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Editorial

Virtual and Augmented Reality for Building

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Virtual reality and augmented reality have reached a technological maturity, allowing them to bring added value in many fields of activity. The building domain is a producer of significant digital data, at the design level (with BIM data—building information modeling), at the construction level (data of the building as built), at the maintenance level, and at the user level [1]. These digital data, coupled with virtual and augmented reality technologies, allow better collaborative work between designers and future users for the design of the building, a more intuitive interaction between users and the building through smart data visualization, and the assistance of maintenance operations [2].

The scientific issues concerned by this topic are related to the information chain, the relationship with the user, and the relationship with the use case. Thus, we can list the issue of digital continuity to ensure that the data created by the various designers for the design of the building are well integrated into a single set and that these data can be used later for the manufacture, maintenance, and use of the building. The building being a complex object, its virtual representation has the potential to allow several designers to collaborate on its design. The digital model of the building is thus intended to be alive, being fed with new data from different sensors and the interventions of the actors of the maintenance and the users of the building. Tools for collaborative design are the subject of much work. The method of interaction with the virtual environment is also an important issue for which numerous research works are proposed [3–5]. Much research also exist in the domain of virtual immersion and sense of presence in virtual environments [6,7]. Training is improved thanks to virtual reality, both for the acquisition of skills in the field of procedure and in technical gestures. Numerous works exist in the literature and the field of building can benefit from adapting these works to its problems.

This Special Issue of the journal *Buildings* concerns virtual and augmented reality for the design, manufacture, maintenance, and use of buildings. The papers selected for this Special Issue address some of the important scientific issues in the field.

Virtual reality can potentially be used as a tool to facilitate the design, maintenance, or use of the building. An important function of this technology is related to the interactions between the human and the virtual environment. Depending on the type of task to be performed (design or maintenance for example), one could be led to use different types of interactions in virtual reality. The paper proposed by Raimbaud et al. presents a method for the definition of the interaction method in virtual reality according to criteria related to the task to be performed in the virtual building [8].

Virtual and augmented reality is a tool that brings significant added value to design assistance. Collaborative design involves several users with different profiles, which improves collective creativity. To enable this, it is necessary that each participant has a digital version of the model on which they wish to collaborate. The work conducted by Reaver [9], presented in this Special Issue, describes a project of sharing immersive experience between several users within a building (Nordic pavilion for an exhibition of the Venice Biennale in 2022). The steps of the 3D digitization of the building and the collection of digital models of artworks allows the authors to propose an immersive space shared between several users for the conception of the scenography of the building.

In order to improve the user's experience in the virtual environment, it is necessary to look at the methods and factors that play a role in this experience. The literature discusses technological factors to improve virtual immersion (by multi-sensorial virtual reality technologies, but also by interaction techniques), and also factors related to the user's sense of presence in their virtual environment. It is then a question of studying the human factors involved in the virtual immersion experience. An important research issue is the embodied experience in the virtual environment. This issue is addressed in many works. It is the subject of the paper presented by Lee et al., who present an advanced bibliometric analysis on this topic [10].

Virtual and augmented reality can provide significant added value for training assistance. Indeed, it is then possible to put the learner in an ecological situation while avoiding putting him in danger. Virtual reality training is also more motivating and allows the learner to perfect technical gestures and procedures more quickly. The paper by Shringi et al. presents research related to the use of virtual reality for crane pilot training [11]. This work showed that virtual reality provided better training for detecting problems in crane piloting.

Virtual reality can be used to represent numerous cases of use for which interesting added values exist for training. Thus, thanks to virtual reality, we can train users to acquire technical gestures and behaviors adapted to a crisis situation. Virtual reality allows for the simulation of situations without the physical risks. This is particularly the case for behavioral training in the face of systemic risks. This topic was the subject of a work presented by Rajabi et al., which aims to study the improvement of emergency training for earthquakes through the use of immersive virtual environments [12].

Conflicts of Interest: The authors declare no conflict of interest.

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