



Registration and 3D virtual reconstruction of the old Carmen's Spa Park (Málaga)

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Abstract

For nearly two decades, computer graphics technologies have been employed in several fields for various purposes. The safeguard, the protection and the fruition of the remains of the past have gained a powerful tool, thanks to the potentialities of immersive visualization and 3D reconstruction. Nevertheless, on many occasions, the graphic information handled by people working in the cultural heritage sector is still in two dimensional models. This paper presents the research carried out to fill a gap in the 3D cultural heritage registration of Malaga, in Southern Spain, by virtual recreation techniques. It illustrates a complete methodology to create a virtual exhibition system, based on archaeological finds and graphical-historical information of the Carmen's Spa Park. The model developed allows the study and displays the historical representation of this cultural heritage.

1. Introduction

Nowadays, data acquisition techniques allow very accurate 3D data sets. Thanks to these technological advances, 3D models are now being used in various fields such as engineering and architectural studies. As a consequence, 3D data sets are quite useful in research projects dealing with 3D reconstruction of heritage monuments. By means of these technologies, environments, scenes, buildings and machines can be generated and illustrated in images enabling virtual walkthrough.

However, while the data is readily available, modeling is a time-consuming process which requires a computational high cost, since, for instance, buildings are usually characterized by a complex geometry. On the other hand, modeling architectural details is no easy matter. Indeed, when tackling the problem of describing their geometry, the elaboration of a distinct 3D model for each of the existing scenarios can be a tedious task. This research project deals with the historical and graphical restoration of a much appreciated area by Málaga citizens.

2. Historical context

The Carmen's Spa Park dates from the 1918, and is located on some land gained from the sea, on the beach of San Telmo, Málaga (Spain). Years ago a pier was used there for the transportation of stones extracted from San Telmo's quarry, which supplied the new breakwaters for the works at Málaga's harbor with raw materials. After discarding the quarry, the site was re-landed leaving a large space for beaches and lagoons, where subsequently the Spa Park would be built.

According to [1], the first historical review related to the Spa, dates back to 1778 in Dieppe, France called "Maisón

de Santé". It was located in the center of the beach, and often visited by those who believed in its healing powers. Since then, there is a talk on the therapeutic effects of bathing in the sea, air baths and sunbathing. Right here, the Earl of Brancas founded the first permanent sea baths in 1822, popularized by the Duchess of Berry in 1824.

Spas arrived in Malaga in 1843 with the Diana's Spa. Baths at these Spas were taken in a similar way to thermal or minero-medicinal water resorts. Inside the building there were compartments to take the baths where cold or warm water was poured in stone, marble or wooden bathtubs. Later, sea baths supply would be completed with similar buildings, for instance, the Star's Spa in 1859 and Apollo's in 1879. They usually had a temporary nature as only one year concessions were granted. They were built out to sea on iron pillars, divided into individual departments for women, men and families.

The Diana's Spa extended from the "Customs' building" to the "Baños de la Estrella" (currently, "Puerta Oscura Gardens"), while the Estrella's Spa was built on the "Pescadores beach" (currently, "Heredia's dock"), and moved in 1862 to the 'Beach of the ciegos'. Apollo Spa was inaugurated in 1879 in front of the 'Postigo de los Abades', near to Diana's and The Estrella's baths; actually not being the most suitable place for sea baths (fig. 1), since sewer drainage and residues of ships mooring at the harbor were poured at this point.

As a consequence of the lack of hygiene, the baths and any Spa establishment were banned in these beaches, so they were moved to the "Malagueta" in 1874.

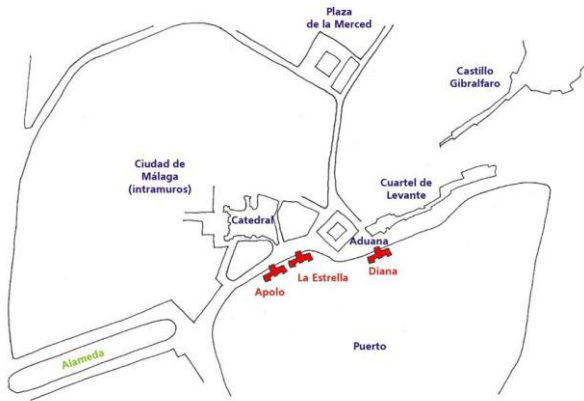


Fig. 1 Spa located in the city of Malaga. 1867-1887.

The Carmen's Spa Park would be established annexed to the "Cerro de San Telmo", which is a mountainous stone terrain with the military watchtower at the top receiving the same name; a 6.8 m high watchtower of the Arab period. The stream of San Telmo, which flows into these beaches, goes by the west watercourse and is currently channeled underground, where the main entrance to "Cerrado de Calderón" housing development is found. Though, these beaches were originally a rectilinear edge that we cannot notice nowadays.

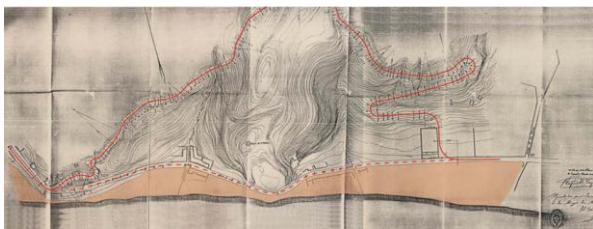


Fig. 2 San Telmo's Beach, the coastal route and temporary deviation to Almería. Rafael Yagüe 21/2/1878. Port file. 1163/24/4.

After the re-landing of its former port, the area of the beaches of San Telmo turned into large beaches used for recreation and bathing practice so far only been used by fishermen. In addition, the railroad bridge facilitated the arrival in this place. The administrative process began on January 10 (fig. 3).

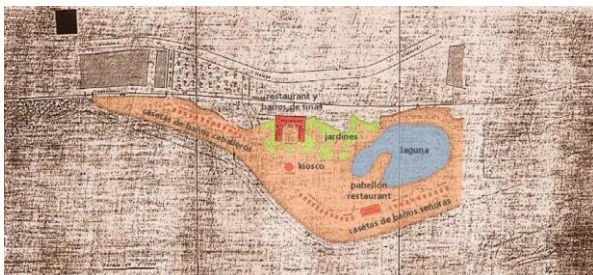


Fig. 3 Map of Spa, signed by the Engineer Carlos Loring Martínez. 1918. Costas file.

The spa was limited to the West by the "Arroyo de San Telmo", to the East by the "Carenero Nuegas (Astilleros Nereo)" and to the North by the railway line. The entrance to the spa was established from the outset by its current access, consisting of a way beginning at the road to Almería (Joaquín Sorolla Avenue) and coming out into the beach, crossing the railway line and bridging the gap between the beach and the access level. These facilities would already have a building near the railroad

tracks, with "U" shape for the restaurant, inside which bath tubs, considered quite usual till then, were offered.



Fig. 4 Portable huts

The rest of the site, as shown in the floor plan of Charles Loring (fig. 3), is set up by the gardens that surround the main building, the lagoon lying to the East and the beaches that were divided into gentlemen to the West and ladies to the East, where wooden portable huts were evenly spread along the coastline, allowing the attire change of the bather, (fig. 4). Thus, the Carmen's Spa Park was inaugurated on 16 July 1918, which offered a new way of taking baths already introduced in the Spanish territory as the beaches of San Sebastian and Santander, proving to be a great success. The houses and the fence which used to separate the women area from the men and family area remained the same until being destroyed by the storms in 1990. They would never be rebuilt due to the judicial process that the community concessionaires suffered as a consequence of the ending of free access to the beaches finished by the Directorate General of Ports and Coasts.



Fig. 5 Photograph of two-store houses. 60's. Manchester Municipal archive.

3. Methodology

Information is provided by means of: maps and plans, drawing and sketches, texts, contemporary photos and slides, photos taken from satellites, scale models, bibliographical references, etc.

Later, the main objective is to digitize every piece of information. Therefore, the different components of the Spa and its structure must be analyzed, in order to be able to compound the whole "puzzle" afterwards.

3.1 Elements descriptions

3.1.1 The facade of the Old Spa

The façade (fig. 7 y 8) is the only entrance to the spa and is the symbol that represents and distinguishes the place. Related to its construction, it is a clear example

of regional architecture, which combines the use of brick, tile and wood.



Fig. 6 The facade of Carmen's Spa. Photograph of the 20's.

The house is built on six pillars made of brick: four at the corners and two intermediate which are connected to those corresponding to the front door; as a whole, this structure together with the exterior facade compound its front face.

The two stretches that form the facade are made with a base of brick in the bottom, pretending masonry bond, and ended by moldings of the same material across the pilasters. The moldings have a gorge and right heel shape resulting in a mixed compound molding, with an arch profile made out of a concave form in its upper side, tangent to a convex form in its lower side.

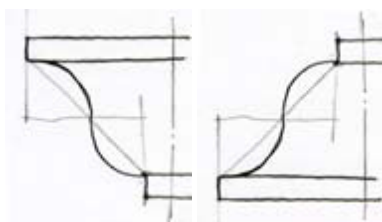


Fig. 7 Molding Profile

The top of the enclosure is finished in tile with blue and white zoomorphic motifs built-in among double rows of brick and a brick cornice with molding formation in the first stretch while the parapet is finished off in vitrified tiles. The corner pilasters annexed to the east fence are also decorated with the same ceramic mosaics and ceramic amphorae made of clay over right molding on brick.

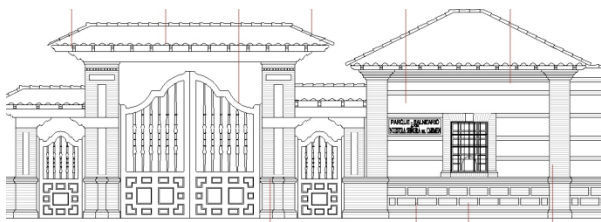


Fig. 8b Main elevation of the cover



Fig. 8a Façade graphic reconstruction



Fig. 9 Tile zoomorphic and carved doors

The roof consists in sloped gables made of Arab vitrified colored tile, alternating blue and white rows, and topped with ceramic vitrified pinnacles (fig 12).

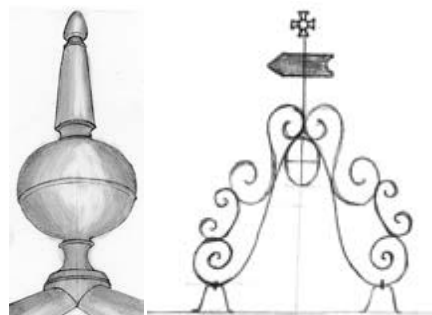


Fig. 10 Pinnacle, and forges vane.

The head profiles of corbels describe a sinuous contour characteristic of the architecture at that time. The other facades of the gatehouse are within the enclosure and are much more simplified.

3.1.2 Fencing

The fence of the resort is made in the same line as the facade using partitions of enclosure which are divided by the pilasters. Each pier is constructed with a brick base, and brick molding pieces that cross the pillars topping the base on its upper and lower side, in a similar way to the facade. The rest of the enclosure walls are finished with white painting on plaster cement, describing a concave curve topped with pieces of white and blue glazed Moorish tiles.

3.1.3 Entrance and terrace

A slight slope takes us down to the colonnade that leads to the interior. This gate, which goes through the terrace and it is interrupted by the restaurant, is formed by Ionic-Corinthian-style columns.

The columns are distributed as follows: six couples from the entrance to the restaurant and four more pairs forward the restaurant (fig. 11 y 12). These groups of columns are not completely the same as up to five different types of capital decoration can be found on the remaining columns when looking closer at them.

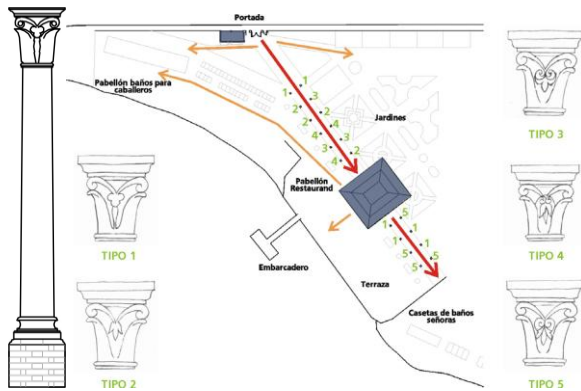


Fig. 11 The entrance colonnade and typologies



Fig. 12a Colonnade, 20's. Original Postal, own collection.



Fig. 12b Virtual recreation down the colonnade

The terrace, next to the restaurant is the center of gravity of the resort, and is part of the construction of the pier made in 1920. It was one of the most expensive and laborious works carried out then, where lots of landfill material was poured, having to wait until its consolidation.

The terrace consists in an open platform built right on the coastal line, raised 1.30 meters above sea level and looking South-West which is protected from the sea by a short stone wall. The platform is provided with a protection wall towards the sea, which is divided into partitions reinforced with pilasters every 3 meters along the terrace edge, only interrupted by the pier bridge.

The partitions were used to hang some advertisements through mosaics, a very common methodology also located at every element of the Spa; illumination posts were distributed over every two pilasters forming connected figures forked in two arms supporting the spotlights.

The Restaurant is located in the center of the terrace, and mainly composed of a one-store building made of wood which would be replaced in 1933 by the current building, designed by architect Daniel Rubio.

3.1.4 The restaurant

Firstly, it consisted of a lightweight building with wooden walls, pillars and large windows bringing great luminosity to the inside. The roof was composed of wooden boards forming the slope gables over visible small beams supported by slender wooden pillars.



Fig. 13 The restaurant, 20's. Website of the chess club. Málaga.

3.1.5 The Pier

The pier is a long narrow platform that goes into the sea, supported by wooden posts resting in an intermediate concrete prism.

On each side of the platform, steel posts are fixed with a rope joining them working as a handrail; the boarding is facilitated by lowering and widening the handrail at the end.



Fig. 14 Photograph of pier 20's. Website chess club. Malaga

3.1.6 The kiosk of the wheel

The kiosk of the wheel corresponds to a wooden shed on the terrace. It consisted on a covered hexagonal kiosk made out from a high platform, pillars and wooden gables

On each side of the pedestal six numbers were plotted, making a total of thirty-six which corresponded to the numbering at one side of the wheel (fig. 15).



Fig. 15 Photograph of the dance-floor roulette, years 20. Website chess pieces chess club. Malaga.

3.1.7 Tennis court

These were three adjacent courts of bounded clay with lime lines where playing in pairs was possible.



Fig. 16 Tennis court, 20's.

3.1.8 Gardens

The gardens were located at the back of the restaurant, going from the entrance to the end of the colonnade on a wedge formation that combined different shapes, square and triangular.

The vegetation was extensive and surrounded everything. In fact, every corner of the spa was decorated with various plants and flowers.



Fig. 17 Current picture of the Garden cage

3.1.9 The wine fountain

This fountain was located in the gardens of the Spa. It had the particularity of flowing sherry instead of water.

The fountain consists of an eight-pointed star shaped basin set into the tiled floor which was made of square patterns alternating white and green as a checkerboard, and finished off with blue pieces at the edges.



Fig. 18a The wine fountain, years 20.

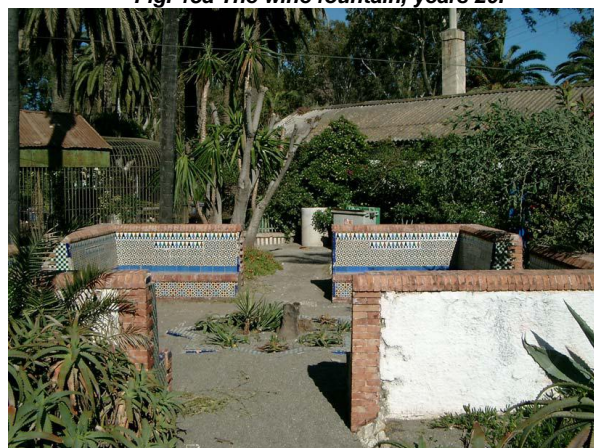


Fig. 18b Current picture of the wine fountain



Fig. 19 Virtual representation of the tiles and the wine fountain.

3.1.10 The football field

The entrance to the pitch was established by the "Parsley Alley", a narrow alley, on the environs of the Spa.

3.1.11 Other components

Skating rink(1927)
Aquarius(1929)

Amusement Halls
Lake of ducks (1930)

New restaurant(1933), it is a new building according to the celebrity and the renown of the place, replacing the former construction. This project was entrusted the illustrious architect from Málaga, Daniel Rubio, resulting in a two-storey building in close relationship with the others works on the Spa and the façade, following the regional architecture, and perfectly integrated with other components of the terrace; It kept the same orientation than the former one.



Fig. 20 View of the restaurant, Daniel Rubio, 1933.

The floor of the restaurant rises on exterior rectangular-shaped pillars spread along the enclosure combining with the outside columns. Inside the building there are only four circular large-diameter pillars, thus defining a rectangular structural grid.

3.2 Virtual reconstruction

The image-based modeling allows performing 3D models at low cost, though generally with high manual intervention. The digital information for three dimensions involves a complex data processing and includes the command of several tools as digital imaging software among which AutoCAD and 3D Studio MAX are used for modeling and mapping of reconstituted buildings, and CorelDRAW Graphics Suite is used for the digitalization of documents and picture retouching, etc.

3.2.1 Data processing

The first step is visiting the Old Carmen's Spa where we can measure and sketch all the remaining elements and structures for the late virtual reconstruction, and for scale reference. Furthermore, it is necessary to choose the right photo in order to make out a digitalized replica and analyze the shapes. Once the photo has been elected, (fig. 21), we will work on Corel PhotoPaint to crop the studied area so as to enhance it for later processing.



Fig.21. Images and picture processing.

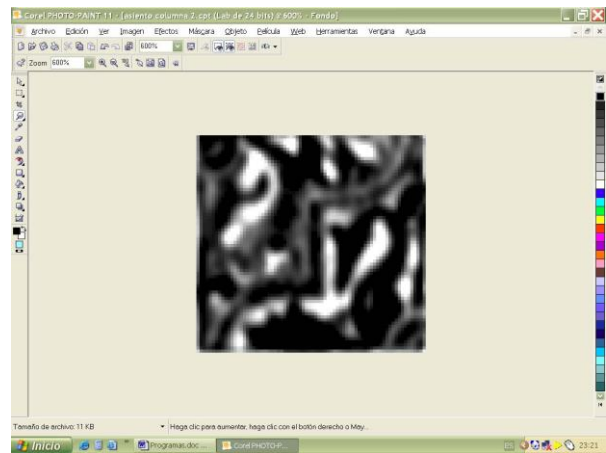


Fig. 22 Enhancing the cut piece

In this piece, a freehand sketch is performed. When it is done, we insert it as image in AutoCAD.

3.2.2 Digitization

Once in AutoCAD, we reproduce the sketch. Although the size is not previously established, the proportions will be taken on account.

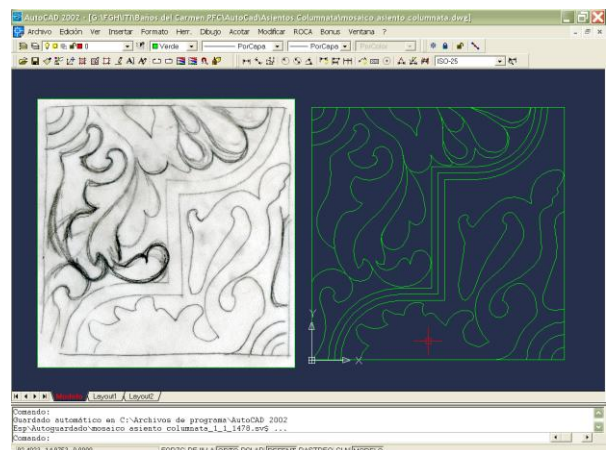


Fig. 23 Reproduction of sketch in AutoCAD

In case of fig. 23, the purpose of the mosaics drawn in AutoCAD is to color the shapes with CorelDRAW. Firstly, the drawings are exported to create closed contours, made of shading polylines on each area. In order to define the polylines, the figures must be properly drawn, exporting the drawings and saving them in swap files (. DXF), since,

it provides a greater effectiveness in the exporting process.

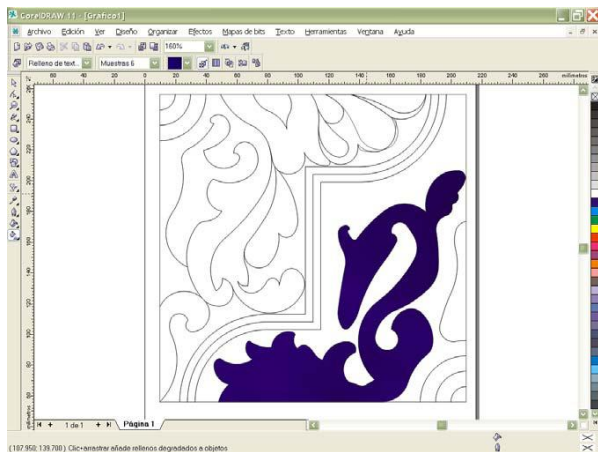


Fig. 24 Color application with Corel DRAW

The process of coloring is easier using CorelDRAW Shader after having defined closed contours. With the filling tool, textures with colors are defined simulating the glazed tile.

When coloring the tile, a bitmap is generated in order to apply some effects which provide greater realism.

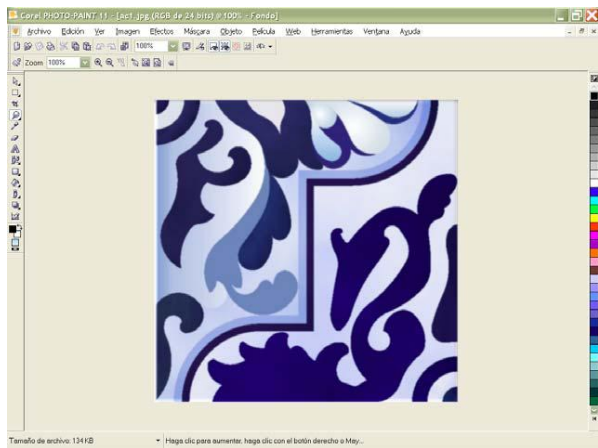


Fig. 25 Results obtained

This process will be carried out for every different type of tile.

Once the images have been converted, each part of the bench is made up in CorelDRAW (fig. 26).

These frames are composed of small pieces manufactured in CorelDRAW, which are pasted on the model in 3D Studio MAX afterwards.

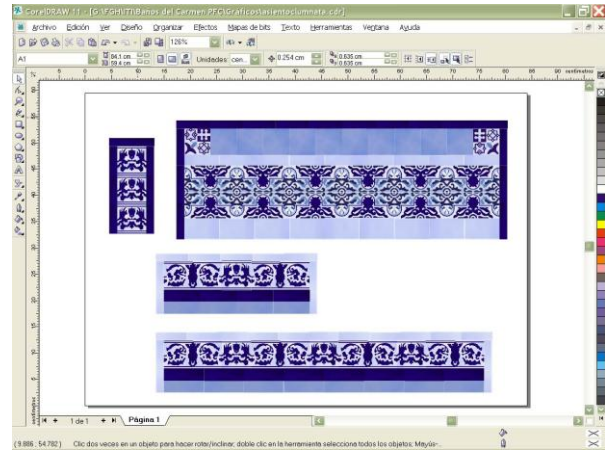


Fig. 26 Composition of images

After reproducing the tiles is the time for the seat. In Autocad, the dimensions of the seat will be drawn only in the floor plan. As the seat does not exist anymore, the proportions have been obtained from pictures, by comparison to the width of the colonnade.

In case that the contours will be going to be extruded, we need to convert them into closed polylines before transferring the files to 3D Studio MAX. The exchange method applied here consists on assigning one color to each polyline, so that each entity will be defined by a different color in the 3D Studio Max file. MAX allows direct importation from AutoCAD (.dwg) files, always remembering to draw near the reference system origin to avoid frights in the exchange process.

By using 3D Studio MAX, we will extrude and rise every polyline (splines) obtaining the seat model in an easy and simple way. We will apply the materials on it, from the mosaic pattern that we have already built.

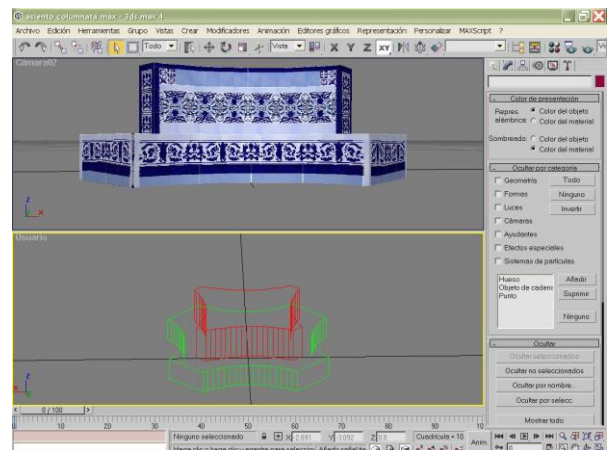


Fig.27 Dealing with 3DStudio

3.2.3 Modeling

Next step consists in studying each part of the building, and finding its main features and resemblances.

These operations are achieved with specific computer programs that help to build the frame, the so-called 'structure in wire'.

The building is made out of hundreds or thousands of faces, using different materials as tile, marble or wood. We can obtain these materials directly from pictures or from computer-generated images.

The last step is a matter of lightening. Lighting parameters must be carefully set in order to get a proper highlight, such as the number, position and intensity.

As final result, a quite accurate visual reconstruction of the old Carmen Spa is achieved by using all these tools.



Fig. 28 Virtual Recreation 1



Fig. 29 Virtual Recreation 2



Fig. 30 Virtual Recreation 3



Fig. 31 Virtual Recreation 4

4. Conclusion

In this paper, we have presented the project of the virtual reconstruction of the old Carmen's Spa Park (Málaga).

The techniques approach suggested in this paper prove to be effective in the 3D modeling of complex cultural heritage sites. Some considerations about 3D modeling of complex architectures have been dealt with here.

A working methodology has been elaborated to facilitate future works on historical and graphical restoration, helping the optimization of sources and personnel.

Finally, citizens of Malaga have been able to visualize how the Carmen's Spa Park used to be years ago.

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