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The VR Scene: convergent design learning

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Abstract

In an era in which space can be worn on the head, downloaded from the cloud, and reprogrammed in real time, the question "What is space?" gains new intensity. While traditional architecture already engages with a wide array of spatial theories, from absolute to relational, from lived to socially produced, virtual reality destabilises all these conceptual boundaries. This paper examines how virtual reality (VR) can redefine the training of student architects, beginning with a pioneering initiative: The VR Scene, the first architectural design competition entirely conducted in a virtual environment, initiated and juried by the authors at UAUIM in 2022. In a pedagogical climate saturated with graphic representation and outdated methodologies, this initiative proposed something else: a competitive, immersive, interdisciplinary context where eighteen teams of students from different years of study were invited to design and present fully navigable spaces in VR. The VR Scene has generated innovative projects and produced a new kind of educational practice—one in which the boundaries between teacher, student, and expert have blurred into a shared space of exploration and negotiation. In this emerging ecology, architecture is not a finished form, but an ongoing convergence process between thought, technology and humanity. Thus, the study aligns with the theme of the Convergence conference, proposing virtual reality as a pedagogical platform of trust, where collaboration becomes possible and inevitable.

Keywords: Architecture, Collaboration, Convergence, Virtual reality, Space

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Introduction

At a time when the boundaries between human and machine, physical and digital, real and simulated are becoming increasingly porous, virtual reality space emerges as a node of both technological and existential convergence, and the question "what is space?" takes on a new intensity. Architecture has always had to decide what space is before jumping into the design process, and in theory, we already have many answers: Absolute space of Newton: a fixed, empty, immutable framework in which objects are placed; Relational space of Leibniz: nothing exists in itself, everything is defined by relationships – between things, between positions (Leibniz & Clarke, 2000); Lived space defined by Heidegger (1971) and Bachelard (1958): not a geometric scheme, but a personal, sensory, affective experience; Space as a social product shaped by Lefebvre: space is shaped by interests, power, ideology, and is ultimately constructed through political interests. As expected, architecture has oscillated between these paradigms, sometimes using one and sometimes combining them, but virtual reality is blurring all the lines of demarcation.

VR is expanding spatial perception, forcing it to reinvent itself (Chalmers, 2022; Tavinor, 2021). Why? Since VR creates space without physical constraints, but with other constraints – code, interface, sensors – space is more than lived; it is calculated, programmed, and an algorithmic product; it is no longer a constant, but a result of code, design choices, and technological performance. In other words, VR does not fit into any classical theories, nor does it deny them; instead, it combines, conflicts with, and transforms them. A VR space can be experienced phenomenologically, but simultaneously, it is dependent on relationships (input-output), programmed politically (who has access?), and produced in real-time by a processor that calculates each texture according to the position of the gaze.

Literature Review

Virtual Reality in support of convergent learning approaches in architecture

Convergent learning is an educational model that integrates diverse types of knowledge, methods, and perspectives into a unified process, as opposed to traditional learning fragmented by disciplines (Brown et al., 1983; Schön, 1983; Hutchins, 1995). In architecture, it entails the simultaneous engagement with materials, human behavior, ecology, legislation, ethics, and spatial perception (Pallasmaa, 2005; Ingold, 2011). In today's context, where architecture is shaped by cultural, technological, political, and ecological factors, convergent learning prepares architects to formulate coherent and responsible solutions (Harvey, 2005; Lefebvre, 1991).

The integration of virtual reality (VR) into architectural pedagogy transforms this paradigm by merging sensory experience with technical analysis, theoretical reflection, and interdisciplinary collaboration. VR becomes an active medium for thinking and simulation, where intuition is informed by data and tested through experience (Manovich, 2001; Tavinor, 2021), and a ground for a holistic architectural pedagogy, where design, research, and learning merge into a profoundly contextualized process (Schnabel, 2009). In collaborative environments, design acquires an open and iterative character, as platforms enable real-time simulation of light, structure, climate, or user behavior, with immediate feedback. Students thus learn to rapidly integrate aesthetic, technical, and ethical information, consolidating transdisciplinary learning, while inter-institutional teamwork expands the critical and speculative potential of design (Bonsignore et al., 2012; Dede, 2009).

Enhancing spatial and critical thinking through VR

In immersive environments, space is a real-time bodily experience. Thus, spatial thinking becomes a sensory practice, in which navigation, perception and interaction replace two-dimensional drawing as the primary form of architectural understanding (Dalgarno

& Lee, 2010). This experience leads to a reconfiguration of the relationship between the designer and the designed space, in the sense of an active, involved repositioning, where architecture becomes an environment that provides cognitive and affective feedback (Bower et al., 2017; Johnson-Glenberg, 2018). This metamorphosis of the cognitive position leads to an expansion of critical capacity. As Zhang et al. (2014) point out, this form of metacognition-in-action is essential for developing contemporary architectural competence, which requires adaptability, sensitivity, and continuous reflection.

Cognitive and metacognitive development in VR

Navigating their architectural project created in VR forces students to engage in a radical and authentic form of self-assessment, in which the relationship between intention and effect becomes immediately verifiable. The virtual space provides a framework in which dysfunctions, disproportions, or inconsistencies become visible, palpable, and experiential, rather than just analyzable on paper (Dalgarno & Lee, 2010). This experiential transparency activates a form of applied metacognition, in which students identify errors and begin to understand the structure of thinking that led to them (Schön, 1983; Flavell, 1979).

VR transforms design into a continuous feedback system. Instead of waiting for correction from a teacher or evaluation from a jury, the student is placed in the position of being their critical observer, literally experiencing the project from within. As Bower et al. (2017) note, immersion triggers a reflexive loop in which perception and thinking about space overlap, allowing for successive self-adjustments on the fly. This loop is metacognitive par excellence, as it activates constant monitoring of one's own design decisions, as well as the ability to learn from mistakes in real-time (Zhang et al., 2014). In pedagogical terms, VR catalyses a transition from exogenous assessment to a model of internal, continuous, and contextualised assessment – what Brown, A. L., Bransford, J. D., Ferrara, R. A., & Campione, J. C. (1989) define as metacognition-in-action.

Methodology

The VR Scene: an extended pedagogical framework

The theoretical reconfigurations of space, brought about by the emergence of virtual reality as an architectural medium, are not limited to speculation; they took shape and had consequences in The VR Scene competition. The competition was attended by 95 students from three fields of study, architecture, urbanism and interior design, the majority was formed by fourth-year students of the Faculty of Architecture. They were organised into 18 interdisciplinary teams, with the composition of the groups relatively balanced in terms of previous experience with immersive technologies: slightly more than half of the participants had previously interacted with virtual reality in different contexts, primarily through gaming experiences. To ensure the competition was conducted effectively and with constant technical support on VR development throughout the entire process, we operated with a VR course, which became part of the optional fourth-year curriculum of the Architecture Faculty, as the "Interactive Visualizations" course, held at "Ion Mincu" University of Architecture and Urbanism in the "MAC Popescu" multimedia laboratory for collective experimentation. In this way, students have focused on inventing, testing, correcting and performing their projects. Each team was encouraged to operate within a framework where space was not 'drawn' but was produced and experienced. They were guided to use the Unreal Engine tool to build their own interactive experiences in VR format, over a six-month period, from January to June 2022.

Initiated and juried by the authors of the present paper, The VR Scene materialised as a tool for repositioning architectural design in the digital age, a virtual reality test applied to a pedagogy still rooted in materiality. The theme proposed a recognisable site - the C.A. Rosetti area in Bucharest - transformed into a hypothetical scenario: a fictitious beneficiary, an imaginary order, and a program to build from scratch, all transposed into a completely virtual environment. It was more than an exercise in representation; it was also a test of

architectural thinking in the absence of gravity, where reality became the frame, but not the limit.

In addition to the technical guidance provided within the competition, the evaluation of the student projects was carried out by a seven-member jury, architects, urban planners and designers, all professors at UAUIM. Both the development of the students throughout the process and the evaluation process itself were analysed using direct observation and pre- and post-event questionnaires to assess engagement, perception of space and the educational process. This dual approach allowed the research team to capture both subjective experiences and evaluative patterns that emerge from interaction with VR environments.

In this sense, The VR Scene was the concrete terrain in which theories about absolute, relational, lived, or symbolic space were engaged to be confirmed, questioned, remixed, and, sometimes, abandoned.

Results

The results were diverse, unpredictable, and sometimes contradictory—just as any genuine experimental approach should be. Out of the 95 students initially enrolled, only 57 completed the project. This significant dropout rate reflects both the complexity of the VR implementation and the demanding nature of the design brief set by the competition, further challenged by an already intensive academic curriculum.

Fig. 1 The VR Scene – First Prize Project during the Award Ceremony (Source:

The six months of the project allowed us to follow the students' evolution as designers, as well as their role as authors of their own learning, and the virtual environment proved to be more than a decoration, representing an active tool for architectural thinking. Because the progress of the projects was monitored without direct intervention in the architectural content, with provided support limited to technical assistance regarding implementation in VR, a significant transformation in the critical autonomy of the participants was observed. As they explored their proposals in virtual reality, the students began "seeing with different eyes", from a distant, almost critical perspective. This shift in perspective led to an increased capacity for self-assessment, with the results showing a visible increase in autonomy in design decisions, a clearer understanding of the relationship between form and experience, and a deep awareness of space as an evolving process, rather than a product. This method often allowed for overcoming moments of conceptual blockage through recalibration guided by direct, immersive experiences.

Beyond the increased autonomy observed among students during the design development phase, the VR-based jury evaluation revealed the potential of the immersive evaluation process, which allowed both jury members to quickly perceive spatial qualities and design flaws, often within seconds of entering the virtual space, offering immediate and embodied feedback that traditional representations usually fail to provide.

However, this mode of exploration also highlighted the importance of intentional spatial curation: the explorable areas must be limited to zones of architectural interest, and every scene must include orientation cues to prevent confusion and disorientation. Orientation, spatial clarity, and narrative sequencing proved essential to providing an intelligible and engaging experience. Absence of these elements often disrupted the immersive flow and negatively impacted the understanding of the spatial proposal. Also, the level of model detail, the quality of textures and materials (understood here as rendering resolution), and the interplay between natural and artificial lighting significantly enhanced the spatial experience. These elements

significantly shaped the user's spatial perception, understanding, and architectural judgement.

The feedback collected through direct observation and post-evaluation questionnaires indicated a strong openness towards integrating VR into both design and assessment processes. Jury members noted that immersive evaluation significantly reduced the risk of misinterpreting students' design intentions through the lens of personal architectural experience. The immersive nature of the design process and assessment of the proposed space in a manner that closely reflected its intended qualities, reducing ambiguity and misinterpretation between all parties involved. On the other side, students reported that VR-assisted design fundamentally changed how they thought about and shaped space. Most participants expressed a strong interest in repeating and further developing this type of immersive experience in future academic or professional contexts. The results confirmed that virtual reality, used as a design medium and not just as a visualisation tool, can stimulate co-creation, active learning and negotiation of meaning in collaborative educational practices.

Discussion

The impact of this educational experiment went far beyond the technological component. It was about what happens when students can no longer hide dead angles behind renderings and are forced to see, move, and test, resulting in a precise repositioning of the relationship between form and experience, and perhaps most importantly, a visceral awareness that space is not an object, but a living process: negotiated, recursive, concrete.

Moreover, VR presentations brought an unpleasant truth to light: we cannot cosmetically alter what we feel. A poorly proportioned space in VR is not an aesthetic failure, but a perceptual dysfunction – one that is impossible to ignore when our body is already immersed. The image was dethroned, and presence became the criterion.

However, the most important achievement was another: The VR Scene turned a competition into a collective learning process—a space where mistakes became methods and fiction, a form of knowledge. In an educational landscape still marked by an obsession with assessment, this initiative made room for discovery, collaboration and negotiation of meaning. It also proved that virtual reality is not just a medium but a catalyst for another form of pedagogical lucidity.

Despite its spectacular promises, virtual reality applied to architecture is not without its flaws – some technical, others epistemic or even ethical. First of all, VR remains a simulation: sophisticated, seductive, but still an abstraction of reality. It simplifies the sensory complexity of built space, reducing it to the visual and auditory, while ignoring texture, smell, and the subtle effects of material properties. Furthermore, access to these technologies involves high costs and specialised infrastructure, which can deepen inequalities between schools, institutions, or students. Last but not least, the risk of overwriting direct experience with the illusion of total control threatens architecture's very uncertain, open and contextual nature.

Ethically, the danger becomes even more slippery: VR can become a tool for manipulating perception, cosmetising projects, and excluding the authentic voices of those who will inhabit the simulated spaces. Participation can be replaced by simulation, and social reality can be replaced by controlled fantasy. More seriously, the data generated by users in VR environments – positions, reactions, gestures – becomes an exploitable resource, often without explicit consent, paving the way for a new type of invisible surveillance. Thus, without a carefully cultivated critical consciousness, virtual reality risks becoming a new technological illusion: spectacular but blinding.

Conclusion

Therefore, in this context, VR is an environment, and like any real environment, it transforms us. It is meant to trigger lucidity and self-criticism. The competition demonstrated that architectural thinking is shifting away from decoration and redefining itself as a critical

practice. At the same time, VR is more than a product of the fusion of 3D graphics, fast networks and intelligent sensors; it is a territory where our perceptions, cultures and bodies are recalibrated. Here, technology serves as a means to functionalities but produces worlds. Perception is composed of artificial stimuli that become more real than reality, social and cultural distances are compressed into a network of avataric presences, and convergence is not just a process but a lived space, a continuum.

This approach strengthens the theme of the Convergence conference and takes it further: collaboration across disciplines and between architects and technology is becoming the invisible structure that makes the project possible. Moreover, architecture, in this context, is no longer about designing buildings but about constituting ways of being together in spaces that think and react in turn.

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Scena VR: Invățarea proiectării prin convergență

(rezumat)

Într-o eră în care spațiul poate fi purtat pe cap, descărcat din cloud și reprogramat în timp real, întrebarea „Ce este spațiul?" capătă o nouă conotație. În timp ce arhitectura tradițională abordează deja o gamă largă de teorii spațiale, de la absolut la relațional, de la produs trăit la produs social, realitatea virtuală destabilizează toate aceste granițe conceptuale. Acest articol examinează modul în care realitatea virtuală (VR) poate redefini formarea studenților arhitecți, pornind de la o inițiativă de pionierat: Scena VR, primul concurs de design arhitectural desfășurat integral într-un mediu virtual, inițiat și jurizat de autori la UAUIM în 2022. Într-un climat pedagogic saturat de reprezentări grafice și

metodologii învechite, această inițiativă a propus ceva diferit: un context competitiv, imersiv și interdisciplinar, în care optsprezece echipe de studenți din ani diferiți de studiu au fost invitate să proiecteze și să prezinte spații complet navigabile în VR. Scena VR a generat proiecte inovatoare și a produs un nou tip de practică educațională – una în care granițele dintre profesor, student și expert s-au estompat într-un spațiu comun de explorare și negociere. În această ecologie emergentă, arhitectura nu este o formă finită, ci un proces continuu de convergență între gândire, tehnologie și umanitate. Astfel, studiul se aliniază temei conferinței Convergences, propunând realitatea virtuală ca o platformă pedagogică a încrederii, unde colaborarea devine posibilă și inevitabilă.