

Virtual reconstruction of the Ducal Palace of Oliveto Lucano (Basilicata, Italy)

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Abstract – The reconstruction of the Ducal Palace aims to create virtual models, seeking a synthesis between technical data restitution and a naturalistic and evocative rendering of the architectural context. Generally, to create three-dimensional models, it is essential to have graphical drawings of the sites that will be represented with 3D computer graphics. Various survey methods can be used to produce these drawings, or data from surveys already carried out in the past on the architectural context can be used. In the case of the context presented in this work, the starting point was the scale plan of a cadastral map from the 1940s and photographs taken on site, specifically of the sixteenth-century basement walls, which are still present since the palace was demolished in 1946 to make way for a square in front of the mother church.

I. INTRODUCTION

The reconstruction of the Ducal Palace aims to create virtual models, seeking a synthesis between technical data restitution and a naturalistic and evocative rendering of the architectural context. In the context presented in this work, the starting point was a survey of a 1940s cadastral map and on-site photographs. The first phase involved reworking the survey and recovering the most important information for 3D modeling (drawings for different purposes contain different information). New digital graphic supports were created, which formed the basis of the work. The materials and surface finishes of the assets in question were identified; in this phase, the consultation and detailed reports of experts, both architects and historians, were essential. In the second phase, after carefully evaluating and interpreting all available data, volumetric models of the structure were created using new two-dimensional supports compatible with 3D modeling software. These models will then be further elaborated with high-resolution textures for the final photorealistic rendering. After a detailed investigation of the architectural features, based on the structures still evident on site, the plans, and comparisons with other architecture

from the same period, the need to analyse and gain a comprehensive view of the Doge's Palace was resolved through the use of 3D computer graphics according to a philological approach.

II. THE DOGE'S PALACE

Oliveto Lucano stands on a long, narrow rock face (Fig. 1), consisting of spurs of natural rock (Garaguso sand) with deep gorges, eroded over time by the Pisciolio River and one of its tributaries. From historical information and an analysis of urban stratification over the centuries, it is possible to establish that the medieval settlement occupied the highest and widest part of the rock, while the western part connects the village to the slopes of Mount Croccia-Cognato. The ridge leads to the highest point of the promontory, where a tower or fortified nucleus likely stood, dating back to Greek rule. These two poles, the ridge and the highest part of the rock, formed the focal point of the town's structural morphology. It is a tenable theory that the two predominant elements of the historic core in the modern era were the Palazzo Ducale (fig. 2)—recognizable until 1946 (the year of its demolition) and of which only the sixteenth-century base walls are currently visible—and the mother church (fig. 3). These two "supporting" elements were gradually joined by various residential units, characterized by their juxtaposition and their modeling influenced by orographic requirements. For the virtual reconstruction of the Palazzo Ducale, interviews were conducted on-site with people (those born before 1946, the year of its demolition) who were able to see and enter the palace. The plan of the Palazzo Ducale taken from the 1940 land registry was beneficial in the 3D reconstruction, given that no photographs and/or postcards showing the part of the village affected by the palace and the mother church exist. To get an idea of the sixteenth-century layout of the Ducal Palace of Oliveto Lucano, we were also greatly helped by Pacichelli's seventeenth-century view of the village of Tricarico, where the sixteenth-century Ducal Palace and the cathedral stand out among the houses.



Fig. 1. The municipality of Oliveto Lucano seen from the south.



Fig. 3. View of the sixteenth-century mother church.



Fig. 2. Remains of the Ducal Palace demolished in 1946.

III. VIRTUAL RECONSTRUCTION

The reconstruction of the Ducal Palace of Oliveto Lucano aims to create virtual models, seeking a synthesis between technical data restitution and an evocative rendering of the architectural context. Generally, to create three-dimensional models, it is essential to have graphical drawings of the sites that will be represented with 3D computer graphics. To create these drawings, various survey methods can be used, or data from surveys already carried out in the past on the architectural context can be used. In the case of the context presented in this work, the starting point was a survey of a cadastral map (fig. 4) from the 1940s and photographs taken on site. The first phase involved reworking the survey and recovering the most important information for 3D modelling purposes, and creating new digital graphic supports that formed the basis of the work. The materials and surface finishes of the assets in question were identified; in this phase, the consultation and detailed reports of experts, both architects and historians, were essential. In the second phase, after a thorough evaluation and interpretation of all available data, volumetric models of the structure to be represented were created using new two-dimensional media compatible with 3D modelling software. These models will then be further processed with high-resolution textures for a final photorealistic rendering. After a detailed investigation of the architectural features, based on the structures still evident on site, floor plans, and comparisons with other architecture from the same period, the need to analyse and gain a comprehensive view of the Doge's Palace was resolved through the use of 3D computer graphics following a philological approach. To generate a reconstruction-correct document, the following steps were performed: • reconstruction of the contour lines

of the area of interest for the three-dimensional reconstruction of the terrain; • creation of a plan updated with the latest acquisitions; • three-dimensional modeling of the structures. This first phase will be followed later, and will be presented in the next article:

- creation of photographic textures with compatible materials or those sourced from the same locations;
- processing of the final high-resolution rendering;
- final retouching of the finished image.

For the 3D terrain modelling, we started with a basic cartography imported into a CAD environment, where the contour lines and detailed plans were carefully redrawn to obtain a complete 2D acquisition. Each curve was assigned a height, thus creating a vector model of the terrain with the exact position of the building to scale. The vector model was then imported into 3D modelling software, which generated a polygon mesh that reproduced the three-dimensional contours of the terrain. This allowed us to then precisely position the scaled structure model on the vector drawing. This was then followed by a planar top-down mapping, allowing us to place the texture previously prepared in the photo editing software. This is done using the terrain contour mesh as a basis, thus saving considerable time when applying and sizing the texture on the 3D model. Furthermore, the texture, prepared in photo editing software starting from a base image of a terrain compatible with the location to be reconstructed, is useful for adding nuances of detail to the map while faithfully respecting the conformation of the territory. Once the terrain modelling and mapping were completed, the building was reconstructed to be subsequently placed on it. For the 3D modelling of the Doge's Palace, we started, as with the terrain reconstruction, from scaled plans to obtain the volume. Once the volume was obtained, we moved on to an accurate reconstruction, taking into account the study of sources, comparisons, and existing structures on site. Once the building modeling phase was completed (fig. 5), we will proceed with the mapping and then the addition of textures. In the reconstruction of historic buildings, the best results are obtained for a photorealistic rendering of 3D models, using photographic images that reproduce the original materials of the structures under examination and which are subjected to a particular treatment with the photo editing software to add elements not present in the photo, such as signs of dirt, etc. In the case of the building in question, a texture of a portion of the wall still preserved on site was chosen, to which a displacement map was applied in the modelling software to highlight the imperfections.

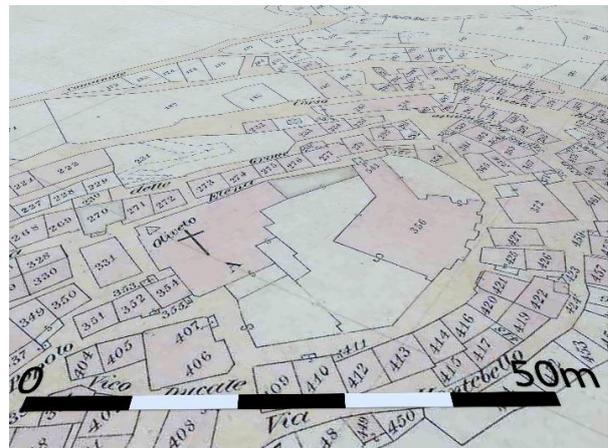


Fig. 4. Cadastral map with plan of the Ducal Palace.

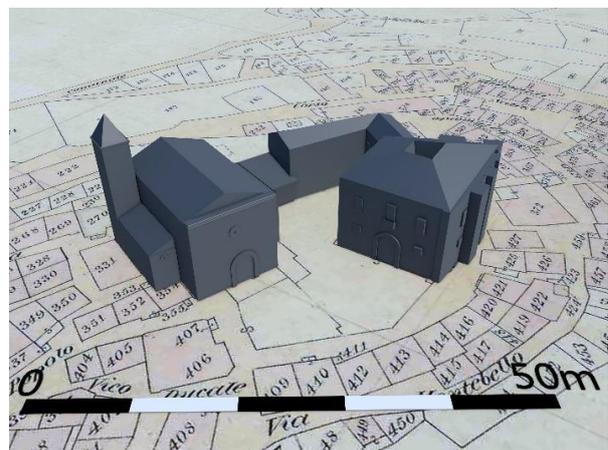


Fig. 5. 3D reconstruction of the volumes of the two buildings.

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