

VIRTUALITY AND MUSEUMS. SOME SUGGESTIONS FROM THE ITALIAN NATIONAL RESEARCH COUNCIL

The advent of Information Technology in the world of museums gradually spread in Italy during the 1980s, the initial aims being the computerisation of catalogues and inventories and then the diffusion of information and education.

During this period of transition from the initial phase of experimentation and the subsequent, more mature, phase of development of computer applications and evaluation of methodological implications connected to their potential, cultural heritage has been generally considered as a single entity in concept and in context. In fact, before specialisation gave rise to specific branches of research, such as archaeological computing, questions arising from the automatic processing of archaeological data were considered in the wider framework of cultural heritage. Efforts were focused on guaranteeing the preservation of the correlation between different kinds of cultural heritages, stratified over time and co-present in contexts that the sequence of historical events brings to identify as culturally defined areas (FERRARI 1991).

The first isolated cases in which computers made an entrance into museums go back to the end of the 1970s and the beginning of the 1980s. These experiments are illustrated in detail in the proceedings of the Conferences on “Automatic Processing of Art History Data and Documents” organised by the Scuola Normale Superiore of Pisa, in collaboration with other Italian and foreign institutions, among which, of course, the Istituto Centrale per il Catalogo e la Documentazione (ICCD) – which was already involved in the project of Automatic Processing of the Catalogue of Cultural Heritage (FERRARI, PAPALDO 1980; PAPALDO, MATTEUCCI 1983) – together with the CNUCE Institute of the CNR. Published as a census, these proceedings are intended to provide an international “clearing house” of ongoing official and individual projects. They are also a valuable point of reference for analysing the evolution of research, directed in this phase mostly towards the computerisation of catalogues and inventories and to the management of collections (PISA 1978; PISA 1984a, b, c; PISA 1988).

The fundamental condition required to justify the attempts to solve the complex problems generated by art-historical research based on electronic data was an acute awareness of the need to recontextualise the work of art according to the various aspects of its specific history (patronage, owners, market prices, restorations, etc.) (BAROCCHI 1984). From a technical point of view, an acute analysis of the situation was illustrated by O. SIGNORE (1984), who suggested, demonstrating from the beginning a singular continuity of intents, that «the computerization of art history needs integration in many senses, i.e., it needs integration, media integration, and integration between

disciplines» (p. 314). To this aim, it is necessary to make a great effort towards data formalization and normalization and above all «to stop thinking in terms of the target software, and start with a more abstract way of representing the reality: the conceptual schema» (p. 317).

During the 1980s, the potential of different information system architectures – with particular attention towards the relational one – the recording of digital images on optical disks connected to alpha-numeric databases, and the use of digital cartography were tested for the first time. These were the years in which the “Giacimenti Culturali” operation was promoted in Italy (*Rapporto* 1989). This term (literally, “cultural deposits”) expresses in a metaphor the concept of a hidden good, which is to be brought to light; its discovery implies an advantage, not so much from an economical point of view but in terms of giving the general population the maximum benefit from knowledge and aesthetic enjoyment of materials transformed by human action (ECO 1988).

This initiative, which promoted the census and cataloguing projects for archaeological, architectural, environmental, art-historical and ethnographic resources, was carried out in cooperation with private enterprises and public institutions; this mutual collaboration was achieved through the integration of the technical and economical resources of the private sector and the cultural programmes of the public one. Notwithstanding the variety of results, this operation brought out the necessity of operating through a preventive programme of intervention, dealing with integration and interfacing problems and bearing in mind – even in the differentiation of aims and respective potential – the importance of promoting a conceptual coordination, before an operative one (FERRARI 1989).

In this atmosphere of “legislative and methodological anarchy” (GUERMANDI, SANTORO BIANCHI 1996) but full of enthusiasm for the experimentation of computer technologies, as demonstrated by the publication of manuals (MOSCATI 1987), information bulletins (PARRA 1989) and conference proceedings (D’ANDRIA 1987; *Archeologia e informatica* 1988), two initiatives were promoted. These are generally considered as the first examples of the widespread use of computer technology implemented for archaeological exhibitions: “The Phoenicians” in Palazzo Grassi in Venezia in 1988 (*The Phoenicians* 1988) and “Rediscovering Pompeii” in the IBM Gallery of Science and Art in New York in 1990 (*Rediscovering Pompeii* 1990; REILLY 1992), which was organised as a result of the Neapolis Project. Of course, these examples are connected to temporary exhibitions – and therefore limited to their duration – and to the economic support provided by sponsors such as IBM and FIAT Engineering.

However, for the first time, new modalities for the exploitation of information are presented. First of all, an exhibition system intended as a system of communication (FERRARI 1990, 76) and an effective interaction between users and machine were promoted. This interaction is created by

simulation programmes, which reconstruct the ancient processes that furnish archaeological data (MOSCATI 1988). In this way, the archaeologist can verify hypotheses and formulate new ones, but at the same time can transmit his knowledge to a wider public.

Only in the 1990s, when the gap was filled between temporary exhibitions and stable institutions, did the museum become a centre for cultural debate on computers and education. In particular, attention was given to the elaboration of data aimed at spreading cultural and educational activities, requiring different types of methods and languages (PISANI SARTORIO 1988). It is worth mentioning that, during the years that immediately preceded these events, the issue of cultural heritage in Italy had taken on a public dimension, so much so that it provoked contrasting opinions and specific areas of interest. New platforms of confrontation were created, first of all the journal «L'Ippogrifo», established in 1988 and specifically dedicated to political and economical issues regarding cultural and environmental heritage (GHERPELLI 1988). It was followed soon after by «If», a journal issued by the Fondazione IBM Italia, which merged the two former «Rivista IBM» and «Note d'Informatica», as a demonstration of the commitment of the company towards social and cultural endeavours and the role of technology as a means of communication between scientific and humanistic cultures.

In the discussions involving problems of cultural heritage management, museums acquired an increasingly important role, as is demonstrated in the survey-report carried out by the Associazione Civita – a consortium of sizeable enterprises, public research institutions and Universities – on the actual situation of national and international museums (VALENTINO 1993 and, in particular, BRANCA 1993)¹. Giving value to a cultural object not only means knowing about it but also communicating about it: for this reason, museums must increase transparency and visibility towards the public. Therefore, it is necessary to project the museum outside of its walls, using telematic networks to reach even the most remote visitors (GALLUZZI 1994).

But achieving this aim requires that questions be asked about the identity of the visitor of a museum, about his/her cultural profile, and about his/her interests. On the basis of such data, it is then possible to identify the different languages by which the art object should be presented (CERIZZA 1989). At the same time, these efforts demonstrate the success of hypertexts and multimedia systems, which offer alternative ways in respect to the paths of traditional visits. They also allow for an enjoyment of differentiated types of information based on interests, level of knowledge and available time of the visitors (FINARELLI, VALLI, ZANARINI 1990).

¹ This is not the only census conducted on museums in these years: see in particular GROSSI 1990.

As also illustrated in the pages of «Archeologia e Calcolatori», which came into the debate during the 1990s by expressing the opinions of scholars working in the cultural world as well as in the technological one, museums should not limit themselves to operate through mere duplication or simplification of the visit and its traditional support tools. Experiments need to be oriented towards the enhancement of all the multimedia potential to complete knowledge (enriching the audiovisual experience), integrate documentation, encourage cross-reference reading and highlight the intercorrelation among information. This requires an interpretative and reconstructive effort necessary for a full comprehension of ancient reality (PAGLIANI 1992; CERIZZA, PAGLIANI 1993).

As has often happened in the course of the life of this journal – in which the term “Virtual Archaeology” was introduced in 1995 (FORTE, SARTI 1995), following an earlier, isolated, intuition of P. REILLY (1991; see also RYAN 2001, 245-247) – from the description of the first applications discussion quickly passed to the theoretical and methodological implications connected to the new IT solutions and, in this case, in particular to the investigation of the conceptual framework of multimedia techniques (PAGLIANI 1996; GUERMANDI 1999; GUIMIER-SORBETS 1999; ORLANDI 1999).

During these years, the radical transformation of the traditional systems of safeguarding, management and exploitation of cultural resources is definitively ascribed to new and increasingly sophisticated technologies. This is well exemplified in the volume *I formati della memoria*, another editorial initiative of the Associazione Civita (GALLUZZI, VALENTINO 1997). Furthermore, ICT is considered as a harbinger of changes in cultural production and fruition even greater than those brought about by the invention of the printing press or photography (cfr. *contra* SIGNORE 1996, 170). At this point, it is evident that we need to forget the concept of museum as *hortus conclusus*, and contextualise the objects exhibited, using the potential of multimedia software. The ultimate aim is to present them in the framework of a factual and intellectual network of information relations. In this way, the meaning of objects can be emphasised and every aspect of their own cultural context can be exploited (GALLUZZI 1997, 19).

However, to achieve this aim, it is necessary to overcome the concept of specialisation based on genres and disciplines, as well as the resistance to adoption of methods of interpolation between objects kept in museums and external documents. The path to be followed is represented by the “museum-workshop”, as an elaboration centre of intellectual products implemented and used both locally and remotely, thanks to new ICT technologies.

The persistent idea of a “museum without walls”, or “virtual museum”, spread in Italy in the second half of the 1990s and acquired a prominent position in communication strategies. In this context, a leading role was performed by CNR, through the “Special Project Cultural Heritage”, promoted in 1996, under the presidency of A. Guarino and the direction of U. Baldini (PFBC 1996).

The fifth subproject, in fact, was dedicated to “Museums: project, management and benefits” and focuses on the central question on preservation and promotion. The foreword states that: «The concept, organization and operation of museums are all areas in need of profound innovation in order to adequately meet the current social demand for access to cultural resources». In particular, in the thematic subdivision of this subproject, the section dedicated to “Museum Systems” – which have the task to illustrate a particularly vast and complex subject more extensively than a single museum – highlights the fact that «only a profound and complete interaction, involving the most technologically advanced features of computer science, such as multimedia networks, can fully guarantee and express the communication potentials of the system».

Such a complex cultural programme, which includes regional museum systems, will enable the public to investigate subjects, otherwise not available, through didactic aids, mainly of an interactive nature. To meet the requirements of a system that should provide artworks and monuments with a network of references to their historical, artistic and geographic contexts, advanced technologies of three-dimensional imaging and animation as well as simulation tools are necessary in order to plan and implement virtual exhibitions and visits based on data contained in various archives, logically integrated along virtual itineraries. Simultaneously, ICT solutions are extremely important to assure the connection between a central hub, which covers the whole area or theme under consideration, and the different peripheral subsystem hubs.

Cultural heritage and museums by now constitute a reality in the Information Society, as it is demonstrated also by the European Commission programmes in which the cultural sector has gradually assumed a leading position for the development of new products and services to be delivered over digital networks. ICT has taken on a key role and Internet is indicated as the most important vehicle for the diffusion of cultural information (CAPPELLINI 1997). Communication, learning, knowledge processing and knowledge management are nodal trends and constitute emergent patterns in the subject matter. Therefore new pathways towards innovation, knowledge development and sharing should be designed also by experts in communications and cognitive sciences.

At the end of the 1990s, the journal «Sistemi intelligenti» dedicated a special issue to virtual museums, edited by F. ANTINUCCI (1998a), who already had directed his attention to the contribution of new interactive technologies in the cultural heritage sector. Multimedia systems, interactive 3D computer graphic systems in real time (Virtual Reality) and telematic connections are all innovative tools as they put the image instead of the text in the centre of the communication process; they are interactive, and therefore they encourage the inclusion and dynamic participation of the users. Finally, they are connected systems and therefore they make various sources of information accessible in real time (ANTINUCCI 1998b).

The debate now becomes more stringent: performances of technologies are well known among the specialists and at this point attention can be addressed to much more specific subjects. These include cultural, psychological, linguistic, semantic issues, as well as economical and administrative ones. M. FORTE and M. FRANZONI (1998), for example, presenting the results of a survey conducted on virtual museums on the web, place the emphasis not only on the contents but also on the forms of communication used in each case. The sample, made up of 390 museums, divided by typology and geographical area, was analysed on the basis of three variables: content, hypertext map with navigational metaphors, and graphics. Notwithstanding a remarkable amount of contents, there is still however a gap between the possibilities offered by new technologies and what has been effectively implemented. It is worth noting the distinction among three types of virtual museums: 1) “simulated museums”, which reproduce the real ones; 2) applications that provide support and improvement to the real museum; 3) the “true” virtual museum, a knowledge space which is accessible through modalities that are different from the traditional ones.

The point of view expressed by S. MICELI, P. LEGRENZI and A. MORETTI (1998) is also very interesting. The authors assert that to create a virtual museum the objective cannot be generic, but must be oriented from the beginning towards three models of museum “identity”: museums addressed to the territory, University museums, and specialised museums, each one with its characteristics, identity and specificity.

With the advent of the new millennium, it seems that the situation is still changing. This is due to the considerable achievements and improvement of interactive visualisation techniques. Capable of creating 3D environments and animating them in real time, they have allowed for the development of spatial simulation models suitable for the exploration of diversified and complex realities. As regards archaeology, which is particularly receptive to Virtual Reality (BARCELÓ, FORTE, SANDERS 2000), the application sectors which are mainly involved concern: the reconstruction of ancient landscapes and the process of stratigraphic sedimentation; architectural studies, for the simulated reconstruction of the original aspect of monuments; and the educational and cultural sector, realised through virtual “musealisation”.

But this is already contemporary history, and its evolution can be followed through the results of the experiments shown in the course of events regularly dedicated to this issue², and in which the Italian voice continues to increase. Also with the support of recently developed portable systems, Virtual

² I am particularly referring to the VAST Conferences, which began in 2000 (NICCOLUCCI 2002) and then continued also in collaboration with other international organisations such as Eurographics and ACM SIGGRAPH, and later the European network of excellence EPOCH. As an online repertory, the most updated tool is <http://vImp.museophile.org/italy.html>.

Reality techniques migrate towards an Augmented Reality approach (BARCELÓ 2001): the elaboration of information and its translation into a digital format modify in some way the character and the value of the cultural object (FORTE 2004). With particular reference to educational-didactic aspects, a process of perception aimed at augmenting its reality is put in motion: it recapitalises the object itself by disseminating and diffusing its message and its content, with a notable spin-off for epistemological and communication aspects. The entire process implies the integration of different insights coming from many disciplines, with an effort towards a common interdisciplinary goal: to develop a better understanding of complex and wide-ranging problems linked to the safeguarding of our cultural patrimony.

The need to adopt an interdisciplinary approach characterises the articles that are collected in the following section of this issue, coming from the research activity conducted in their own laboratories by various teams of the Italian National Research Council. In fact, in accordance with institutional targets³, the main duty of the most important Italian public research body «is to carry out, promote, spread, transfer and improve research activities in the main sectors of knowledge growth and of its applications for the scientific, technological, economic and social development of the Country», through macro areas of interdisciplinary scientific and technological research concerning several sectors.

The task of opening this section was assigned to F. Antinucci, whom we have already quoted and who has recently written a book on the subject of communication in museums (ANTINUCCI 2005). After two paragraphs dedicated to answering the questions “What is a virtual museum” and “What a virtual museum is not” – and this is not a trivial problem if one compares the expectations of ten years ago to the not so notable results actually achieved in this application sector – the Author passes on to a reassertation of the positive conditions which would make the notion of “virtual museum” pertinent and interesting. In this context, the improvement of the technological manipulation of images assumes great importance as a tool for creating “visual narratives” since they allow the objects to communicate to the ordinary visitor of a museum, without having recourse to the traditional verbal description. In this way, the virtual museum can be defined as the “communicative projection” of the real museum, and therefore its structure, far from being merely an analytical presentation, should be radically re-organised.

Among the projects which are specifically dedicated to archaeological applications, there are four experiments which are different in contents, cultural contexts and aims. M. Forte, who has been concerned for many years with the

³ A search of the terms “interdisciplinary” and “multidisciplinary” in the CNR web site has produced in both cases more than 550 answers.

subject of virtual archaeology, together with S. Pescarin dwell on “landscape virtual museums”. They are defined as a holistic model, which represents the ancient territory as a dynamic place in which man and environment can be connected with their relations to past and present perspectives. However, the authors complain that attention is not being directed towards this subject, because in this sector the preponderance of GIS and spatial modelling tools undermines all other computer applications. If GIS have constituted, since the 1990s, a point of reference and a priority tool for research carried out on the territory, they alone are lacking from a communicative point of view and are not able to represent the dynamic behaviour of ancient and modern landscapes. A more complex system is then proposed, which integrates different procedures and tools and aims at offering a real time access to a spatial 3D landscape virtual model and to its cultural and environmental information.

S. Chiodi explains the origin of the “Iraq Project: the Virtual Museum of Baghdad”, through the development of the two project proposals which were approved by the Italian Ministry of Foreign Affairs. After the closing of the Iraq Museum for the well known local situation, the goal pursued has been to give people the possibility to virtually enter, wander through and observe the most important exhibits kept there and explore the ancient civilisations and the geographical context to which they pertain. In the case of this project, the interdisciplinary approach is well exemplified: in the planning phase more than ten Institutes of the CNR have been involved together with many researchers, who operate in different sectors: from informatics and telematics, to computational linguistics, cognitive sciences, legal studies and, obviously, cultural heritage.

F. Gabellone and G. Scardozzi again focus on the revolutionary role played by the introduction of image-based technologies and remote sensing in the study and reconstruction of ancient landscapes. The experiment illustrated here regards the city of Ur and was carried out as part of the Iraq Project. It starts with the 3D image-based modelling of the golden helmet of the Sumerian king Meskalamdug (around 2400 BC), and then proceeds to its contextualisation among the grave goods of a tomb identified within the Royal Cemetery of Ur, to the reconstruction of the city as a whole, with its most significant monuments, and finally, to the analysis of the archaeological area as it is today. We are, therefore, dealing with an approach that, using different kinds of images, leads from the object to the territory and permits us to virtually operate on different scales of detail and to present them to the visitor.

A. Emiliozzi, P. Moscati and P. Santoro also present a project of virtual reunification and recontextualisation, in this case, of the grave goods found in a tomb of the Sabine necropolis of Colle del Forno, located on the Via Salaria 30 km. north of Rome. The tomb, excavated in 1972 and unfortunately already looted, held a princely burial, as testified by the magnificent grave goods, which constituted of both local products and objects imported from the Orient, as well

as two wheeled vehicles: a cart and a chariot. Thanks to an in-depth scientific analysis, the grave goods – presently exhibited in two different Museums: the Ny Carlsberg Glyptotek in Copenhagen and the Museo Civico Archeologico of Fara in Sabina – have been integrally reconstituted and the restoration and virtual 3D reconstruction of the cart permit the recontextualisation and enjoyment, without limits of time and space, of this Italic masterpiece dating back to the end of the 7th or the beginning of the 6th century BC.

The contributions that follow describe sophisticated computer tools designed and implemented in CNR laboratories and show from different points of view how ICT can support the realisation of virtual museums and solve problems related to usability, accessibility and enjoyment aspects. First of all, R. Scopigno, P. Cignoni and C. Montani discuss the potential of 3D graphics technologies to acquire high quality digital images of real objects, modelling them and returning them to us in a wide range of visual presentations. In particular, 3D scanning technology has evolved considerably in recent years and the Authors stress the problems related to the improvement of the processing phase and the visual rendering of complex and very large 3D models efficiently and in a simple interactive way. Some specific tools have been implemented in this optic and experimented through several case studies, generally related to stone monuments. They have turned out to be very promising in the process of automation of data acquisition, processing and restitution, as they reduce user intervention, limit the time needed to perform the process and, finally, improve its accuracy.

The two articles which follow pass over the visualisation aspects of information and return to the analysis of the structuring of texts and contents, which in turn involve information sharing issues. Within the framework of the Virtual Museum of Naples project, carried out with the aim of promoting the art-historical and cultural heritage of Naples, A. Aiello, M. Mango Furnari and F. Proto discuss ontological issues, which arise from the articulate analysis of information relative to a cultural heritage knowledge domain. On the wave of the Semantic Web Initiative goals, and through a formalised description of the metadata sets of the ICCD (Istituto Centrale per il Catalogo e la Documentazione) recommendations, the purpose is to facilitate the retrieval of information contained in heterogeneous document repositories distributed on the web. The result of this ontological approach, which has been influenced by works of N. Guarino, head of the Laboratory for Applied Ontology of the CNR Institute of Cognitive Sciences and Technology (GUARINO 1998), is a different way of facing the recontextualisation theme, which prove again to be one of the central aims of virtual museums of cultural heritage.

The experiment conducted by A. Bozzi, L. Cignoni and G. Fedele resorts to a neural network system in a visit to a virtual painting gallery, represented by iconographical objects collected in an imaginary space and accompanied

by a formalised textual description. This approach relies on the fact that techniques of digital image analysis can highlight iconographic features, for example through the identification of similarities in chromatic and graphical patterns, but cannot capture other aspects, such as logical and conceptual associations, that only a textual description can achieve. For this reason, it is important to analyse the interaction between digital objects and their linguistic captions, constructed according to five levels of understanding on the part of the viewer: identification of the contents, the scene represented and the intentions of the author, emotional activity of the viewer, capacity of formulating aesthetic, ethical or epistemological judgements.

The last two articles deal with the adoption of technical tools aimed at facilitating the usability and accessibility of virtual museums, overcoming visual, hearing, physical, cognitive and cultural barriers and giving disabled users, and more generally, a wider audience, equal opportunities for exchanging and sharing knowledge and experiencing cultural contents in the most significant way. O. Signore, after having clarified the distinction between usability and accessibility, stresses the importance of this topic also from a theoretical point of view: web accessibility is not only a technological challenge but involves a revolution in web site design since the initial planning process, through the creation of effective, efficient and satisfying user interfaces. It also involves concepts that are expressed by principles, guidelines and success criteria promoted by specific international organisations, such as the World Wide Web Consortium (W3C) through its Web Accessibility Initiative. Furthermore, Semantic Web technologies and ontological classifications can constitute a support tool for knowledge representation and management as well as semantic interoperability.

In conclusion, F. De Felice, F. Renna, G. Attolico and A. Distanto present the Omero system, an application based on haptic-acoustic interaction which has been implemented with the purpose of allowing visually impaired people to access multimedia contents, experiment with 3D virtual objects, as well as managing spatial data. Therefore, the system accomplishes the task not only of improving access but also enhances the users' knowledge, extending and integrating visual and verbal information with tactile sensations. The use of touch, i.e. the haptic experience, which is characterised by a larger and greater flexibility, has been tested in the virtual world, making communication of cultural objects more effective, regardless of their location in the dimensions of space and time. The results achieved are proved by several tests, including the visit to the virtual model of the Norman-Svevian Castle located in Bari and that of the Apulia region.

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