Fig. 1. Pergamum Museum, Berlin, Germany

VIRTUAL TECHNOLOGIES (or not) FOR DISSEMINATION

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Virtual technologies have burst onto the scene of heritage dissemination and they are giving way to new strategies and methods for the transmission of knowledge. However there is a real risk in the use of these technologies when they are not properly applied. The present paper reflects on the correct use of the technology for heritage dissemination and it shows some examples where its applications are, or not, suitable for the purpose of communication.
The fascination of these new tools cannot cancel the real objective of dissemination which is the transmission of a specific cultural message. Any dissemination resource selected must be based on researched facts, specific objectives, clear messages and well-defined categories of public participation.

Keywords:
Virtual technologies – heritage – dissemination – museums – 3D models

1. INTRODUCTION

Heritage has long being an area of specialized knowledge but at the moment, the importance of public opinion and involvement has changed the way in which professionals handle the dissemination of information regarding conservation works.

Traditional signage employed over the years is giving way to new strategies and methods for dissemination and the so-called "virtual technologies" are taking an important role in this field. The possibilities offered by this technology are often quite impressive, but at the same time, we run the risk of being fascinated by them and thus forgetting the main objective: the transmission of knowledge.

One of the more popular and fashionable applications of this technology today are virtual models. These are digital reconstructions of objects, usually simplified, that can be used in a computer simulation or in Virtual Reality presentation format. Museums all over the world are starting to use these kinds of models to explain heritage and more specifically, architectural heritage. However, contrary to popular thought, the idea of "reconstructing" lost reality is not a new concept.

2. RECONSTRUCTING THE PAST. AN OLD HABIT WITH NEW LANGUAGES

Human beings have always tried to investigate and understand great buildings from the past that have now disappeared. We have many examples but can only mention a couple of them here such as the tower of Babel, the Great Ziggurat of Babylon, described in the Bible and by Herodotus and represented many times in art history until the discovery of its ruins by German archaeological excavations conducted by Robert Koldewey after 1913. There is also the famous Lighthouse of Alexandria, which still stood in the 12th century, but completely disappeared at the end of 15th century. It has been represented countless times throughout history as well.

In fact virtual representations are just the contemporary language used to achieve the same objective, that is, the comprehension of the past. Drawings, engravings, watercolours and so on have been substituted by computer graphics, but the intention remains the same.

Instead of pencils or ink, these virtual 3D models are made using specific software where the geometrical, textural and lighting information are included and processed to obtain more or less realistic images (renders), which show us the appearance of the building.

Interestingly, the origin of this type of representation can be traced back to the documentation process at

Fig. 2. Teotihuacan (Mexico). Ars Virtual. Fundación Telefónica, Spain.

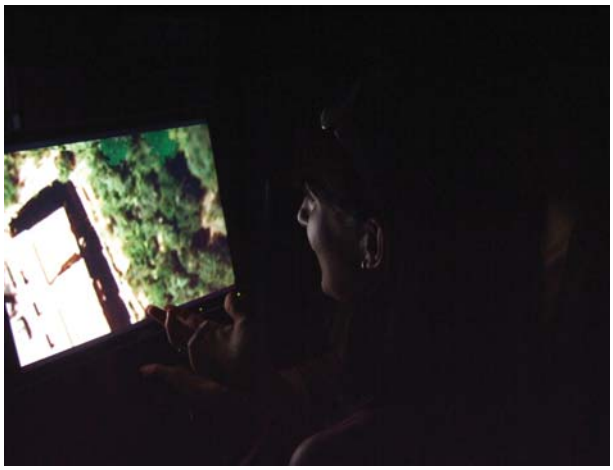
the beginning of the 1980s. It is the result of putting together all the data surveyed from the archaeological sites to achieve a data file containing all the information available. The second step is immediate: if it is possible to construct a virtual 3D model of the remains including all the data in the computer, it is also possible to introduce hypothetical data relating to a supposed original state and to create that other model.

3. 3D MODELS APPLICATIONS

From the very beginning the virtual 3D models have been useful in explaining the hypothesis of the researchers (FORTE, 1997), first in a simple way and with greater depth of complexity with the passage of time. The evolution of these technologies has led to more modern techniques such as the 3D scanner laser which allows an incredible fast survey of objects and sites with a huge cloud of points. In this particular

Fig. 3. Teotihuacan (Mexico) Collection of pictures.

Villa di Livia. Virtual application in the Museum of Diocletian, Rome, Italy. The room with four individual workstations is often empty. The green workstation (on the right) does not work.



User trying to manage the application without success.

instance the representation is only possible for the current state of the object or site, and for the time being it is often quite useless for dissemination purposes applied to architectural and urban scales due to the exaggerated amount of information (points) that make the required output data quite unmanageable. However it is an extraordinary tool for reduced scale works of art (MESSINA, 2008), especially in risk zones where saving time in the survey means also reducing the threat of harm for the professionals working on the projects.

Focusing again on 3D models as representative of the original states of the object or site, possibly the most interesting application of this type of representation is called "augmented reality", that is, a view of a physical real-world environment whose elements are merged with (or augmented by) virtual images from the 3D models thus creating a mixed reality. The final evolution of this technology will allow us, for example, to visit archaeological sites and to see the virtual reconstruction in its real position (FRISHER, 2002, VLAHAKIS, 2001). However the equipment required for this application is not currently very functional although it is making fast progress.

Therefore, at present one of the more popular uses of 3D reconstructions are the on-line (i.e. internet based) real-time models which lets the user navigate inside the virtual space while generating images fast enough to give the sensation of movement. The main problem of these real time models is the excessive simplification of details in the execution and the low quality of textures and lighting in order to allow the rapid generation of imagery. In this case the question is whether it would be better to use a good collection of pictures and/or videos to explain the site instead.

In addition, these models more frequently represent the current states. Often these representations do

Fig. 4. Wooden model representing Ishtar gate and Babylon walls. Pergamon Museum, Berlin, Germany.

Fig. 5. People surrounded the wooden model in the room of Ishtar gate and Babylon walls. Pergamon Museum, Berlin, Germany.

Fig. 6. General view of the hall. Pergamon Museum, Berlin, Germany.

not promote further research or investigation for additional information on the object or site to justify the economic efforts that go into such representation. Furthermore, the possibility of navigating through an inaccurate model may result in a reconsideration about whether or not to employ this technology.

Another interesting research direction is the inclusion of metadata within 3D reconstructed environments, which should be easily handled by the public, but for the time being these types of applications have management and maintenance problems due to the constant failures of the workstations. Also, their use is not always easy for every type of public.

Nevertheless, virtual reconstructions are quite useful when applied in clarifying the different historical phases of a building. Most historic structures have more than one construction stage and 3D models enable us to obtain images from each historic moment, explaining the evolution and comparing those stages without touching the remains (ALMAGRO GORBEA, 2005; GONZÁLEZ GARRIDO and FERNÁNDEZ RUIZ, 2002).

The production of 3D models is also very useful for testing different solutions for restoration works, such as the construction of new shelters.

4. DISSEMINATION INSIDE MUSEUMS AND ON ARCHAEOLOGICAL SITES

Obviously these technologies have a great appeal when used in dissemination and many museums and archaeological sites have quickly incorporated technological devices to improve the interpretation of their collections.

But what is really happening in the museums? The Pergamon Museum, probably the most important museum in Berlin, includes among its collection one of the most astonishing remains of ancient history: the Ishtar gate and the Babylon walls. These remains are exhibited inside a vast elongated hall where there is a wooden model of the walls in their original state as well. This model is located in the middle of the room with the same orientation as the remains; it is therefore very useful for visitors who may compare the current conserved walls with the reconstruction, to better understand the exhibition. In fact the model is always surrounded by people trying to comprehend the structure, making comments on their impressions and explaining to each other their opinions on the structure, given the pedagogical nature of this tool used by the museum.

Within the same museum, in the room of Greek sculptures, a different dissemination resource was selected to explain Roman baths, using a virtual reconstruction.

The setup consists of a large display screen, which is visible to all visitors. The display is controlled by a touch screen pad which guides visitors through the application. There are also "hot points" on the touch pad to enable users access the different spaces in the layout by selecting a hot spot. The 3D model appears in the large display screen and the spectator can visit the virtual site in real time and simultaneously get specific information from the touch screen control terminal about the spaces represented in it.

Independently of the low quality of the model, which is lacking in textures or lighting to create a friendly representation of the architecture, the reality is that nobody seems to be interested in the display or

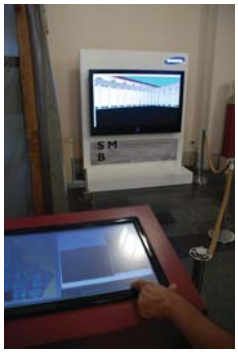


Fig. 7. Touch screen pad and large display screen of the application, Pergamon Museum.

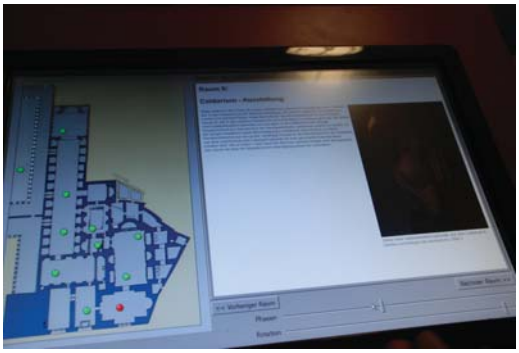


Fig. 8. Control screen terminal of Roman baths reconstruction. Pergamon Museum in Berlin.

Fig. 9. Virtual image of one of the space represented in the application. Pergamon Museum in Berlin.

Fig. 10. Interactive video screening at the Altes Museum in Berlin, Germany.

Fig. 11. Children controlling the application with the mouse at the Altes Museum in Berlin, Germany.

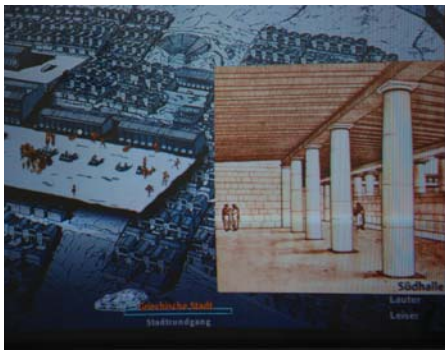


Fig. 12. Short video activated by public from the Altes Museum in Berlin, Germany.

application. Perhaps it is difficult to use or too much of an individual tool, but the fact is that people do not pay attention to the device.

While at the same time the wooden rAt the same time, the wooden reconstruction of Babylonian walls is constantly surrounded by people. In fact, all the models inside the museum capture much more public attention, and particularly, they seem to attract elderly visitors' interest.

The museum also includes other types of technological applications, such as interactive terminals where visitors may obtain information based on their individual interests and preferences. They are mostly consulted by younger visitors, although there is no great demand for them.

The video screening however, has better reception from all categories of visitors, although children often quickly loose attention. This is why an intermediate solution such as interactive video screening is a better solution for all groups of visitors to the museum. There is an application of this type of technology at the Altes Museum in Berlin. The display is located in an isolated area with seats for spectators and it is controlled with a simple mouse. A drawing of an ancient Greek city appears on the screen and the public may select one of the buildings by clicking on it. Each structure has a short simple movie attached to it, explaining its main features. Interestingly, the application is controlled more by children while adults and elderly people just watch the information on the screen.

Therefore it is quite evident that there are important differences in interaction and appreciation among the various categories of visitors, which are usually based on age groupings. Adults and elder people are not usually technologically-minded and prefer to learn through activities that involve showing and telling, that is passive systems. They also require good seating, accessibility and in the case of using

Fig. 13. Archaeological remains of the Roman forum of Segóbriga, Spain.

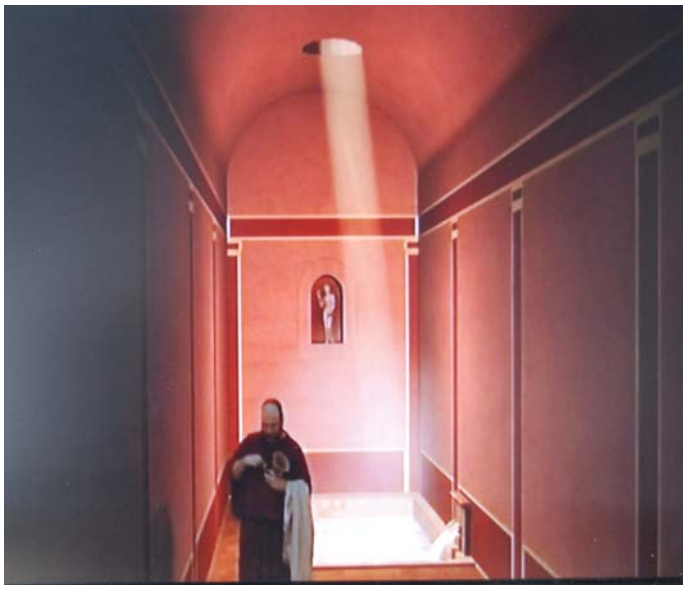


Fig. 14. Representation of Roman frescoes which does not follow known Roman standards. Alhama Baths, Murcia, Spain.

virtual models, realistic visualization. Just as the European Renaissance perspective was completely incomprehensible for the Chinese, who have a totally different representation system in referencing the same historical period, so elderly people do not usually understand the virtual reconstructions. They do not appreciate the space or the dimensions and often perceive the image as an abstract figure made of many colours.

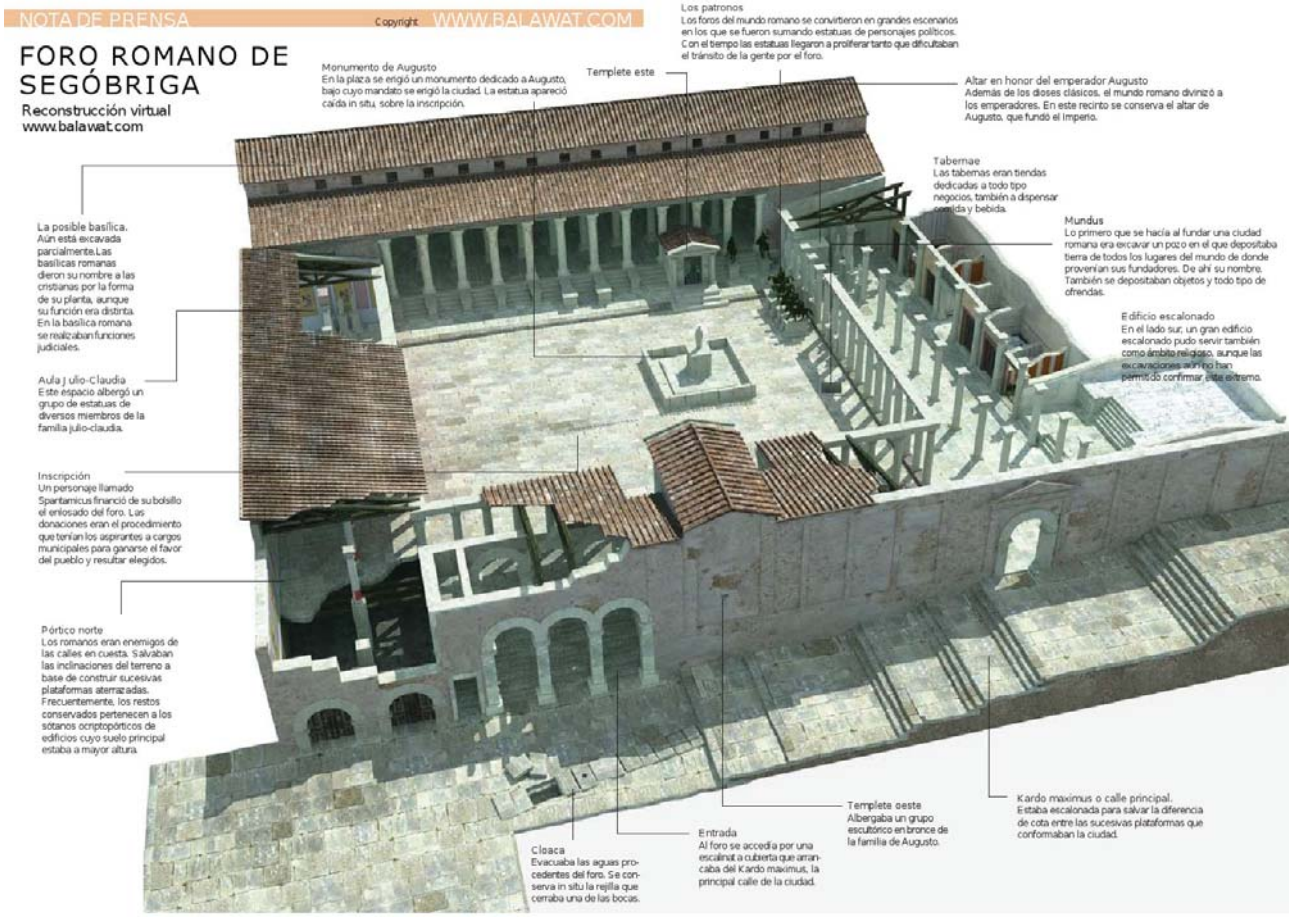


Fig. 15. Virtual reconstruction of the Roman forum of Segóbriga by the private company "Balawat" (BALAWAT, 2005).

Fig. 16. Roman republic temple with an excessive distance among columns. In this case, existing and reliable sources (Vitruvius III, 3, 4) were visibly not consulted (AA.VV., 2004: 59)

However younger spectators like to determine what they do by themselves. Indeed, they tend to prefer to do things in their own order and require movement and frequent changes of activity, i.e. active systems. They are completely accustomed to virtual visualization thanks to video game graphics and they know perfectly well how to navigate inside virtual worlds.

But the most important question here is **how much information can they really get?** Are they just playing? Because a child moving through a virtual application is not necessarily learning about what he is watching. To make sure children gain the knowledge of the intended message, there is a need for an additional strategy. For example it is possible to introduce activities that compel them to pay attention to the information from the virtual reality. These activities could be designed as educational activities coordinated with schools or activities that challenge the children to teach their parents who are not familiar with these types of tools how to use them.

This then generates another vital question **when is a 3D model useful?** Usually these models are considered as dissemination tools, which means they are used at the end of the process to explain to the public the results of all the research. However since a virtual reconstruction is a 3D design, it also plays a strong role in checking the hypotheses of researchers with regard to the original state of the architecture, according to the evidences. They have the characteristic of showing the mistakes and forgotten points when virtually portraying the whole structure.

Nevertheless, the interpretation of archaeological sites is probably one of the best applications for virtual reconstructions. The biggest challenges for research teams in dissemination of data from archaeological remains is how to clearly convey the original state of buildings that disappeared centuries ago, and for most of which only the foundations still remain visible. Until now, the interpretation of most sites relied on the ability of designers to prepare drawings, in order to present the existing information. In some other instances, the projects have gone further by actually

Fig. 17. Virtual image of a Muslim street from the 13th century in Granada with some mistakes such as urban vegetation or the large section of the street, which is in fact much narrower in reality. (NEOSMEDIA, 2009)

Fig. 18. Physical model of the market in Mexico-Tenochtitlan. Field Museum of Chicago, USA.

reconstructing parts or the totality of the remains (STANLEY-PRICE, 2006) as a "didactic tool for visitors".

At present with 3D models it is possible to "virtually" reconstruct the structures, without "touching" the remains and to extract images from every point of view, which may be included in interpretation panels strategically located all over the site, to help visitors to understand the ruins. In these models it is also possible to explain constructive aspects of the buildings, or to include furniture to clarify their function as well. The "virtual" insertion of finds extracted from the archaeological excavations in the appropriate contexts is also an interesting application. And from the model it is possible to prepare videos and more elaborately detailed materials, to show in the interpretation centres at the sites, which have been created at many sites over the last two decades. Good quality materials greatly improve and enrich these centres.

5. VIRTUAL RECONSTRUCTIONS, A RIGOROUS PRODUCTION PROCESS

There is an important point of consideration when making virtual reconstructions of historic buildings. When these models are not made by heritage specialists, it is necessary to have a constant supervision mechanism. A virtual reconstruction is a 1:1 scale model and every detail needs to be

Fig. 19. Video on Zapotec construction of buildings. Field Museum of Chicago, USA.

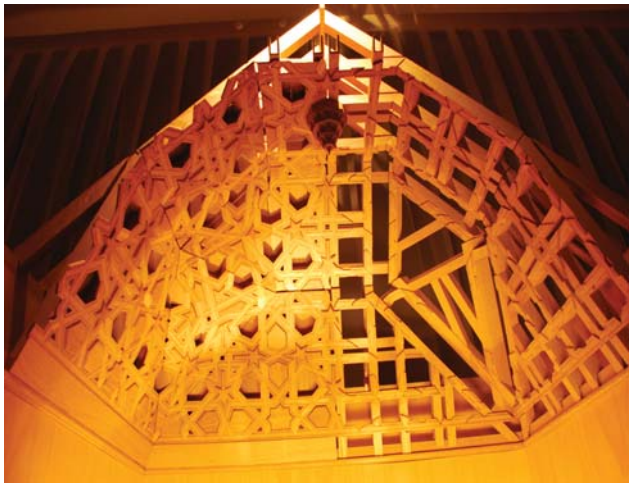


Fig. 20. Islamic ceiling model made in wood with construction details. Science Museum of Granada, Spain.

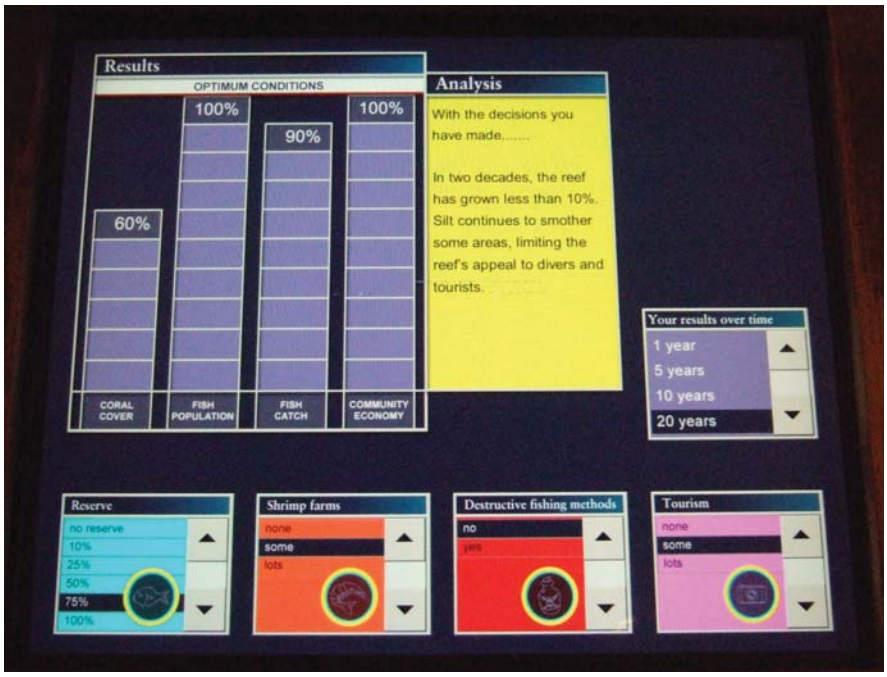


Fig. 21. Computer application for evolution assessment of a coral reef. The user determines different conservation parameters and the computer assesses the results after 1, 5, 10 or 20 years. Aquarium of Chicago, USA.

defined. If researchers do not supply the complete documentation for every part of the structure the person developing the model will. He will likely invent the missing information, whatever it is because he cannot leave a gap. Sometimes these "gaps" affect the decoration and others concern the structure or other historical aspects such as the environment or the objects inside, but the message may then being seriously altered, even if unconsciously, which may affect more or less the accuracy of the knowledge passed on.

Virtual reconstruction can be a very powerful tool for dissemination due to its visual impact, and it is therefore very important to guarantee rigorous detailing on the models. The "levels of fidelity" in the interpretation need to be perfectly clear for spectators, which also means finding the best ways to explain what part of the representation is hypothetical and what is precisely documented. This clarification might be made using text, images, voice-over (in the case of videos) or whatever means, according to the selected dissemination resource. Finally, when the existing data are not enough to correctly define the model, probably the right choice will be not to make a 3D model, but to use a different dissemination tool.

6. CONCLUSIONS: THE RIGHT RESOURCE

Dissemination of information from every project requires detailed and complete scientific research, the appropriate technology and pedagogic dissemination. The latest advances in technologies, when applied to cultural properties, sometimes fascinate research teams and people in charge of communication. But it is necessary to accurately determine when a new technology for dissemination is useful and when it is not. It is also important to decide the right resource, depending on the receptor of the information or categories of the target audience. Scholars and visitors with special interests will probably require publications with the sources and scientific references and commentaries. On the other hand, the general public will possibly need simpler explanations, visual information, interaction or data through inquiries instead of direct information because human nature is naturally inclined to curiosity about hidden details. Finally, technologies will have to be adapted to each specific type of spectator or visitor.

Sometimes excessive use of technology Sometimes excessive use of technology leads to confusing and useless messages, which represents a waste of economic resources and creates a psychological barrier or distance for the more elder visitors. However at other times, technology gives us the perfect tool to clearly explain our ideas. Therefore we first need to determine the main message, that is what we want to tell the public and then decide the appropriate resource, technological or not, which in turn depends on the subject. For example functional or typological messages may be comfortably explained with "physical models" since the virtual models have

Fig. 22. Polychrome projections over the façades in Cathedral of Amiens, France.

technical, and consequently economical difficulties in creating believable environments. Historical messages may rely on a video format to better express this kind of information, and since virtual reconstructions allow recreating environments and moving through them, they may be of great use in this case. Constructive or structural issues are commonly well explained with wooden models. For increased public awareness, well prepared technological applications may allow people to learn through playing with the application as a means of familiarizing themselves with the information. For example, extracting instantaneous statistic conclusions from management decisions on conservation might be very useful. Iconographic or formal messages can use technology in very interesting ways, such as the polychrome lighting projections made over the façades in the Cathedral of Amiens in France or the Cathedral of Vitoria in Spain.

Virtual reality has interesting applications but, until now, these applications have been often of an individual nature and most of the time uncomfortable. However, the functionality of these tools will likely improve in the future, but anyway we will always need to re-appraise our exhibitions and sites interpretation. Dissemination today depends more and more on creativity and new tools bursting onto the scene but it must always be based on complete research, specific objectives, clear messages and well-defined categories of public participation. Otherwise we will waste the effort and the knowledge will disappear in the big gap between our intention and their attention.

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