Loughlin Kealy
Stefano F. Musso
Editors

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The workshop was attended by almost 65 participants representing: Belgium, Denmark, France, Ireland, Italy, Poland, Portugal, Spain, United States of America,United Kingdom.

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Computer Simulation of the Impact of Restoration on the Building as a Method of Communication

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Even if restoration is carried out very conservatively to respect the building's integrity, the restoration of an old building always involves a transformation that has a greater or lesser impact on its materiality, character, authenticity and traces of the past. The installation of new electrical wiring or plumbing, the possible substitution of damaged parts, the repair of the lesions found, the filling-in of gaps in the cladding, the re-bonding of the masonry, new coats of paint on the walls, etc., inevitably affect not only the built substance of the building but people's perception of it also.

This impact is unavoidable, but can be controlled so as to be coherent with the expectations and criteria of the restoration project. It is distressing when the restoration of a building has been carried out, to later hear the author of the restoration express his grief about the transformation the building has undergone against his will, and despite the control he has exerted during the works. Even the most detailed project can neglect some issues regarding the impact of the intervention on the building being restored.

Today, informatics makes it possible to simulate efficiently the effects of interventions: the cleaning and conservation of materials (Torsello 1999: 253-259); the insertion of new functional elements or furniture; the filling-in of gaps or the addition of materials, and so forth. The idea is to draw up projects in the awareness of the transformation one is willing to accept, to gauge and assess it, and control it before beginning the works by means of computer simulations. These are very useful tools at the decision-making stage of the intervention, because they help predict the final impact on the building after restoration (Torsello 2005: 15-17).

At the same time, informatics has become an instrument for communication concerning the restoration project, not only with the technicians, architects, builders or bricklayers, but also with the owners or the man in the street, especially in the case of monuments or buildings that form part of the heritage of the inhabitants of a region or country. The restoration project is no longer expressed only by means of floor plans, elevations, sections and building details, technical reports or budgets, addressed almost exclusively to the world of construction professionals and specialists, but can also be manifested by means of computer simulations that show the building in a way that is very close to the way it will look when the restoration works have been completed. Informatics provides not only two-dimensional means, for example, with photoplans of the façades, sections, floor surfaces, etc., that is to say, a whole world of pixels (Torsello 2003), which can be manipulated to prepare proposals before and after restoration by gauging the impact of the intervention, and also produce virtual, three-dimensional images of the spaces after restoration *(Fig. 1)* and predetermined visual tours that provide a dynamic image of the visual perception of the final result.

Informatics continues to develop very powerful tools that can be used to communicate the restoration project to the people who will be working on it and to the owners before the intervention. Virtual tours and even enhanced reality not only provide an in-depth knowledge of the final result of the restoration and its impact on the building, but make it possible to discuss the details of the execution process and coordinate the tasks of the different craftsmen participating in the restoration works, even before the works actually begin.

For this purpose, the first step is to prepare photoplans of the external and internal façades of the building, that is, rectified photographs reproduced to a scale that has a metric value. A photoplan contains a great deal more information than a simple elevational drawing. In fact, a photoplan not only reflects the geometry of lines, edges, cornices, ridges, fascias, bays, changes of plane, etc., but also the texture, colour, tone, surface gradation, treatment, shadows, etc. The photoplan does not substitute for the metric survey, which, by selecting the information to be drawn in a critical manner, makes it possible to discover details that might not be visible to the naked eye, but complements it and serves as a basis, for example, for a possible manipulation of the photograph afterwards, to make tests or simulations of the results of the restoration, as in the case we are dealing with here.

Even if it is made in great detail and with care taken to imitate materiality, virtual computer simulation is usually much cruder than the reality of what is later executed, but it provides an excellent approximation that makes it possible to detect beforehand any problems in the process and the result, or any possible incongruence of a spatial, material, chromatic, textural and other nature. In other words, the computer simulation of the result of restoration works is not only a useful way to present them to outsiders or communicate with the promoters or those performing the restoration, but in the first place and above all, it is useful for technicians to test and verify on a computer

Fig. 1
Antechamber of the Mexuar in the Alhambra (Granada, Spain). Three-dimensional computer simulation of the previewed result both of the restoration of the historical surfaces and the insertion of new floors.

the possible result of the criteria, techniques and execution modalities they propose in their restoration project.

It is a way of consciously planning the transformation one wishes to make; to measure, gauge and manage it before starting the works by means of computer simulations. The authors of this text have carried out this type of study on several occasions: in the restoration of the antechamber of the Mexuar in the Alhambra in Granada (Spain) (Mileto & Vegas 2008/I); the restoration of the pavement of the bridge in Pobla de Ballestar in Castellón (Spain) (Mileto & Vegas 2008); the treatment of the external surfaces of the Cálig Tower in Castellón (Spain) (Mileto & Vegas 2007). The simulations made, in each case, compare different project options based on diverse criteria and with a view to weighing up the advantages and disadvantages of each possibility, and the different degrees of impact it would have on the building. In this way, the option chosen was the one that best adapted to the criteria defined in the project.

In the case of the restoration of the surfaces of the antechamber of the Mexuar in the Alhambra, not even the client knew exactly what treatment should be applied to walls that during the detailed stratigraphic study had revealed important information about the construction of the Nasrid complex. In this way, the client was offered considered explanations of six options for the most realistic manner of restoring it *(Fig. 2)*. The advantages and disadvantages of each of the six possibilities were expounded, in view of the results of the computer simulation and the degree of difficulty involved. After setting forth all this reasoning, the authors of this paper chose one of the options and proposed it to the Foundation of the Alhambra and the Generalife as the most suitable for this case. Once this option had been approved, the works began and their execution could be controlled down to the slightest detail, thanks to the existence of this preliminary computer document. Afterwards it was possible to examine not only its 'before' and 'after' states, but also the computer simulations with the actual results in order to compare them *(Fig. 3a, 3b, 3c)*. The client followed, participated in, and judged the progressive results of the works with the computer simulations prepared as a reference manual to obtain the results of the project. In this case as in others, the computer simulation was not an objective that had to be achieved above and beyond any other consideration. The decisions taken while drawing up the project were reviewed throughout the works, according to the discoveries made in the course of the restoration, so that some changes in the initial computer simulation of the project were made.

The restoration project for the pavement of the bridge in Pobla de Ballestar in Castellón required that the many gaps in the pebble pavement were to be filled in. It was a medieval bridge, in surroundings dating from the same period, and had suffered very little transformation over the years, so any restoration intervention could have affected the perception and materiality of this site which had remained intact for several centuries. Several computer simulations were made to test the impact of the different ways of filling in the gaps in the pavement, from stone with different rendering to brick, and from lime to rammed earth *(Figg. 4, 5)*. These computer simulations were checked and studied with the client, who was delighted to be able to participate in the decision-making process regarding the restoration of a bridge that is a symbol for the inhabitants of the whole region.

Cálig Tower in its present form was first built in the sixteenth century. Most of the today's façade surface dates from the same period and is the building's original lime mortar rendering. This rendering has a characteristic texture and patina caused by exposure to the sun, rain, wind and elements over all these years. Naturally, some of the rendering had come loose and left gaps that revealed the masonry fabric underneath. Besides, in an inadequate recent intervention, the original profile and the hipped roof at the top of the tower had been replaced with naked brick battlements in a postmodern style, and a flat roof.

This intervention, which had a great impact on the town, had stirred up a great deal of indignation among the local people; so much so, that one of the first things they wanted the authors of this text to do in the second restoration phase of the tower was to demolish the battlements and eliminate the previous restoration works. Although we felt the same as the townspeople, the responsibility of using the money provided to restore and consolidate a

Fig. 2
Antechamber of the Mexuar in the Alhambra (Granada, Spain). General view of the six options offered to the client to help to decide which one was most appropiate.

building to remove the traces of recent restoration works by an architect who had died between the first and second phase and, on the other hand, the patent impossibility of *unrestoring* the building and leaving it as it had been before, as we were asked to do, encouraged us to seek alternative constructive rather than destructive solutions So several computer simulations were made with a view to making a well thought-out decision on what to do with the top of the tower, and to finding suitable justification for each option.

Around twenty possibilities were considered *(Fig. 6)*, which ranged from completely eliminating the crenellations, leaving a simple parapet to partial

Fig. 3a
Antechamber of the Mexuar in the Alhambra (Granada, Spain). Photoplan of elevation no.1 prior to restoration

Fig. 3b
Antechamber of the Mexuar in the Alhambra (Granada, Spain). Computer simulation of photoplan of elevation no.1 after restoration

Fig. 3c
Antechamber of the Mexuar in the Alhambra (Granada, Spain). Photoplan of elevation no.1 after restoration

demolition of the postmodern pinnacles on the battlements, or even refashioning these battlements to achieve a proportion that would have greater historic credibility. Within each of these options, several suggestions were made to integrate the contrasting naked brick fabric used to build the battlements in postmodern style, using a coat of coloured lime mortar to achieve acceptable chromatic integration.

All these possibilities afforded by the virtual simulation of restoration that are used in the decision-making process in real projects, both internally to the project and externally as a means of communication with the outside world, can be applied equally to the teaching of architectural restoration. Both the authors of this paper are lecturers at the Higher School of Architecture of the Polytechnic University of Valencia, where they teach architectural restoration to undergraduates and graduates, including seminars, master and doctorate degrees. At all these levels of education, computer simulation is an extremely useful didactic tool to explain to the students each of the projects presented, with their different options for intervention and their respective advantages and disadvantages, the perceptive effect on the building, the impact on the materiality and the historic design of the building.

Undergraduate students do a practical group exercise that consists of preparing

Fig. 4
Medieval bridge in Pobla de Ballestar in Castellón (Spain). Several computer options done to test the impact of different ways to substitute the remains of the pavement

Fig. 5
Medieval bridge in Pobla de Ballestar in Castellón (Spain). Several computer options done to test the impact of different ways of filling in the gaps in the pavement.

a restoration project in as realistic a way as possible. Before presenting a proposal for a project, the study undertaken comprises detailed maps and a preliminary survey that includes: a historic study; material mapping; a structural study; the presentation of a hypothesis of the mechanisms that can cause lesions and deformations; the study of material pathologies; a stratigraphic study and more (Mileto, Vegas, Noguera 2008). With all this information gleaned, and with the aid of virtual computer simulation *(Fig. 7)*, the students make several virtual restoration proposals, and explain their reasons for each, weighing up their advantages and disadvantages from every possible standpoint.

Finally, computer simulation in the world of architectural restoration is very helpful because of its didactic power in the promotion and appreciation of monuments. Indeed, virtual simulation not only shows what the building will look like after restoration, but can also simulate its state at earlier historic phases since its creation, showing the successive transformations that it has undergone until its final state prior to restoration works. In recent times, this type of virtual computer simulation has also permitted restorers to avoid demolishing parts that have been added on to the building, in the first place by detecting possible incongruities, and in the second place by showing the desired effect in virtual reality , without having to demolish parts of the building that are sometimes important and that conceal other, older building phases.

On the one hand, this type of exercise permits a realistic evaluation of the possible impact before performing the works, and on the other hand, the evaluation of different restoration options by direct comparison of their effects on the building. In this way, the option chosen will be the one that best complies with the criteria defined in the project. This method, by means of the presentation of real cases, is set before the students, who have to draw up a minor restoration project during the year. It is a process of self-evaluation and analysis of the success of one's intervention in order to encourage critical capacity and develop greater coherence between the theoretical objectives proposed and the actual restoration works in the projects drawn up.

References

Mileto, C. and Vegas, F. (2007) 'Proyecto de restauración del conjunto formado por la torre medieval y los dos edificios adjuntos. Cálig' in VVAA: *Praxis Edilicia. Diez años con el patrimonio arquitectónico,* Biblioteca TC, Valencia, 162-165

Mileto, C. and Vegas, F. (2008) 'Il restauro della sala laterale al Mexuar nell'Alhambra di Granada (Spagna)' in CARBONARA, G.: *Trattato di restauro architettonico. Aggiornamento*, UTET, Torino. 71-101

Mileto, C. and Vegas, F. (2008) 'Il restauro del ponte nella Pobla de Ballestar (Castellón, Spagna)' in CARBONARA, G.: *Trattato di restauro architettonico. Aggiornamento*, UTET, Torino, 51-69

Mileto, C., Vegas, F. And Noguera, J.F. (2008) 'Teaching Restoration at the School of Architecture

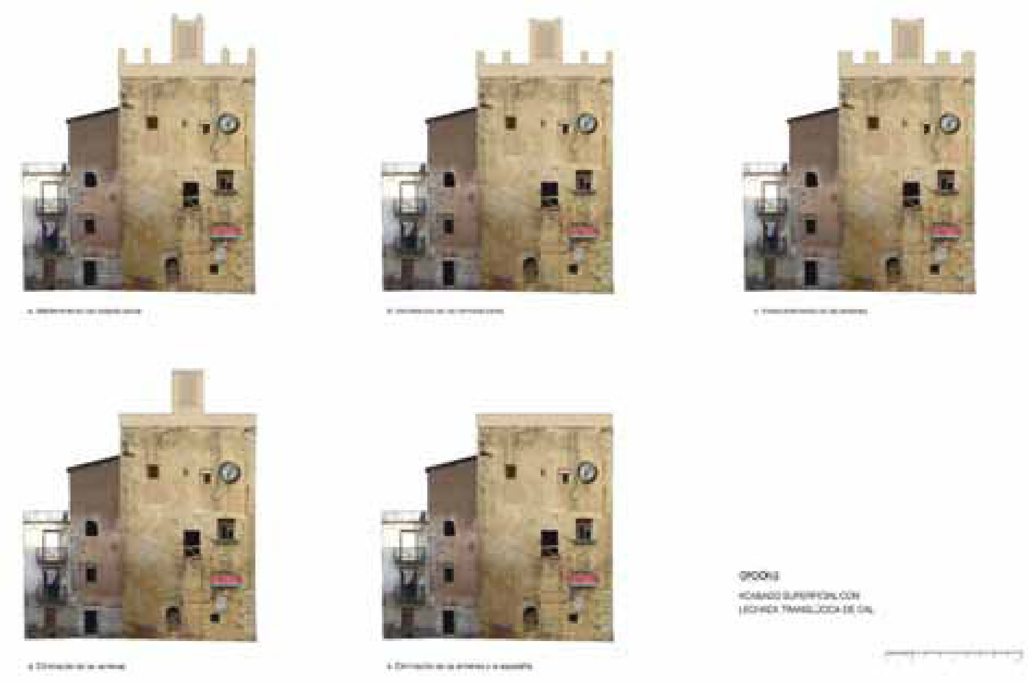

Fig. 6 Medieval tower at Cálig (Castellón, Spain). An example of the multiple possible options for the treatment of the external surfaces of the battlements built in postmodern style of the former restoration.

Fig. 7 Practical exercise done by undergraduate students with virtual computer simulation in order to test the impact and appropiateness of the chosen option for restoration.

of Valencia' in Musso, S.F. and De Marco, L. (eds) (2008) *Teaching Conservation/Restoration of the Architectural Heritage. Goals, Contents and Methods*, EAAE transactions on architectural education no.38, 395-402

Torsello, B.P. (ed) (1999) *Il castello di Rapallo. Progetto di restauro*, Marsilio Editori, Venezia, 253-259

Torsello, A. (2003) 'Oltre l'immagine' in *Anfione e Zeto* no. 16, 173-178

Torsello, B.P. (2005) 'La restauración de la arquitectura. Cómo y por qué' in *LOGGIA, Arquitectura & Restauración* no. 18, Valencia, 10-17