

Fabbrica della Conoscenza

XV INTERNATIONAL FORUM

Le Vie dei
Mercanti

Carmine Gambardella



WORLD HERITAGE
and DISASTER

WORLD HERITAGE and DISASTER

Knowledge, Culture and Representation

La scuola di Pitagora editrice

Fabbrica della Conoscenza numero 71
Collana fondata e diretta da Carmine Gambardella

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WORLD HERITAGE and DISASTER
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Le Vie dei Mercanti _ XV International Forum

Carmine Gambardella
WORLD HERITAGE and DEGRADATION
Smart Design, Planning and Technologies
Le Vie dei Mercanti
XV Forum Internazionale di Studi

editing: Ciro Ferrandes

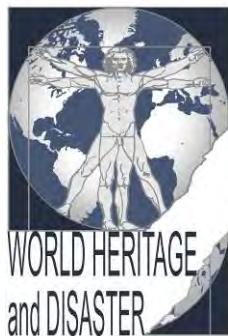
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ISBN 978-88-6542-582-4

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Il volume è stato inserito nella collana Fabbrica della Conoscenza, fondata e diretta da Carmine Gambardella, in seguito a peer review anonimo da parte di due membri del Comitato Scientifico.

The volume has been included in the series Fabbrica della Conoscenza, founded and directed by Carmine Gambardella, after an anonymous peer-review by two members of the Scientific Committee.



Le Vie dei
Mercanti

XV FORUM INTERNAZIONALE WORLD HERITAGE and DISASTER

Knowledge, Culture and Representation

Naples 15 - Capri 16,17 June 2017

Emergency and Survey. The use of photo modeling to document the minor heritage after a natural calamity

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Abstract

The question of documentation of the architectural heritage after a catastrophic event, such as landslide, flood or earthquake, is a topical subject, as shown by the latest events in our Country.

In the emergency after a disaster, the housing needs of evacuees by rebuilding as soon as possible, coexists with the urgency to document the building heritage in order to supervise and plan compatible recovery operations to preserve its features.

The modern technologies give the possibility to complete a proper survey by reducing the data acquisition times as well as the measurement errors.

Leaving aside the use of laser scanners and drones, this paper is a presentation of the results obtained using the photo modeling technique applied for the documentation of Alianello (MT) a small town in Lucania, abandoned after the disastrous earthquake of 1980. With the use of photo, processed with specific software, it was possible to detect in detail this small village by returning survey papers from which it is possible to analyze the crack pattern that affects the individual buildings, operating in safety.

Keywords: survey, photo modeling, documentation, analyses

1. Introduction [Enza Tolla]

In the practice of survey and architectural representation, the survey method and the techniques used for cataloging and data transmission play an important role.

The design for the project has not only an instrumental role, but it is also a theoretical elaboration, in fact it contributes to the shaping of a spatial concept and a project design, on the contrary to the survey design is predominantly attributed a data communication role, because the object we represent already exists and design is the tool that allows its transcription on the drawing paper and then its communication

This is just partly true, in the survey, the drawing is the means by which it carries out the analysis of the building, redrawing what we have seen and measured, it obliges us to reflections and critical thoughts that find materialization just in the drawing.

The survey drawing is an operational tool of the analysis conducted, it allows progressive control of the adequacy of data, it allows to go beyond what we might call an aseptic return of real, to be itself an interpreter of investigated reality.

In this sense, the drawing is an active element of the mental process, It is able to interact with the researcher, to stimulate reflections and thoughts, along the operating path of research and study.

The survey drawing, like the project design, describes not only the existing, but it helps us to develop the analysis of the building, given that the drawing helps to increase the knowledge and the advance of knowledge changes and expands the content of patterns.

The project drawings seem to give a series of objective information, but they are the product of the author's subjective interpretation who transfers in them his capacity for analysis and synthesis, his culture and his knowledge.

Drawing a measured building doesn't mean give back an image like a photo, but it explains the result of a series of choices, related to the critical ability to select the information to be given, in the right way.

The survey is not a neutral and selective process, but a subjective one, and so, it allows us to analyze the architecture by choosing the methodology to be used not only for the analysis and the measures collected, but also as regards the graphic representation of detected data.

The process of analysis will necessarily differ according to the specific areas of study and to the purpose of survey, as many will be the graphic rendering mode. The intentions behind survey define also the type, the number and the quality of papers to be produced, from traditional graphics to the virtual transcripts.

Computer graphics give the possibility to greatly expand the expressive range of our measurements, one thinks of three-dimensional modeling, simulations or animations.

The three-dimensional models, created with graphics programs, may present a surface treatment, in the texture and color, very similar to that of real surfaces, it is also possible to represent the model with particular lighting conditions, to build in this way more realistic views.

The introduction of the time dimension in the representation, also through animation, allows more detailed inspections and it offers a chance to return image otherwise not achievable.

The dynamic representation, the visual simulation of a path or the gradual breakdown of a complex organism are some of the most interesting possibilities offered to us by the use of new technologies. At this point, the creation of a real descriptive mode becomes useful, defined on the basis of survey data which are: dimensional and geometric, functional and distributive, structural and architectural but also environmental, compositional and historic-critical data.

The planning of graphics to be produced, ensures a conscious use of drawing during the steps of the relief itself, in fact it is an investigative tool and it allows, at the same time, to provide graphical outputs appropriate to the topic and the specific field of study.

2. The info-graphic template for survey [Antonio Bixio]

The "model" word includes a multiplicity of meanings that, in some way, bring back to a single concept. In fact, "model" is a generic and transverse term and it affects different areas of study: from mathematics to economics, from numerical systems to the molecular chemistry, etc.

This term defines, a specific role: to represent, in an effective way, a phenomenon or a real situation.

From this generic definition, which collects all model types, it is possible to include the 'info-graphic model' among the best and current devices in the analysis of architecture, of the territory and of the city, like a "bridge" between the reality and graphic analytical-planning process.

The info-graphic model combines the graphic designs, identified by traditional representations (projections of Monge, axonometric, perspective or quoted projections), it becomes an integral part of them. The classic elaborates, (maps, fronts and sections) would be enough to fully represent a reality built with fidelity and portability; but technological innovation and, therefore, the info-graphic model, open the horizons of communication and knowledge, making it more immediate, intuitive and for a large audience. The instant disclosure of an existing or planned architecture goes through the global communication that, today, is organized in the network and that demolishes all the space-time limits.

The "facility" of modeling is affiliated with automatic software which become highly risky instruments for the control and management of a project idea or of a reality analysis. In fact, the digital model in architecture has to be thought like a sort of manual construction on a controllable scale, as a sculpture which finds its forms by basic spatial elements or from volumes through the dynamic relationship between a generating line and a directrix. CAD Digital modeling uses automated tasks from which we can not dismiss but, like all automatic process, it is appropriate to have knowledge of the facts to be able to govern and lead the instrument without subordination and dependency.

About the applications of survey laboratory, after the end of initial phase of the info-graphic design, there is the three-dimensional modeling phase, it becomes a moment of great maturity it gives a "form" to what the mind has already set in detection phases and in two-dimensional rendering. In this way, it is a bit "shaping from memory", as the instrument were the direct expression of the acquired knowledge, space, analyzed and perceived geometry. It is considered to be the most appropriate process to teach how to "think" the space and how to represent it and how to manage survey data without any subjection to technology and innovation.

It is possible to have doubt about the usefulness of the info-graphic model made in advance, before a traditional graphical analysis (two-dimensional), as a tool for the design and for the existing study, or a doubt on its adequacy and on its use even during the creation phases or during the analysis of architectural forms. The info-graphic survey template can not be conceived as the only analysis tool. In fact, the cognitive process subject to an analytical path, as the one carried out on the existing, it brings together a series of data composed in partial and precise representations, putting the decomposed reality back together. The architecture relief is not a predetermined process, it is full of accidents and conditions which can not be programmed.



Fig. 1: Alianello, village of Basilicata.

The graphical analysis should be done in progress, as it is possible to acquire information and useful elements for the work. The structure of a course of research depends on techniques that require very stringent operational moments. For example the use of the instrument for the direct detection is important to approach to the architecture to be analyzed with graphic notes, photos and horizontal and vertical measurements, etc.

So the preliminary surveys have an important role, as well as it is not allowed to skip the phase of graphic (plans, depiction of a plan, elevation, prospectus or section. They are obligated steps which have their logic, and they find their completion in the info-graphic modeling, like the last analytical form of representation.

It is also true that it is possible to create each of the two-dimensional graphic representation (maps, fronts sections, axonometric projection and perspectives) starting from info-graphic model, changing the observer's point of view and working with appropriate intersecting planes. Even if the model can be executed with prowess, with precision and with the care of every single part, it can never give us back all the information related to the traditional representation in different scales of graphic reproduction. A model could be even executed in "full-scale" and so with the absolute definition of each element of the reality to consider; from a doorknob to the covering of the entire building, from a window pane to the type of an insulation package, everything may have an unlimited definition in the virtual modeling. Each info-graphic model should be conceived by defining the level of detail and specific themes to treat.

For this reason it is necessary to separate the traditional graphical analysis when performed on two-dimensional CAD modeling from info-graphics that should be set according to what you want to analyze. This approach, adopted in the Survey Laboratory, allows to follow a method of knowledge of existing by using complementary but interconnected instrument. Moreover, the info-graphic modeling, far to propose a complete virtual representation of reality, defines new forms of representation which perfect those in the technical drawing.

3. Methodological approaches to the study of architecture in emergency through photogrammetry [Giuseppe Damone, Carlo Plastina]

The documentation of the architectural heritage after a catastrophic event such as landslide, flood or earthquake is a central point to monitor the state of heritage, and also to produce elaborates on which, in a second moment, lead reflections about recovery and restoration projects.



Fig. 2: Alianello's square.

Subsequently to a catastrophic event, as the latest events in our Country confirm, it is necessary to give an answer to housing need of evacuees but at the same time, it is important to conduct the first major operation that will become fundamental for the preservation of monumental and minor built heritage.

To detect and then to know the status of building damaged by an earthquake, for example, allows us to plan immediately first interventions to prevent its collapse. These interventions, obviously, are carried out in a much more complex situation than the normal conditions when usually the relief is operated. The problem of collapses, ruins and other extreme conditions make difficult the work of operator who has to work in dangerous conditions.

Today, through the use of new technologies, it is possible to conduct great detail reliefs by standing at distance from the object to investigate; one of them is photogrammetry.

The photogrammetric survey is a relief operated through the use of camera machines - cameras, two rooms cameras, etc. - which allow to extract from frames the information necessary to trace graphics of the investigated object. This allows the return of metrics information of the detected object starting from its photographic image, by adding qualitative data on its character. Necessary condition to achieve this purpose is the visibility of the points to be detected.

Through this modern technology, which partly replaces the expensive equipment such as 3d laser scanner, 2d and 3d rendering of buildings, or portions of urban areas are developed for a more complete reading of the architectural organism and they coexist with the results obtained from more traditional experiments. The cost of this technique is now guaranteed by the recent availability of computers able to process large amounts of data and by technological advances got from computer graphics.

Each photo shot is associated to a system of Cartesian axes which allows to deduce the coordinates for each point of image by giving a metric value to the same picture. This shot is performed by considering some technical measures, such as the overlapping at least 60% of the images.

3.1 The case of Alianello in Basilicata

Alianello is in the municipality of Aliano, province of Matera, it was built on a rock spur at 350 meters above sea level to the left of the Agri river and its origin going back to the late Middle Ages.

The historical information about this small village are almost non-existent, cause it is just a tiny village that in its moment of demographic peak numbered just over 200 inhabitants.



Fig. 3: Photogrammetric model of Alianello.

The major historical events of Alianello are linked to the two great earthquakes: the first in 1857 and the second one in 1980. With regard to the earthquake of December 1857, a big part of the hamlet was condemned, about a quarter of the population died because of damage to the building stock, and after several inspections to assess the situation, in 1925 Alianello was declared condemn and almost the entire population moved to Aliano and to the neighboring towns.

With the earthquake of November 1980 even the latest families move out of the center which becomes a ghost town.

Today the village is still in a disastrous state because of landslides, destroyed buildings, inaccessible roads and conditions of total abandon, condition that led to the choice to conduct an experiment on the use of photogrammetry for the assets monitoring.



Fig. 4: Photogrammetric model of Alianello.



Fig. 5: Alianello's church.



Fig. 6: Alianello church's processed by Agisoft Photoscan- working phases.

It is precisely the conditions of the small town - quite similar to those found in a center just hit by an earthquake – to dictate its choice as the scope of photogrammetry for its documentation – it was possible to process a digital model using the Agisoft Photoscan.

From work done, it appears how important is this cheap, fast and accessible technique of relief and how it is a very valuable one.

It has been possible to achieve the creation of accurate three-dimensional models and vector drawings in CAD from a simple acquisition of digital photos, with the ability to use the results obtained by drawing a map of crack patterns to analyze buildings damaged by earthquakes or by a state of deterioration.

The advantages are many; among these the possibility of providing data from appropriate safety distance (effecting a kind of remote sensing) in order to avoid coming in contact with precarious buildings. Another point in favor of these important techniques is the rapidity to get a large amount of information using lighter equipment, easier to transport and faster to use.

We can also remember that, given the "speed of execution" of this method and its cost (not only of necessary equipment but also of staff employed), this work can be repeated over time to evaluate the time evolution of cracks and of the structural instability.



Fig. 7: Photogrammetric model of Alianello.

The phase of graphic and vector rendering of data enables the rapid identification of structural cracks and it allows to read them in an overview, this can be very important to evaluate the structural condition and the damage levels of a building, in order to implement repairs and safety interventions. Photo modeling and photogrammetry represent the effective and immediate tools of relief and monitoring of the crack patterns of a building.

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