

DYNAMIC 3D REPRESENTATION OF ARCHITECTURE AS A DESIGN TOOL: THE OLD TOWN OF COSENZA

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ABSTRACT:

The availability of a realistic representation of a historic site is very important to foresee the impact of restoration works or housing projects on the environment. For the enjoyment of an old town center, it is also important the dynamic factor, that is the sequence of views and perspectives that visitors see during their way. The visualization and animation of architectural reality based models can be an effective design tool. In this paper, the 3D model of a square of the old town center of Cosenza, and two animations are presented. In the first one, the present look of the square is shown. Some zoomings underline the high level of details. The second animation shows a nocturnal view, and the effect of a lighting project can be observed.

1. INTRODUCTION

1.1 The Architecture Representation

The representation of the architecture has a particular importance for the old town centers. A realistic model is a very useful tool from several points of view.

It is an investigation tool:

3D sights allow to study the dimensional proportions among buildings, the topological and chromatic relationships, the use of decorative elements. In case of adjacent buildings, it is also important to study the whole blocks peculiarities, besides the characteristics of the single elements.

It is a design and planning tool:

3D sights are useful to design restoration and housing works, to evaluate the insertion of new elements in the surrounding landscape, to optimize the insertion of decorations and the effects of lighting projects.

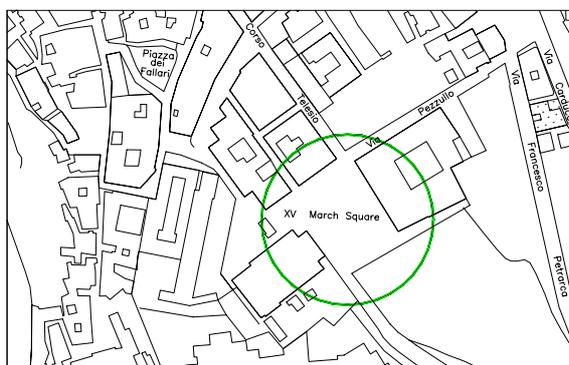


Figure 1. Map of Cosenza Old Town

In order to study the elements of historic sites (quarters, streets, squares), it is important to consider the time. The designs of many monumental sites have been set up taking into account astronomical studies, and peculiar scenographic effects are obtained during particular days (solstices, equinoxes). The

monuments itself become clocks (sundials) or calendars (pyramids, Stonehenge). The same site offers completely different sights, passing from the day to the night.

The actually available CAD softwares allow to obtain realistic three-dimensional views, but often a static representation is not exhaustive. For the study of an old town center, it is important the dynamic element. Depending on the followed paths, one can have different sequences of sights and perspectives, that emphasize the spatial relationships of the urban elements. A dynamic representation, allowing to choose different virtual paths, is, therefore, an important tool both for study and planning aims. It can help the designers and the planners to foresee the future look of a town, after the realization of a project.

1.2 The subject of the manuscript

The paper describes a 3D model of the largest square of the old town of Cosenza. The model is used to realize an animation, showing the present state of the square. In order to demonstrate the use of the 3D model animation as a design tool, the realization of a lighting project has been simulated. A second animation shows a nightly dynamic view of the square.

The technique used for this job is the evolution of the procedure applied to the main street of Dubrovnik (Artese, G. and Salemi, G., 2002).

2. HISTORICAL NOTICES

2.1 The old town center of Cosenza

The old town of Cosenza lies on a site that was inhabited 3000 years ago. Many ruins of the roman age were found. The city and his hinterland were built on seven hills. The main urban conglomeration is located on the Pancrazio hill, with the overhanging medieval castle of the emperor Frederic the Second (XIII century). Several earthquakes, during the centuries, damaged the city; many buildings were destroyed by the biggest

one (1638), and by the *Calabria earthquake* (1783). The large part of the houses and monuments actually present were built during the XVI, XVII and XVIII centuries.

After the second world war the city of Cosenza has grown in the plain zone, and the old town became depopulated. During the last 20 years, several restoration works have been realized. The facades of the main buildings and the paving of the main street (corso Telesio) and of the main squares (Dome square and XV March square) have been restored.

2.2 The XV March Square



Figure 2. Augmented Reality View of XV March Square

The square studied in the present paper (piazza XV Marzo) is the widest one in the old town center of Cosenza (Figure 2). Four important buildings overlook the square:

- the *Rendano* theater, built between 1877 and 1909;
- the *Academy Palace*, (XVI century), that accomodates the *Cosentina Academy* founded by Aulo Giano Parrasio (a famous member was the philosopher Bernardino Telesio);
- the Sersale House (1592);
- the palace of the Province, built between 1844 and 1847 in neo-classical style on the remains of the monastery of S. Maria of Costantinopoli (1711 – 1720).

3. METHODOLOGY

3.1 The Surveying

The surveying of several points on the paving of the square and on the buildings facades has been executed. A 3D polyhedric model has been obtained (Figure 3).

The images of pavings, facades and decoration elements have been obtained using a digital camera.

The facades and the roofs of the buildings have been modeled considering plane elements; the railings of the balconies have been apart modeled, using 3D elements.

3.2 The Image Processing

The images have been previously equalized and the obstructions present during the shots (people, cars) have been removed. Then a rectification has been executed, by using at least 5 surveyed points.

For every face of the model, a rectified and clipped image has been attached. For the small details and for the balustrades, the textures obtained from the photos have been used.

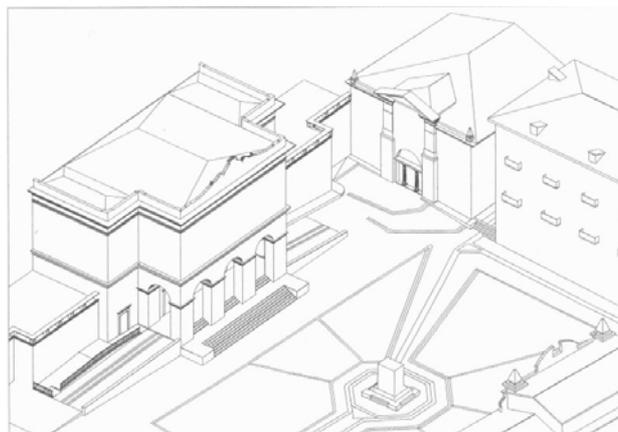


Figure 3. 3D Wireframe Model of the Square

3.2 The Background

A different procedure has been used for the background, with the Pancrazio hill and the castle. From the digital map of Cosenza, a 3D model of the hill has been obtained, using a Delaunay triangulation.

On the triangular faces, the relevant portions of the aerial photos have been applied. The castle has been modeled as a parallelogram placed side by side of an octagonal prism, on whose faces the textures obtained from photos have been applied.

4. INSTRUMENTATION AND SOFTWARE

4.1 Hardware

A ZEISS Rec Elta RL total station, with electro-optic reflectorless rangefinder, has been used for the surveying. The angle measurement accuracy is equal to 5^{cc}, the range measurement accuracy is +/- 3 mm.

The images of the facades have been obtained using a digital camera KODAK DC 3200 with a 39 mm lens. For the details a 135 mm lens has been used.

A Personal Computer with INTEL Pentium III processor, 256 Mbytes RAM and a Matrox Millennium G200 graphic board has been used for the data processing.

4.2 Software

Autocad 2000 has been used to obtain the 3D models.

Stereoview 200 has been used for the image processing and rectification.

3D Studio max has been used to generate the animations.

5. THE ANIMATIONS

5.1 The First Animation

For the first animation, a typical path has been chosen. It begins at the end of the main street. The visitor enters the square from Telesio Street, bordering the Sersale Palace (Figure 4).



Figure 4. View from Sersale Palace



Figure 5. The Rendano Theater



Figure 6. The Theater Portico

The visitor continues down to the Rendano Theater (Figure 5), and enters the portico (Figure 6). From the portico, it is possible to see the perspective of the Academy Palace (Figure 7) and, on the right side, the Palace of the Province (Figure 8).

Coming out, the path continues on the right side, with a view of the Academy Palace and Sersale Palace (Figures 9 – 10). Panoramic views are given (Figures 11 – 12). Some zoomings underline the details of the buildings.



Figure 7. View of the Academy Palace from the portico



Figure 8. View of the Province Palace from the portico



Figure 9. View of the Academy Palace, Sersale Palace and Province Palace from the square

The perspectives chosen for the animation are obtained from points of view having a height of about 1.7 meters, while the final sequence offers a panoramic view. The lighting conditions are typical of a spring sunny day.



Figure 10. View of the Sersale Palace



Figure 11. Panoramic view of the Province Palace



Figure 12. Panoramic view of the Academy Palace

5.2 The Lighting Project

A lighting hypothesis for the square has been set up. Three kinds of lighting instruments have been used:

- A target spot to light up the fresco on the facade of the Academy Palace;

- Four omnidirectional lamps on the granite base positioned in the center of the square, and four ones in the portico of the theater;
- Several target direct lamps, with vertical direction, on the entablatures of the buildings.

The lighting hypothesis isn't a real project, but it is used to demonstrate the augmented reality effect of the 3D model.

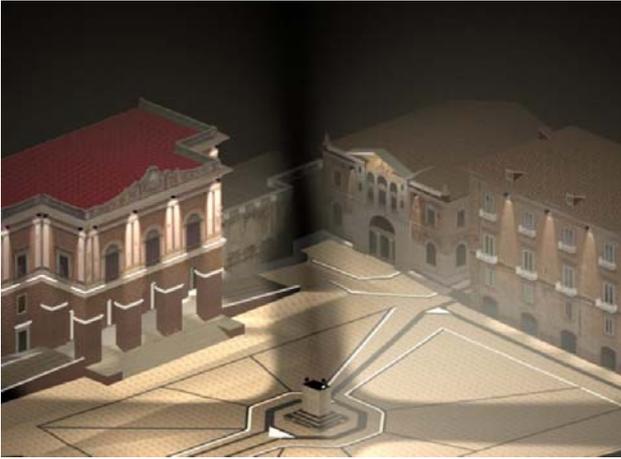


Figure 13. Nocturnal view of XV March Square



Figure 16. Nocturnal view of the Rendano Theater



Figure 14. Nocturnal view of XV March Square



Figure 17. Panoramic view of XV March Square



Figure 15. Nocturnal view of the Academy Palace

5.3 The Second Animation

For the second animation, a different path has been chosen. The visitor starts near the theater and walks around the central base. Some zoomings underline details of the buildings. Panoramic views are obtained following a second loop, at a height of about 15 meters. This animation offers the nocturnal views obtained by using the previously described lighting hypothesis.



Figure 18. Panoramic view



Figure 19. Panoramic view

6. CONCLUSIONS

The dynamic representation of the largest square of the old town of Cosenza has been used as a design tool. The effects of a lighting project are obtained. In our case, the foreseen lighting hypothesis should be optimized. It is evident that a poor lighting is present in some zones of the square. The realistic 3D model and the animations can help the designer to optimize the project.

7. REFERENCES

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