From Space to Place

2nd International Conference on Remote Sensing in Archaeology

Proceedings of the
2nd International Workshop,
CNR, Rome, Italy, December 4-7, 2006

Edited by

Stefano Campana
Maurizio Forte

BAR International Series 1568
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3D Visualization of archaeological place of Corzano

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Extents, purposes and context of the research

The report we are to present is the result of a former research, which was commissioned in order to constitute the documental basis for the material and signification recovery of Corzano – a fortified settlement on mountains between Toscana and Emilia-Romagna. This research was conducted through the study and the documentation of surviving fortifications in a place, which, during the centuries, has represented an important presence in the life of the community and of the surrounding landscape.

Therefore, it is the result of a complex work of reconstructing an organic documentary picture, which has been obtained through the integration of multiple informative repertoires: from material documentation on the site's existing buildings (created during three different surveying campaigns on the surviving fortifications) to territorial and land documentation of its context, to the individualization of realistic evaluating potentiality for material and meaning restoration of the site of Corzano.

The ranging and the proliferation of fortified settlement and garrisons along the main roads interests the communities on the Tosco-Romagna mountains especially between the twelfth and the fourteenth centuries. The seigniorial powers with military origins and the same monastic orders rise and take roots (until the Florentine conquest, which is completed at the beginning of the fifteenth century) in peripheral territories of the imperial and ecclesiastical jurisdictional seats, faraway from big urban centres, but with an important strategic role for the viability connecting the Po valley to central Italy.

Here, the exercise of power is executed controlling the ancient *romee* roads, which pilgrims and armies from the north ride to reach the central Italy through the passes of the *Alpes appenninae*: in fact, along these roads are settled many *castra* and *rocchae*, as well documented by the contemporary sources and the current remains of material structures.

At the end of 2005, the Municipality of Bagno di Romagna, in the province of Forlì-Cesena, has commissioned a research to the Department of *Progettazione dell'Architettura* of the University of Florence[1] for the creation of documents and the formulation of hypothesis on the recovery of constructional works in Corzano, an outstanding example of a garrison with a military eminent character that controlled important trans-Apennine roads conducting to the Val di Bagno.

Articulation of the research

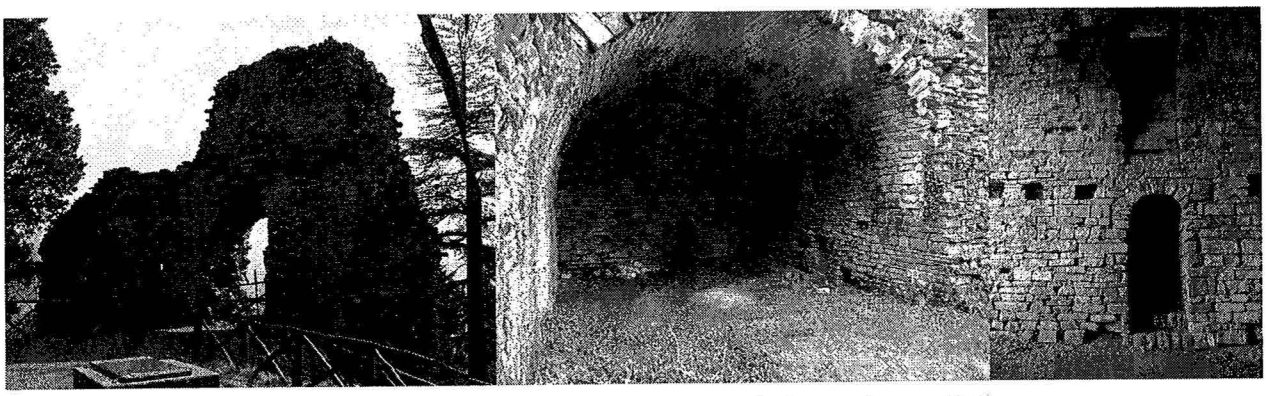
The documentation and the survey of material and immaterial aspects that connote cultural heritage represents more and more the tool to try keeping knowledge control at least of rapid land transformations (where it is impossible to act on every single case), and, more, the necessary operative assumption for all of the situations where it is possible to concretely intervene.

In this strategy, the result of surveying operations assumes the value of representing model of the investigated object, a model for which the thematic elaboration of basic information represent a fundamental critical aspect to manage the building.

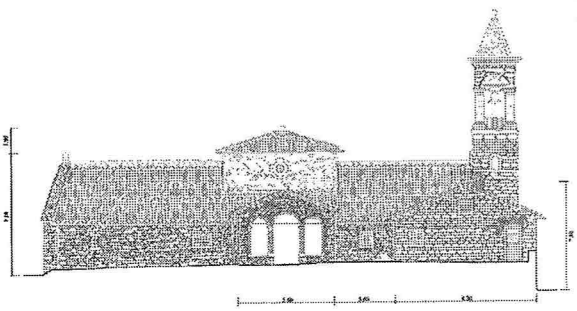
In fact, the higher is the technological level of surveying procedures (by means of the most sophisticated digital tools and methodologies) the greater results the exigency of critically rule the sense attribution of acquired information and the deep understanding of formal, functional, building and spatial meaning of the surveyed/revealed object.

For this reason, during the survey planning of the site of Corzano, the surveying project preceding the field operations has carefully considered the exigency of thematic and critical elaboration of data, looking further the objective of precision and data exactitude, to concentrate on determining the complex formal, social and cultural organization of the settlement and its constituting elements to try and go along the steps of its creation again.

[1] The scientific chairman for this Agreement is Doc. Paola Puma, who coordinates the working group including: Michele Cornieti, Carlo Battini, Lorenzo Bianchini, Diego Cacciamani, Elia Carli, Francesca Concas, Sergio Di Tondo, Silvia Mantovani, Francesco Tioli, Giorgio Verdiani.



Il Santuario della Madonna di Corzano



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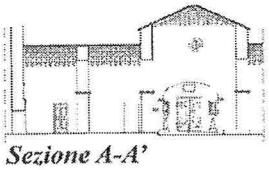

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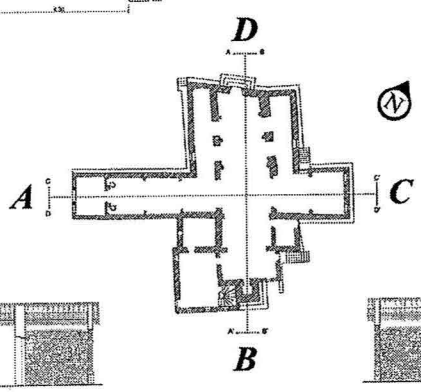

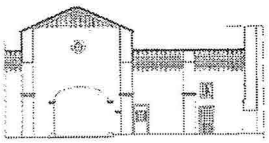

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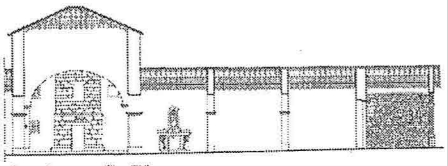

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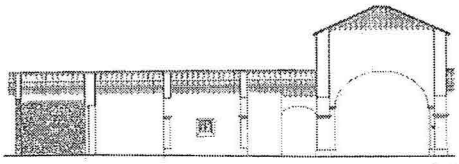

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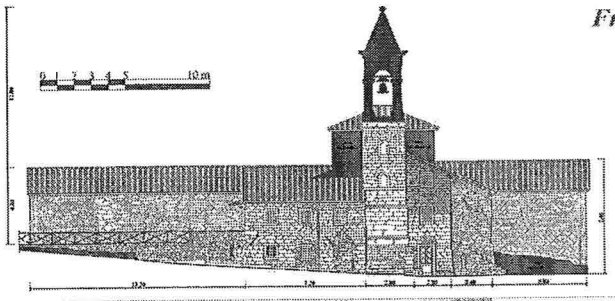
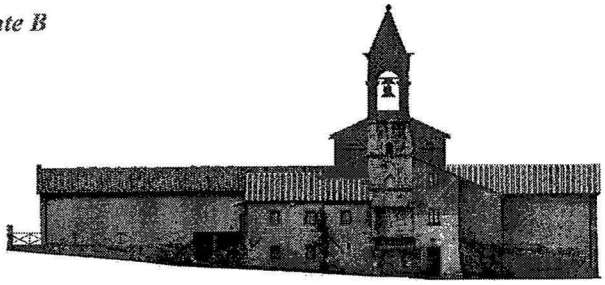
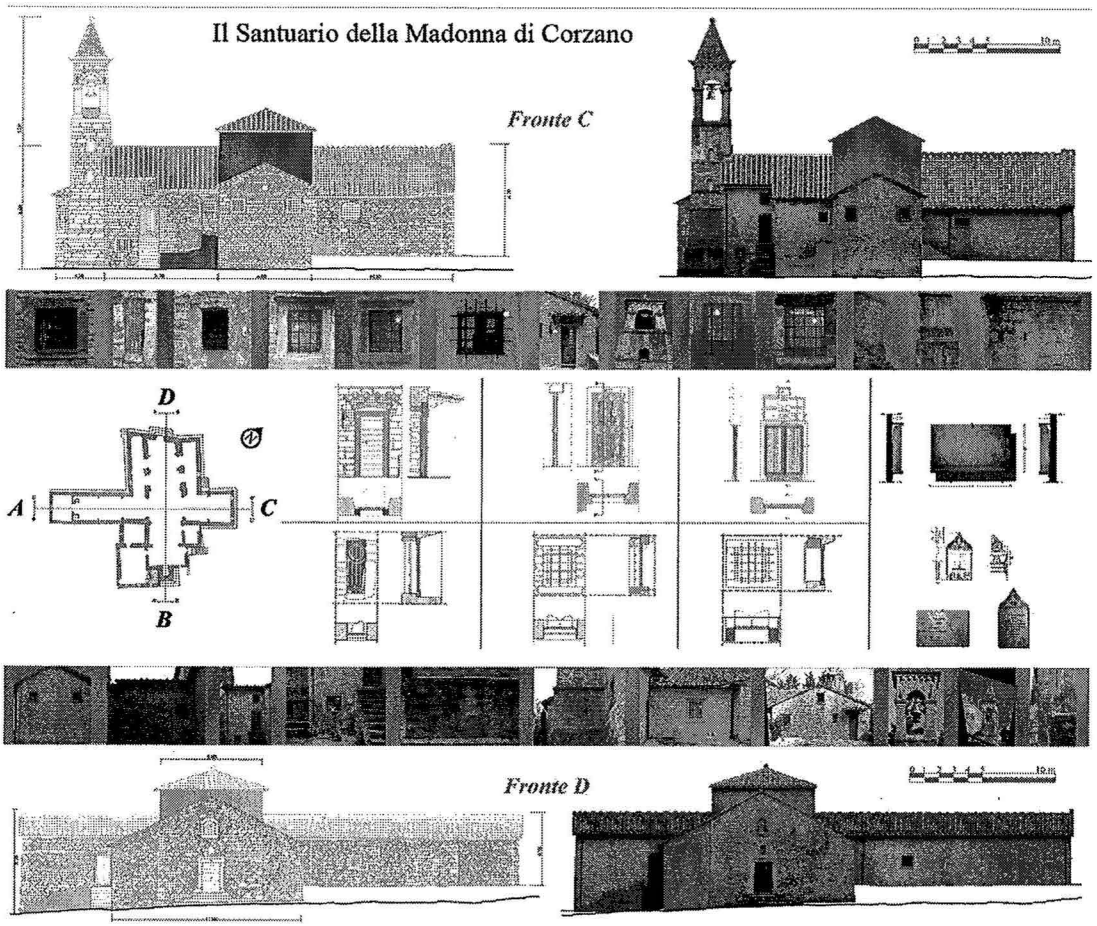






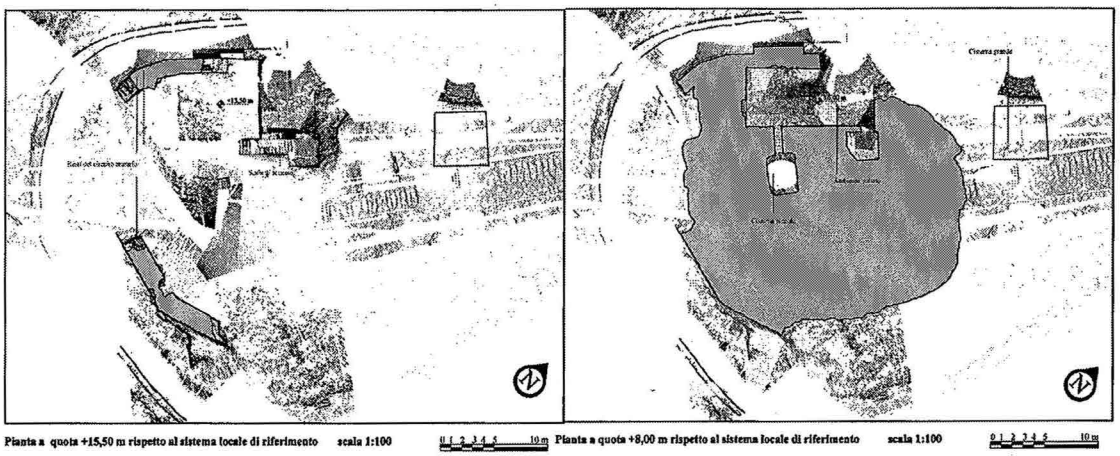
In such sense, we have tried to effect a *good* survey, a scientific survey which could give reasons to metrical, formal, spatial and material characteristics, but which could also allow the reconstruction of the place's historical transformations, the reflection of its chronological steps, the verification of formal problems, the underlining of time successions, the collecting of its essence by recording anomalies or static reasons and, finally, its real comprehension.

The surviving constructional works in this place, the ruins of the Fortress (which is datable to the twelfth century) and the Sanctuary (which is documented since the thirteenth century), have been surveyed at the beginning of 2006 during three thematically articulated campaigns, with following base restitutions and thematic elaborations aiming to the critical evaluation of a range of aspects in connection with the possible individuation of remains, which can conduct to the typical settling fortified typologies of that territorial context, the specific individual settling and territorial control modalities, morphology, building techniques, the possible original configuration of the castle. The plan of work has been drawn considering different steps their own methodology, tools and proceedings: but these steps are characterised by strong integration, aiming to the production of descriptive elaborations of the elements complexity, though they are intentionally simplified and friendly designed for not specialists final users.

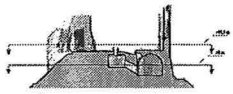
The researching project of the work group had different objectives and steps:

1 data acquirement: creation of a data base, documentation and integrated survey through the realization of an updated and complete morphological, dimensional survey[2] of surviving buildings and their characters: the rests of the fortress, the Sanctuary and their close context;
2 thematic restitutions of morphologic, metrical and material data through the following production of basic graphical restitutions and thematic elaborations for the critical evaluation of the building[3] ;
3 Critical elaborations: structural, building, geometric and preservative consistence of the constructional works aiming to chose useful elements for the possible individualization of signs that could help us to verify if the few current surviving structures allow to give hypothesis on formal analogies with other typical fortified places in that territorial context, on the specific settling and land control modalities and on the possible original configuration of the castle;[4]

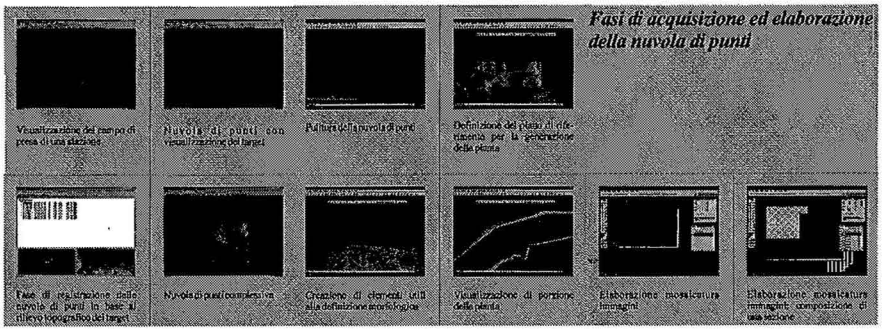
[2] Specialist deepening on surveying methodologies is by Francesco Tioli and Giorgio Verdiani.
[3] Specialist deepening on thematic elaboration is by Carlo Battini.
[4] Specialist deepening on critical evaluations is by Francesca Concas, Michele Cornieti, Sergio Di Tondo.



Corzano dal rilievo alla restituzione



Piante e sezioni



4 Planning and restoration proposals consisting on the verification of the possibility to interpret an evaluating project on Corzano not as a sequence of additional building interventions but as the evaluation of resources already present in such a rich territory, and, if ever, limiting interventions on the site to the few necessary maintaining and recovering works.[5]

Data collection

During the first organizing step, the structure of the data base has been created: at first the historical documentation had to be collected in this data base, in order to be systematically ordered, configured and referred to for the following creation of links among historical, surveyed, reinstated and elaborated data.

Integrated survey

The planning of the integrated survey campaign has been necessary to the collection of data from:

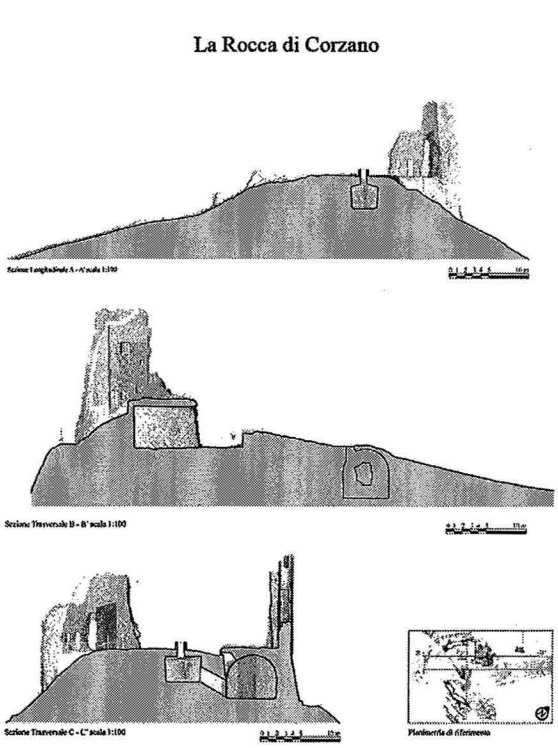
- Digital survey of the fortress, by means of Leica HSD 2500 laser scan with ToF (time of flight) technology;
- Photogrammetric survey of the Sanctuary;
- Topographic survey, by means of a total station Leica 706 no-prism, for the necessary references;
- Direct survey, supporting the photogrammetric survey.

Thematic restitutions and critical elaborations

In this case, the particular morphological and environmental conditions of the place, with the intrinsic characteristic of the constructional work and its grade of preservation, asked for and indispensable integration among the different tools, surveying and data interpretation procedures. In fact, every methodology, from the most traditional to the most technically evolved one, has been chosen because it was the most suitable to investigate specific aspects. The surveying campaign and the following interpretation of the Corzano Castle's structures have put in evidence the necessity of a systematic confrontation during the operations between the data that were collected by means of the laser scan technology and those collected with the traditional investigating tools for architecture and archaeology, such as the analysis of geometrical configuration and stratigraphy of the fronts.

The undifferentiated and massive collection of the metric data through the laser scan technology on one hand gives a complete, precise and fast survey as unimaginable

[5] Specialist deepening on project proposals is by Anna Lambertini, Silvia Mantovani, Paola Puma, Gianfranco Corzani.



before, on the other hand shows the lack in the surveying action of the fundamental intellectual operation: the critical discrimination of the constructional work.

During this necessarily autopsic step, the surveyor is immediately bound to read and to formulate interpretations on the investigated object, while with the laser scan technology the operator risks to remain at a superficial understanding of the object: the point cloud model that has been generated through the laser scan technology digital survey, in fact, does not supply an exhaustive picture of the possible information of the constructional work, but its efficiency appears as it is supported by other investigative tools, so that it can clarify complex situations through the three dimensional view.

The same accurate and massive characteristics of its contained data put the point cloud model in an intermediate position between the investigated object and its representation through conventional systems and elaborations, which are still indispensable to conduct critical analysis.

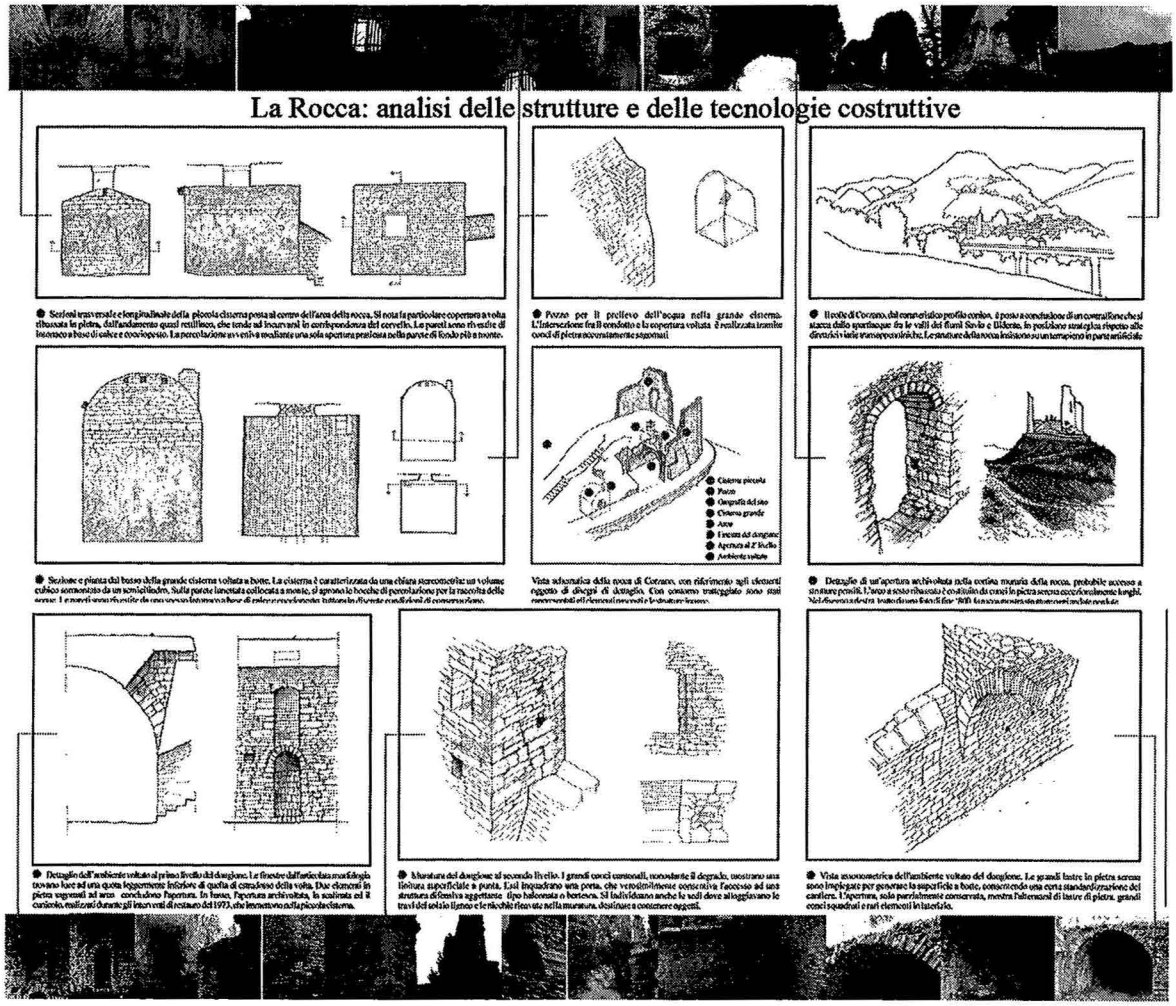
Once that the geometrical data are acquired, it is necessary to effect a "virtual survey" through a selection of sensible points, in order to describe the geometry of the object; this operation can be equalized to discernment, although the point cloud itself is a discontinue object.

In any case, as every following elaboration of data and digital geometry causes a loss or an alteration of the original information, such a model is the most precise and congruent under a metric and morphologic point of view, although perceptively distant from the investigated object and difficultly manageable.

If, at the level of usual representation, the data gained from digital survey has to be treated through more or less laborious applications and processes, the rough point cloud is a valid tool during the stratigraphical analysis, as it allows, for example, verifying at a three dimensional level interfaces and relations among the different actions, or eventual alterations of parameters' co planarity and variations in the alignment of constructive elements, as index of meaningful stratigraphical events. More, it is immediately possible to extend the verification to interpreting hypothesis on the whole building, in order to evaluate its coherence.

In the investigation on the Castle of Corzano, the interpretation of the complete three-dimensional cloud of points model has put in evidence discontinuities and anomalies in the plans and in the walls alignment, which could not be perceived with traditional tools, due to the characteristics of the place and the inaccessibility of some structures. Their congruence has been verified through the information of the traditional reading of wall disposition.

This has helped in the individuation of late or restoration interventions, which sometimes have modified the perimeter of the original plan in the fortified settlement. In those contiguous walls portions, which have been realised in different times, the different superficial degradation of the material do not seem to affect the view of the cloud of points with false colours, due to the material reflectivity (a local sandstone). Instead, the multi resolution and NURBS digital geometry three dimensional model, which has been elaborated starting from a cloud point with the integration of data collected from a following detailed topographical survey, is useful to deepen the investigations the composing and spatial matrixes of the fortress, through the individuation of geometrical and proportional relations. Particularly, the possibility of extrapolating aimed cross sections in different zones of the whole area and spatially extending the hypothesis about surviving original walls has permitted to desume information on the planning origin of the settlement and to give hypothesis on the building protocols based on empirical measurements used by the makers of the fortress. Finally, such a model, shaped on the selection of the surviving original structures, has given support and reference to some reconstructing hypothesis that, even if showing evident limits, have been formulated on the base of typological and morphological confrontations on similar buildings in the same geographical area and as a consequence of the analysis of



indirect, written and iconographical documentary sources.

From the drawing to the 3d model: three-dimensional view as analysing, verifying and communication tool

The collected data that have been collected during the steps 1 and 2 have been elaborated and divided into different database, which have been related under finalized rules.

The first use of the collected information has allowed the production of a wide range of graphical elaborations, constituting the necessary documental base for the understanding and the interpretation of data. More, they represented synthetic documents of the analysis that have been conducted in a direct contact with the place, such as the stratigraphic interpretation of walls, the geometric and measure relations among the parts, interpretative keys which have contributed to clarify the historical and constructive facts of the structures that have determined its current configuration.

The second use of the collected data has involved the regulation of tools allowing the analysis of the examined object by means of interactive systems that is manageable by final user too. These tools have been defined in a plan that foresees the creation of three-dimensional digital models with different scale of detail: textured VRML model, average detail definition model, high detail definition model.

An important goal of the working group has constantly been the will of using an interpreting and representing system of surveyed data where the three dimensional visualization is not a simple representation of both the current state and the hypothesis of reconstruction, but a tool for investigation, analysis and scientific control.

Under this profile the study of the place has been conducted creating an easy manageable general model, which is indispensable for the morphologic and geometric analysis of the constructional work. Later, the detail definition has been improved to investigate the building, stratigraphic and structural characteristics: this has allowed the formulation of a former hypothesis on the genesis and the development of the building, which has converged on the final model. The final model has been set on an average scale of representation, in order to better suit for a fast visualization within a web browser.

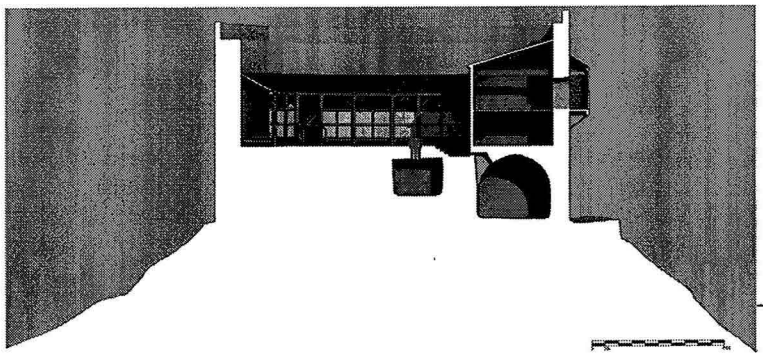
The third use of the surveys has been the production of a virtual model of Corzano place, as a synthesis of the study and allowing the proposal of the castle's original configuration.

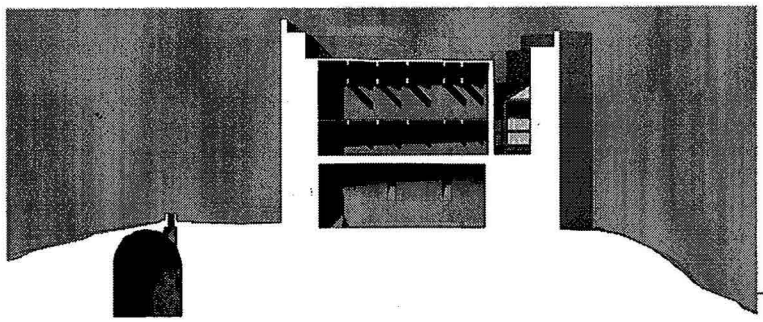
The purpose of the differently scaled three dimensional representations rises from the necessity of producing elaborations that can be used not only on dedicated systems with suitable software and hardware, but also within a wider project that indicates the web as source of information exchanges and cultural growth.

In fact, the planned research included the creation of informative web pages.

The elaborated three-dimensional models have been used as a tool for immediate visual communication, with links to other pages with more definition and information. This simple and intuitive tree-structure allows both the simple visitor and the expert to concentrate his attention also on detailed portions of the constructional work, without loosing the starting general conuration.

The plan foresees the possibility of interaction with data banks for admitted people, who can insert annotations and results of researches on analogous themes.





Ipotesi di ricostruzione

Stato ricostruito:
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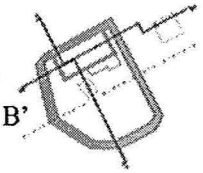

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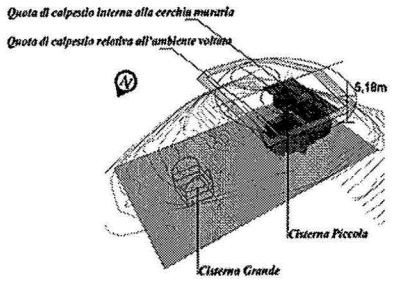
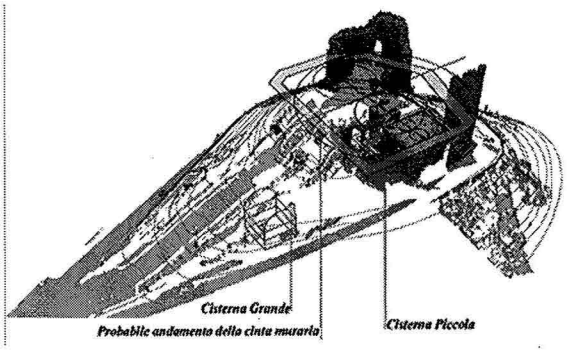
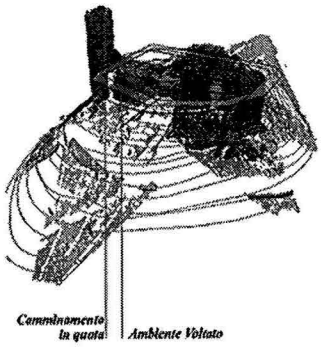
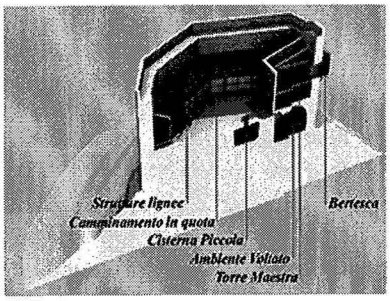


Ipotesi di identificazione degli ambienti principali







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IN MERITO AL RICONOSCIMENTO DI AUTORIALITA' DICHIARA

Paola Puma, Carlo Battini, Loreno Bianchini, Francesca Concas, Michele Cornieti, Francesco Tioli, *3D Visualization of archaeological place of Corzano, Documentation, search, communication medium*, sta in: "From space to place", Archaeopress, Oxford, England, 2006, pag. 339-345.

Si dichiara che i capitoli:
Extents, purposes and context of the research;
Articulation of the research.

sono stati scritti dalla candidata e che, per scelta editoriale, tale indicazione non è stata mantenuta dall'editore.

Firenze, 14 luglio 2017

In fede
Paola Puma