

The Raphael's School of Athens immersive experience

A VR digital movie for Cultural Heritage

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Introduction

Identifying aims and objectives is the first step in the design of a Cultural Heritage digital experience. Especially for the setting up of temporary exhibitions, they must match economic and human resources available, as well as deadlines, leading to the development of effective products, able to meet the expectations of visitors increasingly experienced in the use of technological devices.

Nowadays, thanks to robust technologies, digital reproductions have cognitive value comparable to the originals' one. Human knowledge transmission has always produced copies on copies, focusing now on content, now on form, now both on form and content. In this long-lasting historical perspective, digital technology has become part of the process, but compared to the techniques used in the past, it has the advantage of being able to convey a cultural asset and its storytelling at once.

The presented work fits into this context proposing a virtual experience of the School of Athens that goes beyond the digital reproduction of the work of art, creating an immersive digital movie based on a scientific 3D reconstruction of the scene represented by Raphael and on a storytelling able to exploit tools and languages of the entertainment world.

The School of Athens 3D reconstruction

Designed for the celebrations for the fifth centenary of the death of Raphael, the exhibition "Raffaello e Angelo Colocci. Bellezza e Scienza nella costruzione del mito della Roma antica" is dedicated to the figure of Angelo Colocci, a humanist little known to the public who had relations with Raphael, sharing with him ideas and interests. Emblematic are the frescos for the "Stanza della Segnatura", realized from 1509 to 1512 by Raphael and to which Angelo Colocci contributed to the designing of the iconographic programme (Mangani, 2018).

The proposed VR experience is focused on the representation of the “School of Athens” and its aim is to communicate this masterpiece in a novel way able to reveal the hidden meanings of its characters and architecture, taking advantage of the communication power of a short movie along with the emotional engagement provided by an immersive virtual journey.

Starting from the high-res 2D digitization of the fresco, provided by the Vatican Museums, the first step was the 3D reconstruction of the scene in three steps: the geometric study of the perspective representation, the reconstruction of the structure and finally the modelling of its details.

So firstly, the work was focused on the analysis of principal perspective points and lines, that as in (Spagnesi, Fondelli, Mandesi, 1984) led to the detection of a compositive scheme based on an isosceles triangle which generates a cubic space above the horizon line. Through the partition of this space, it was possible to create a modular geometric grid to proportionate the architectural macro-elements.

From this study a complete architecture was obtained supposing the geometry of those parts not visible in the fresco. A careful analysis of the sources that inspired Raphael was carried out, emphasizing his interest in ancient architecture, like the basilica of Maxentius and the Pantheon, and in contemporary architecture, suggesting a Greek-cross plan. The most complex challenge was the definition of the central element: the dome. It presents problems both related to structural and lighting aspects. A lack of geometric concordance was found between the different levels of the architecture: at the centre of the fresco the naves look perpendicular to each other, this is not confirmed in the upper level where the sails supporting the drum of the dome have a trapezoidal geometry, while they should be characterized by a triangular shape, suggesting naves not perpendicular but mediated by a wall inclined of 45 degrees. This “error” was interpreted as a pictorial choice aimed at preserving the symmetry and harmony of the scene: Raphael was indeed aware of this incoherence, as demonstrated by a sketch in sanguine pencil on a preparatory cardboard kept at the Pinacoteca Ambrosiana (inv.126), so, the 3D reconstruction was modelled having a correct structure, being fundamental for the aims of the VR experience to represent a realistic architecture, so to remove all the artifices represented for the purposes of the two-dimensional composition. Regarding the scene lighting, the space under the dome looks considerably brighter in comparison to the naves. This condition was simulated thanks to the rendering software: the sunlight was positioned recreating the shadows on the front of the building, but even modifying its intensity, the light below the dome was anyway less and less intense in comparison to the one of the naves. The only way to generate the same lighting condition of the painting was to place a second artificial light in the centre of the architecture, that was considered as another pictorial artifice for allegorical and 2D compositional purposes, so again discarded to not alter the realism of the scene.

The last step was the reconstruction of the architectural details. For each element it was chosen a sample one, divided in its components and compared to existing Renaissance architecture and treatises. The identified correct conformation has been iterated for all the similar elements.

The resulting architecture is shown in Fig.1, it was modelled using the opensource software Blender and its textures were elaborated using Adobe Substance Painter to generate Physically Based Rendering (PBR) materials.

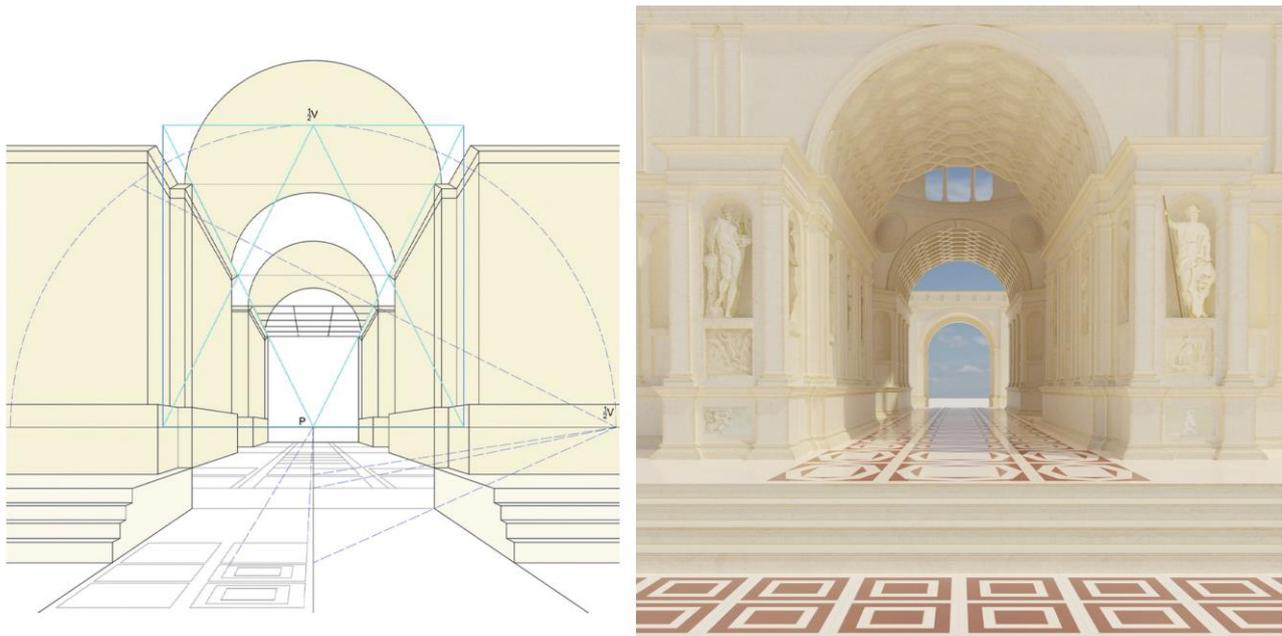


Fig. 1. Geometric compositive scheme and rendered 3D reconstruction of the architecture depicted in the School of Athens by Raphael.

The immersive experience

The experience proposed for the School of Athens is based on a digital immersive storytelling that makes the user lose the separation between real and virtual world (Bonacini, 2021). Thanks to the use of VR Head-Mounted-Display equipped with headphones, visual and auditory perceptions have been combined, obtaining a complete immersion in the architectural 3D reconstruction whose experience is completed by the presence of characters guiding the visitor.

The digital movie was made up of four parts: in the intro, the user is inside the Stanza della Signatura where he can observe the School of Athens along with the other frescoes by Raphael; in the second part the user is inside the architecture, under the dome represented behind the philosophers, there he meets Raphael and Angelo Colocci played by two actors, presenting themselves and explaining the allegory of the architecture of the School of Athens; in the third part the user is in front of the great temple and the philosophers gradually appear populating the fresco, being presented by the two actors; in the conclusion, the user returns to the Stanza della Signatura positioning the 3D reconstruction point of view as in the fresco.

Developed using the Unity Game Engine, the immersive journey with Raffaello and Angelo Colocci was designed for Oculus Quest 2. Wearing the VR headset, the user experience starts with the language selection. Users' hands are immediately detected by the device, avoiding the use of joysticks. As shown in Fig.2, the actors' footage was recorded on green screen, edit and insert in the different scenes made of 360° images rendered inside the 3D model. Philosophers' representations were also insert in the third scene after being edited with 2D animations to make the experience even more dynamic. The VR headset was also programmed to stop the experience when a user takes it off, restarting from the language selection when the next one puts it on.



Fig. 2. School of Athens virtual scene. Actors on green screen positioned among philosophers.

Conclusions and future developments

The UX was evaluated thanks to questionnaires and direct observations. A high percentage of visitors (91%) experienced the digital movie in VR mode, even if it was projected on a screen for those who did not want to wear the headset. Out of observations, it also resulted that only 6% need some help by the museum operator, and only to make the experience start. A problem that was mainly related to the low lighting of the room affecting the hand detecting by the headset cameras. The storytelling and sense of immersion were the aspects mainly appreciated, conversely, the interaction was considered basic, not having the user the possibility to freely explore the virtual environment. The choice to have a VR experience while seated was driven by the museum exhibition set-up, a further implementation could be the development of a more interactive experience, also taking advantage of gamification elements linked to the storyline guided by Raphael and Angelo Colocci.

Conflict of Interests Disclosure

The Authors declare that they have no conflict of interests.

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