THE SEDUCTION OF THE SIMULATION.
3D MODELLING AND STORYTELLING OF UNREALIZED PERUGIA RAIL STATION

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ABSTRACT:

The study aims at enhancing and requalifying the area of Fontivegge in Perugia. It seeks to instil in the population a sense of identity and belonging to the place through the digital reconstruction of the first design hypothesis of the station itself, transmitting the cultural heritage of the place with new participatory methods, such as serious games and virtual reality. Starting from the project drawings preserved at the academy of San Luca in Rome, conceived by the architect Antonio Cipolla, the project is reconstructed philologically following historical and archival studies, by interpreting the data collected. Following the reconstruction of the 3D model, evocative mook up images and a virtual reality are created, making the intangible tangible and explorable. Through the virtual simulation of the place and its visualisation, new forms of participation are sought, mending the relationship between territory and population, laying the foundations for a different reading of the area and a cultural heritage accessible and open to all.

1. INTRODUCTION

The research aims to test the value of virtual reconstruction within urban regeneration strategies. The case study regards the Perugia Rail station, a place interested in these days by the "Extraordinary Program of intervention for urban regeneration and security of the peripheries", an Italian National Program of Urban Recovery (Piano, 2015), with 30 million euro of funding, project proposal born from support of the University of Perugia (Bianconi and Filippucci, 2020, 2018).

In the realization of space transformation the need to deepen the meanings (Jencks, 1969) that guide urban regeneration appeared, seeking an operational surplus value in culture. These studies are aimed at researching the sense of identity of the place (Bianconi and Filippucci, 2021; Pallasmaa, 1994), promoting social cohesion (Scholz and Smith, 2016) and the sense of belonging (Francis et al., 2012; Kim and Kaplan, 2004).

For this reason, in parallel of a series of activities, the goals to research the roots of the place are defined (Norberg-Schulz, 1980), aiming to finding in the origins their originality (Purini, 2021).

This challenge is centred in the field of the communication (Paladini et al., 2019) and this paper shows how it attempts to rewire the relationship between the territory and the population through visualization (Hassani et al., 2015; Tommasi, 2021) (Paola et al., 2017) and interaction (Coopmans et al., 2014; Gračanin, 2018) of a virtual simulation. In the value of wonder of discovery, virtual reconstruction is able to stimulating research and empathy and transforming the intangible in tangible, viewable, explorable and able to be investigated (Picon, 2010), because the digital truly represents a great opportunity, a persistent and pervasive tool (Hampton, 2016) that speaks to today's man (Benjamin, 1969), thus fostering new forms of participation (Carpentier, 2011), particularly for young people. (Bennett, 2008). For these reasons, the reconstruction aims to be explored in the new spaces regenerated by the project, according to a serious game strategy developed in virtual reality (Alvaro Marcos Antonio de Araujo Pistono,

Arnaldo Manuel Pinto Santos, 2021; Bianconi et al., 2020; Checa and Bustillo, 2020; Ioannides et al., 2016; Larson, 2020; Skamantzari and Georgopoulos, 2016; Smith et al., 2020).

The research is developed in the line of digital representation of cultural heritage (Adembri et al., 2016; Bianconi et al., 2021, 2019; Curci and Fiorini, 2013; D'Andrea and Barbarino, 2012; Fiorini, 2013; Puma, 2018; Velli and Velli, 2017) and, in particular, the reconstruction of unbuilt architecture (De Vos and De Rijk, 2019; Johnson, 1993; Webb and Brown, 2008; Webb, 2012). (Figure 1)

Figure 1. Reconstruction of the station of Perugia Fontivegge, by the architect Antonio Cipolla.

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The digital model reconstruction needs of data and historical archives occupy a fundamental role (Rinaudo et al., 2020), but the handmade drawings are usually unable to guarantee a full reconstruction, according to a different request of accuracy. For this reason, the study needs to find different fonts to guarantee a correct philological reconstruction, based also on the interpretation of different data.

The creation of a different virtual reality is tested in a storytelling of the place (Banfi et al., 2021; Ferraro, 2015; Filippucci, 2021), useful to understand the reason of the actual state of art of a part of the city. The memory values is applied to stimulate imagination and comparison (Appadurai, 1996; Kuliga et al., 2020), to create interaction (Bach et al., 2019; Gobster et al., 2007; Gračanin, 2018), to active relationship between the place and the citizen (Adler and Goggin, 2005; Ko et al., 2013; Rosenman et al., 2007).

2. METODOLOGY

The research aims to develop a replicable process of digital representation of historical scenarios, based on philological reconstruction of the roots of the place.

As a first step, detailed historical research about the evolution of the area is carried out, searching the most significant urban polarities and their stories.

Defined the case study, the research needs to finds all the different information that, directly and indirectly, can describe the urban landscape and in particular the architectures selected. To create a virtual reconstruction, it is important to deepen all the different design issues, analysing through the drawing processes forms, materials, solutions and value of the space, using similar works to interpreting the design of the missing parts.

The drawings are digitized and reproduced starting from bidimensional drawing and, subsequently, developing a 3D model for representing the morphogenesis of the entire building, the biggest commitment of the challenge if developed with a high level of details, according to the reasons for the construction.
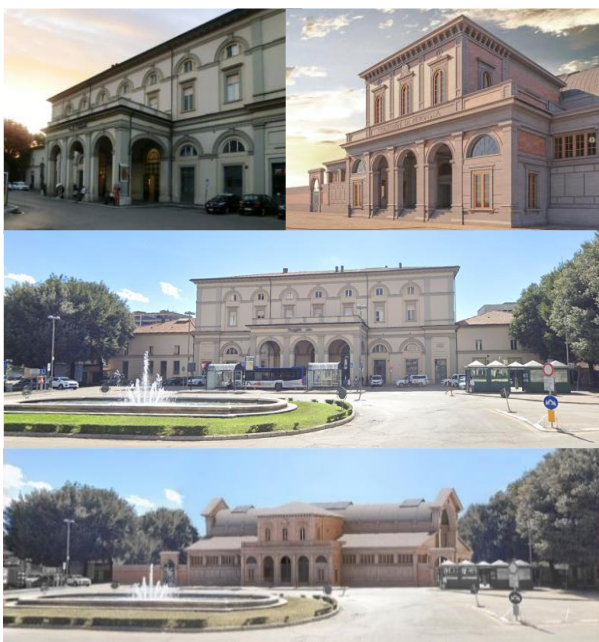
Connotative issues as textures and light support communication issues, developed in the awareness of their use for the purposes of virtual visualization and immersive experiences, using specific render tools (3D Studio Max and V-Ray) to create photorealistic and evocative renders and to realize mock-up images. (Figure 2 and Figure 3)

Then the model has been placed in a digital environment for virtual reality in order to make it explorable and navigable in all its parts, with visualization by headset for VR visualization creating a true immersive experience, in a specific installation.

In addition, to improve the usability and accessibility by citizens, a serious game is made using a specific software (Unity online platform) born for gaming, necessary to allow digital exploration.

The accessibility of the digital reconstruction open to the urban community through QR codes, possibly enhanced within an urban wayfing path. In this way, the virtual reality becomes a place to explore spaces, to play and to increase one's knowledge and awareness about the value of architecture and of an alternativity. These new ornaments of the city, in the value of virtuality, define places to stay, an innovation for the area, and for this, it helps the place to regenerate itself.

3. CASE STUDY – FONTIVEGGE STATION

3.1 Historical Background

The transformation and design of railway tracks has represented a powerful element of modernization and transformation of the Italian territory (Meeks, 1956). In the second half of the nineteenth century the links created have radically changed the image of the city despite this process was triggered late compared to other European countries (Pyrgidis, 2016). The policy of railroad modernization was adopted following the formation of the national state with the aim of connecting the major Italian urban settlements (Guadagno, 1996).

The Italian region of Umbria was also at the center of projects relating to rail transport (Buttaro and Covino, 1989), key elements of the territorial modernization process (Bianconi, 2011). Perugia, the central city of the region, was the epicentre of the infrastructure in 1845 and 1856 firsts hypothesis, as a fulcrum of transversal connection between the two seas. (Perdonnet and Polonceau, 1846) Unfortunately, for the orography and the more favourable geographic position, the city lost its centrality, (De Cenzo, 2004) stolen by the near city of Foligno (Cioci, 1986), with the route that arrived in the Umbrian capital only in 1866 (De Cenzo, 2004).

These facts are essential to understand the reasons of the evolution of the successive projects over time. In fact the first

Figure 2. Comparison between the built station and the project station

Figure 3. mook-up image of unrealized station

design hypothesis, signed by high quality, developed under the papacy in 1851, by the architect Antonio Cipolla (Portoghesi, 2013), character of great depth of the second half of the nineties, with the subsequent Unification of Italy and all the transformations of the technical equipment related to the centralized design of the infrastructures, this project was replaced with a more anonymous place, related to serial types. (D'Agostino, 2013) It, punctually maintainseds some elements of the Cipolla's idea, which still remains the genesis of the urban space and architecture of this pole.

3.2 Original Drawings

Cipolla's original drawings are now preserved in the Academy of San Luca in Rome. The drawings in figure 5 rapresent the architect's original tables of a plan and two elevations, made in watercolour and ink. In margins are written the date of realisation and a graphic scale, a fundamental detail for the reproduction of the project in its exact dimensions.
All the archival architect's representations conserved have been analysed, with the aim to develop an accurate historical and typological study, and particular attention was spent in the stations realized by Cipolla.
This project was part of a city that tried to become the Italian railway junction, the meeting point between the longitudinal and transversal railway lines of the country. (De Cenzo, 2004)
The station in the original project was designed for an important flow of travellers, the flow of a railway hub that never happened. From the drawing, it can be assumed that this is a first class station, intended for a large number of travellers with large spaces for staff and citizens, rather than a second class, also referred to as a through station, with minimal space for staff and freight. (Chabat, 1862; Meeks, 1956).

3. Digitalization process

The project tables have been scanned and digitally reproduced, in their study design indeterminacies have emerged, and in

order to reproduce them, other studies have been made to realize them faithfully.
Different technical details were analysed and represented, with a faithful reconstruction of the initial project, we enhance the cultural heritage and the potential of a construction of greater magnificence through its visualization using AR and VR inside the actual station, so that place will can de able to come to live.
The biggest challenges were found in the reconstruction of the train tunnel and rear elevation, according to the lack of information. In the building currently constructed, it is possible to see how some of the details of this project were revised, such as the materials and the doubly symmetrical plan, but completely distorting its form and functions, placing the space for travelers at a minimum and maximizing that for the railway staff by inserting housing and leisure areas.
For the train gallery, life and projects of the architect Antonio Cipolla were analysed. It was found out that he had taught Mengoni and therefore a similarity study was made with the Vittorio Emanuele gallery in Milan. Following a comparison this hypothesis is discarded because of the presence of buttresses that support the trusses and the dome, impossible to
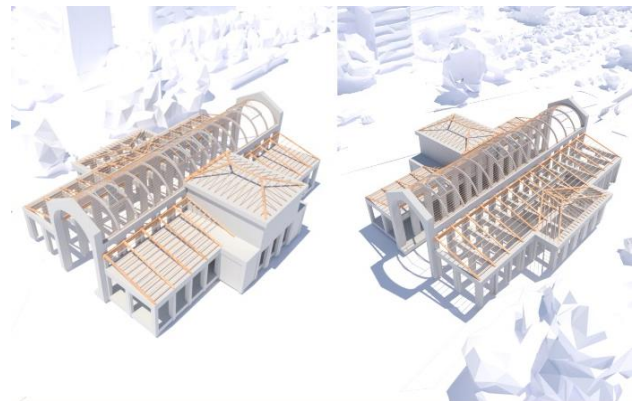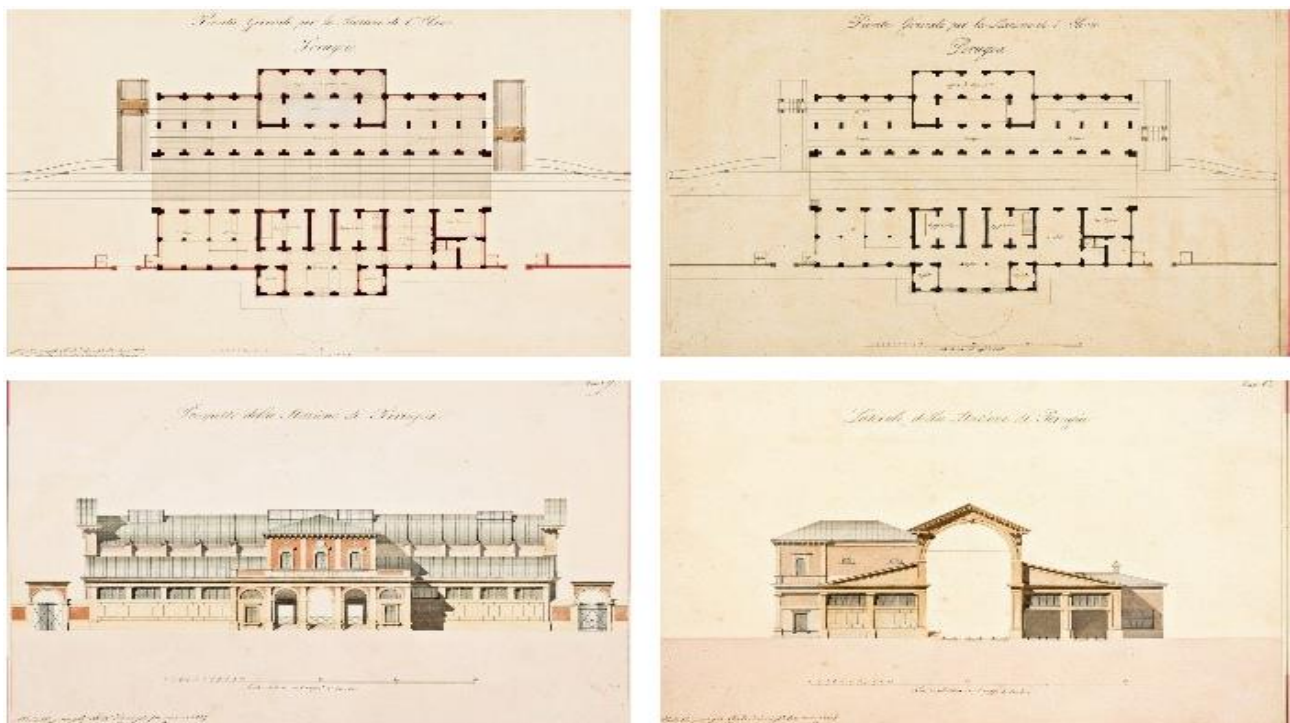

Figure 4. Study for static roof system

Figure 5. Project tables of first designed hypothesis of the station of Perugia Fontivegge, by the architect Antonio Cipolla.
(drawings 3056, 3057, 3058 and 3059, Accademia di San Luca, Rome)

see in the case of the station of Perugia, due to the little lateral space present. Studying the projects of the architect, it is found a possible similarity with the coverage of the station of Genoa. It is identified with a central chain that supports the trusses, as in our case, and a circular structure mixed metal and wood. Consequently, it was taken as a basis for the reconstruction of the coverage, modified and adapted to the dimensions of the project by tightening the curvature of the trusses. (Figure 6)

For the back, the same type of window openings and design is assumed, because of the linearity of the project and its symmetry. However, in the projecting, it is implied the use of exposed brick instead of marble, due to its lower price. The static system of the coverings of the lateral wings and of the central body was studied, hypothesizing a wooden truss system with single and double pitch, typical of the stations of the nineteenth century. (Figure 4)

The second floor was not faithfully reproduced, because of the scarcity of sources, but it is assumed by following the French manuals. (Chabat, 1862) It is thought to have as its function the accommodation for the stationmaster or railway officials.

Even the interior details are hypothesized by studying the architect's work by inserting mirrors in the walls and wooden coffers in the ceiling of the waiting rooms. (Portoghesi, 2013)

For the reconstruction of the ticket office, a drawing in the Fadda manual, one of the most important Italian railway standardization manuals, (Fadda, 1915) of a first class station was used as a model, which is well suited to the plan under analysis.

After the definition of the details in the plan, in the elevations and in the sections, it was built a 3D mesh of the project, from whitch has been possible to derive interesting perspective sections and photorealistic renderings. (Figure 7 and Figure 8)

The mesh is positioned in the context following the line of the existing tracks, permitting a dimensional comparison between the two works. It shows how the station in the project is much smaller, but with well-distributed and optimized spaces. The back part, used as a workshop, disappears and in the part in front of the tracks the space destined to the railway staff is considerably enlarged.

By taking the existing station and setting the same date, time and exact position of the building on 3ds max it was possible to derive renders to insert and contour using Photoshop on the images taken creating realistic images of what has never been realized.

3. Accessibility and spread

In order to make the project accessible and comprehensible to everyone, it has been used a modelling according the approach
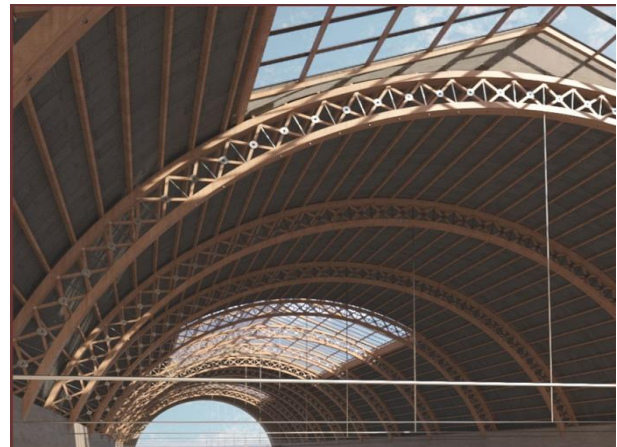

Figure 6. Render of the train gallery roof

Figure 7. Perspective sections extracted and processed from the digital 3D model

to developing videogames, creating a visualization to high resolution of the 3D model previously realized with possibility of navigation.

For the realization of the videogame the 3D model previously realized has been inserted in the platform of Unity through passage for FBX file, which maintains all the modeling parameters, as normal map and geometries, set in advance. Through metashape is realized a 3D mesh of the existing context, purified from the station at the current state, in order to insert it in the virtual model and allow a better reading.

The materials are inserted, leaving the context in white, in order to give more relevance to the station and after the insertion of the lights is performed the calculation of the lightmap to allow the visualization in VR of the correct lighting.

Through the realization of a script in C++ the movements of the camera were made possible, with the visualization in first

Figure 8. Perspective sections extracted and processed from the digital 3D model

person, inside the project, in order to explore it in its totality.

The project is then exported on the online platform of Unity which supports the interaction between script and model, creating a real interactive game platform, without the help of the installation of the program itself (Figure 10), aviable at following link.

first project of Perugia Fontivegge station. - Unity Play

Moreover, it is planned the installation of VR visualization stations through headset in the station of Fontivegge in order to increase the interest in the place and consequently decrease its decay. (Figure 9)

Key focus of the requalification project is to increase the interest of the population in the place, increasing the flow of people in it and consequently decreasing its degradation.

4. CONCLUSIONS

Digital technology, through the seduction of the simulation, fosters the knowledge processes (Coleman and Blumler, 2009)(Fiorillo et al., 2021), centred on the value of the memory as base of the identity. The realization of an immersive tour, with the help of headsets for VR or internet-connected computers, allows everyone to access a long-lost masterpiece, thanks to a progressive and deferred deepening proper to the interoperability of digital (Bianconi, 2005), which is then strengthened in the performance of new devices increasingly capable of replicating images similar to reality (Salerno, 2018).

The virtual scenario creates interest about the actual rail station, helping to read the place by a different point of view. From drawings, intuitable and readable only by those with specific knowledge, comes a detailed reading, readable and accessible by all. Anyway, the research opens also to new interactions, related to the development of the Metaverso, new digital squares of the digitalized citizen.
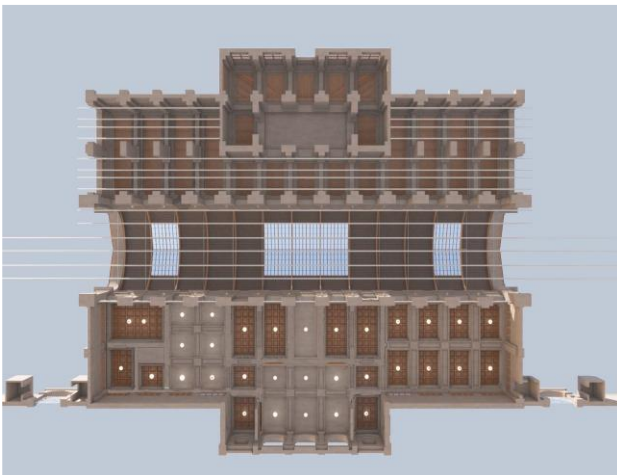

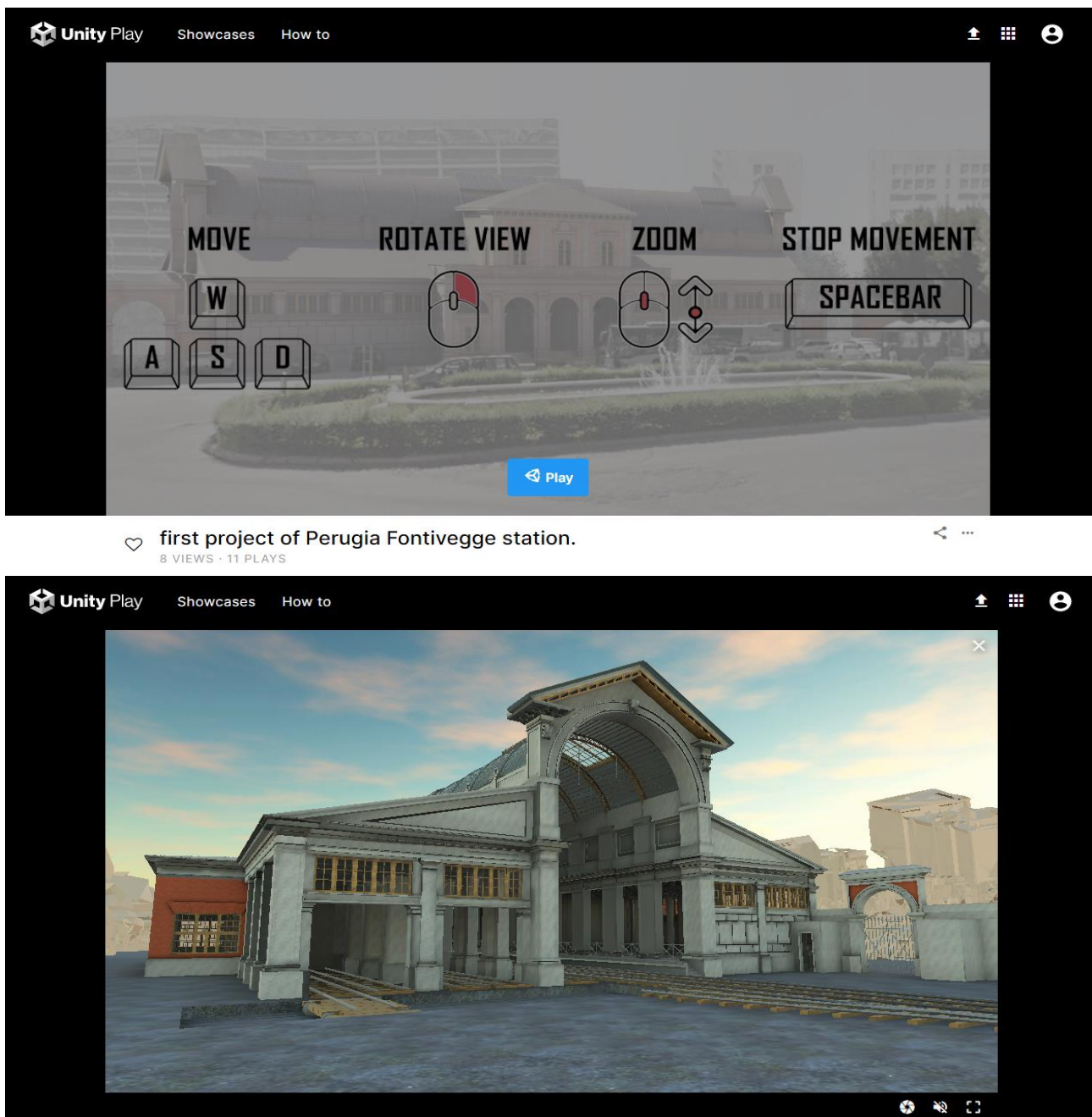Figure 9. Spherical image of the arrival of rails in 360° angle view

Figure 10. Screenshot taken from the online game

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