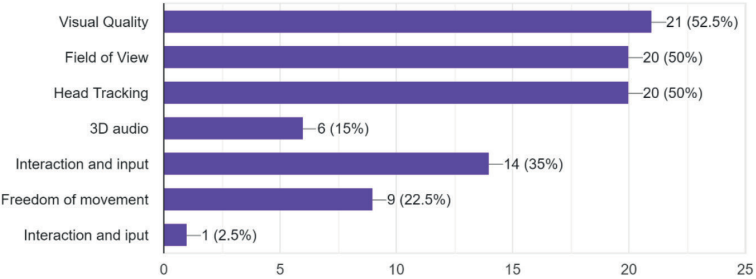

Figure 2: What elements of the VR experience contributed most to your sense of immersion? / Source: VR Survey

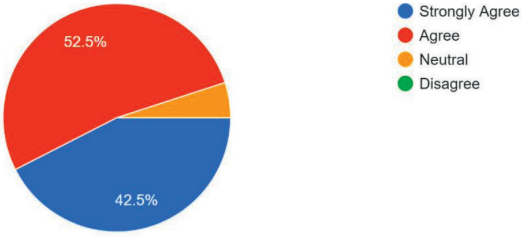

Figure 3: Do you think that the application of VR-based technologies in architectural design studios can be effective? / Source: VR Survey

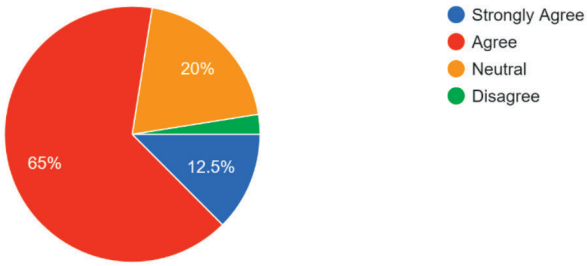

Figure 4: Do you believe that VR should be integrated in teaching and other academic instances? / Source: VR Survey

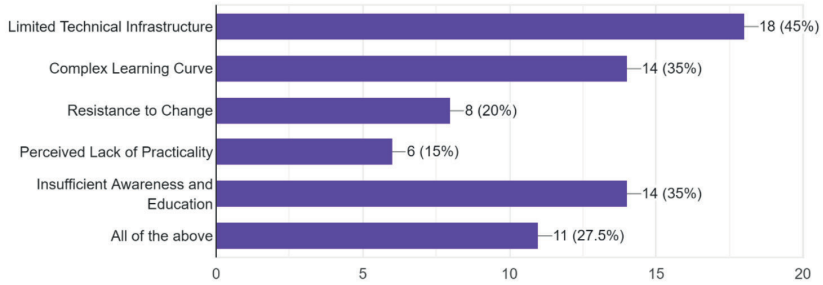

Figure 5: Why do you think the adoption and implementation of Virtual Reality (VR) technologies in the field of architecture have been relatively slow compared to other industries? / Source: VR Survey

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