CONTEMPORARY LASER SCANNER 3D
FOR ENHANCEMENT OF CULTURAL HERITAGE

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ABSTRACT

In architecture the Laser Scanner 3D is an instrument to surveys of monument widespread and certainly reliable, now.
This experience uses the laser scanner 3D to preserve and increase in value the monument. Specifically, during the restoration of the castle in “Mola di Bari”, in the South of Italy, was realised the excavation in the courtyard of the castle; it was possible to found, near the sea, a “village” of 1600-1800 B.C. The relief and the storage of the pertinent specifications with a laser scanner 3D enabled immediately the conservation of the finds, the fruition of the courtyard and, in future, the possibility to increase in value and promotion of the important find.
Her veracity assented the authorization from the proper Office to the refilling of the excavation.
In the future, in fact, with this type of study it will be possible to reproduce on the scale, in the museum realized in the same castle, all the complexity of the find: his context, his meaning also for “the outsiders”, his material. At the same time, the original is safeguarded down the floor, but always “at hand” in case of different necessity.

INTRODUCTION

During the restoration of the castle in “Mola di Bari”, a small city near Bari, in Puglia in the South of Italy, was realised an important excavation in his courtyard.
In fact this complex monumental, erected with the will of Charles I Angevin in 1276, has the sixteenth-century architectural “facies”: it has, now, the shapes of quadrangle with bastions and thick masonry.

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Figure 1: The castle in 17° century

The castle is external at the historical ancient part of the city, near at the sea on the side North, separated from the city by a moat and by a masonry bridge. These last two parts (masonry bridge and moat) are restored in 2007, because they was forgot and neglected during the last century. After decades of abandonment and uses incorrect, for example as a military traffic light, a stone quarry, a chapel, a handicraft laboratory, etc., the part that was in better conditions was utilized for the public slaughter-house. For this destination it was opened a new entrance in the walls, on the opposite side of the old town.

This paper doesn't study its many and many and interessant historical news or the specificity architectural of this monument. For this research, it's only important the beginning: Carlo I Angevin repopulated Mola di Bari's land and founded its “palatium” to defend the Adriatic seaboard [1]. Before this time and before the restoration of 1999-2000 we don't had certainty about former frequentation of this place. Someone assert that the foundation of Mola di Bari is Greek, someone that it is Roman, someone that it is Norman [2].

It's sure that during the restoration of 1999-2000 it was realized the excavation in the castle's courtyard to find the “Angevin palatium”. The remains founded wasn't medieval. So, in the restoration of 2006-2008 was organised excavation in the courtyard to knows all it had preserved.

EXPERIMENTAL

As it's synthesized in the introduction, during the completion of the restoration of the castle in Mola di Bari (2006-2008) was realised the important excavation. In fact, at the beginning, it doesn’t knows the extension and the quality of the remains. So it was
organised a scrupulous stratigraphic excavation [3] in the castle's courtyard for a surface of 35s.m. and for a depth of 1.50m.

The excavations, from 22.01 at 23.04.2007, has determined the realization of a provisional cover in a corrugated sheet-iron to work under that structure and, at the same time, safeguard the remains. In this case, in fact, the remains are made from the same configuration and quality of the ground, from the position of a stone splinter, from the position and the depth of the holes, etc. So they are extremely perishables, if they touch the water or also if they stay in a humid place.

The excavation with the direct guard of the Superintendence Archaeological develops stratum by stratum. For every stratum it was made the relief, the drawing of samples and finds, a first restoration – washing, cataloguing, dating, reconstruction and preservation.
Figure 3: The laboratory of restoration.

Every potsherd was identified with a progressive number, its stratum (US), the position with x and y coordinates and the altitude [4].

Figure 4: The phases of restoration.

The excavation and the study of the potsherds, founds in the courtyard, testify that here there was a “village” of 1600-1800 B.C.
It's sure that in this place, during that period, there were five times in which this place was inhabited.
The first reflexion is that all these potsherds are at few centimetres from the ground.
The second is that there aren't traces of different utilization after the second century B.C.
Finally, the excavation has stopped at US 325.

Figure 5: One level before the US 325.

On the US 325 there’s the “village”: a cobbled paving, two cabins, the holes of the pile caisson and the big wall enclosure – 2.50 metre wide. A pile caisson's diameter is 25cm or 50cm. The paving is a stone floor, made by little cobblestones; on this surface we have found many potsherds in ceramic and bone. The paving delimit two circular cabins: their half was destroyed by the medieval building.
The flooring of the cabins is clay of compact texture. The North cabin has a boundary in little stones plunged apeak one beside the other; the east has a boundary in media stones [4].
The scientific quality, the historical importance, the nature, the extension and the homogeneity of that we had found in the courtyard have determined the necessary of the conservation.
But, from the other side, an aspect very important was the complete fruition of the courtyard. That is impossible if we decided to leave under the open sky the excavation. In fact his last level isn't only vast (2/3 of the surface) and it has, also, a depth of one metre and a half.
Therefore several professionals, the civil service, and the Superintendence had decided to check my hypothetical solution.
The idea was very simple: first, we make a scientific relief of the castle; second, the closure of the
area’s excavation is made in clay, the disassembly of the temporary cover; third, the realization of a
model. This practice is reversible and give us many possibilities for the future use.
The relief detailed of the “village” and the storage of the pertinent specifications was made with a
laser scanner 3D.

Figure 6: The US 325: the last level of excavation

Figure 7: Image from the pc monitor during the scanning of the excavation: the “cloud of point”.

The digital technique utilized, with his laser, follows the surfaces, combines every real point with virtual point endowed with three spatial coordinates. These coordinates are determined as regards the points fixed by spheres. All the points combined immediately compose the so-called “cloud of point” or the virtual “image solid” entirely true to the reality. In fact the error of the instrument is 1,5 mm at a distance of 200m and the velocity is 5000 point at the second. Besides, for every point of the “cloud” the instrument learn his value as reflectance, his position, the nature of his material, the type of work-surface or degree of decay.

So, the “cloud of points”, realised, is the virtual archives of the find, from which we can choose and take, every time we want, only the necessary information according to the situation, the aim and the funds. In fact, made a choice of cubic part with a side of 30cm, we had realised a virtual model.

![Figure 8: Virtual model of a part of the prehistorical find.](image)

From the virtual model by the laser scanner relief it was possible to produce a copy in different materials; in this case the reproduction is in laminating white resin in full-size scale.

Now, this model is conserved in the Superintendence.
**Figure 9:** The real model in resin.

**Figure 10:** The real model in resin by haut.
RESULTS & DISCUSSION

The veracity of the model, the possibilities of this system (reproduce a part or the total, in every scale we want, in so many materials, for any reasons), the virtual verification and so on, assented the authorization from the proper Office to the refilling of the excavation.

The virtual database replaces the mould of the “excavation” - sometimes it's impossible, for example in correspondence of the holes. The mould is in need of much more time and it not have the possibility to “come back” at the data base and find other quality, ect.

In the future, in fact and for example, with this type of study, it will be possible to reproduce on the scale, in the museum realized in the same castle, all the complexity of the find: his context, his meaning also for the “outsiders”, his material. At the same time, the original is safeguarded down the floor in the courtyard, but always “at hand” in case of different necessity.