

E-Museum of Heritage Resources-The Challenges

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Abstract—Some heritage resources remained unexplored and for some there are no tangible conservative practices put in place; therefore, digital technologies and digital applications are profoundly influencing, shaping and re-shaping the environment of change in contemporary society. They also open the way to new, distributed, ways of working, communicating and investigating new products and services in the heritage sector, as in other sectors. These digital technologies and their applications in social computing come with some challenges. This paper studied the challenges and intensifies further research in e-museum as visual means of accessing and conserving heritage resources.

Keywords— Heritage; Resources; Tangible; Digital; Technologies.

I. INTRODUCTION

Digitization refers to the process of converting analogue to digital data, with the purpose of enabling data processing, storage, and transmission through digital circuits, equipment, and networks. Digitization is enabled by different electronic devices such as scanners, cameras, and 3D technology. Cultural heritage digitization is part of today's agenda for many cultural and memory institutions and has two main purposes (1) providing a wider range of audiences' access to (digital) heritage and (2) assuring long-term preservation for the (digital) objects which are created, so that those objects can be located, rendered, used and understood both in the present and in the future. However, no process can guarantee to be eternally effective as one must consider the implications of fast-changing technology and the possible obsolescence of the electronic devices or the digitalization tools available in the present. The term preservation defines those actions taken to care for or safeguard (something) against deterioration. When applied to cultural heritage, preservation may involve methods of minimizing risk of loss, slowing physical deterioration, and optimizing the conditions that ensure the maintenance of the integrity of the heritage asset. In this sense preservation is not only physical but may include methods to safeguard the information about a particular heritage object or practice, including proper documentation through digital methods. Preservation is a future-oriented concept that seeks to safeguard an heritage asset for future generation. Preservation is sometimes used interchangeably with the term 'conservation'. The following are a few basic questions which are directly relevant to the integration of ICT in the cultural heritage sector, and are also central to the goals of conservation and public appreciation of heritage: (1) what are the accepted and acceptable objectives for the interpretation and presentation at specific cultural heritage sites? (2) how can ICT assist heritage professionals in achieving their research, administrative, curatorial, and interpretive/educational aims? (3) what considerations should help determine the choice of

digital heritage applications given their wide variety of specific forms and techniques? The evolving field of using ICT within cultural heritage has in recent years produced a wide range of applications for scholarly research, public interpretation, and the marketing and management of cultural heritage sites. What makes the field of cultural heritage a particularly complex field for ICT integration are its ever-widening dimensions. ICT can also serve as an important interpretive, and management, tool at sites where visitorship is permitted, but must be kept at carefully monitored levels. ICT is uniquely suited to offer a wide range of information types and perspectives to visitors at cultural heritage sites. In recent years, great strides in the management and processing of heritage data have been made with the development of a wide range of digital database applications and Geographical Information Systems (GIS), whose potential for cross-referencing and comparison is great. In addition to structural and physical data, new categories of intangible heritage are now being systematically collected and inventoried. ICT can offer new applications to link the entire spectrum of heritage resources. Digital visualizations, including virtual reality have recently become important elements of the documentation of cultural heritage sites. New ICT applications have begun to utilize visualizations in a systematic way. The study carried out in this paper addressed various challenges confronting ICT applications in conserving heritage resources and intensifies further research in e-museum as visual means of accessing and conserving heritage resources for capacity building.

II. RELATED LITERATURE

There are adages that the only problem with predictions is that they concern the future. The past decades have brought so many changes on such scales that any attempt to predict precisely the impact of the new ICT with respect to cultural heritage is doomed to future failure and/or retrospective mockery. Nonetheless, it is useful to survey past developments in order to discern which of these are likely to have an impact on the decade to come. The Internet is changing rapidly and is changing quickly what is possible. In 1995, there were 5 million users of the Internet. In 2000, there were 200 million. In March 2004, despite complaints of a dot.com bust, the Internet has grown to 804 million. In 1995, over 95% of the Internet was in English. In 2004, English represents 35% of the Internet and European languages also represent about 30% of the Internet. Technologically, while convergence was a buzzword throughout the 1990s, there will soon be convergence at a new level whereby telephony, television and Internet systems become interdependent and then fully interchangeable. There is disagreement exactly when it will happen. Within the heritage and historical disciplines, the past

is no longer only the domain of specialized scholars, but is also seen as a resource for the economic development of local communities and regions, a medium for cultural identity and cross cultural communication, an edifying destination for cultural tourists, and a focus for educational enrichment. At the same time, the digital information and communications technologies have produced a wide range of applications for collecting and processing historical data, documenting and monitoring the physical conservation of objects and monuments, visualizing historic structures and environments, and creating interactive information networks that can link professionals and scholars with students, museum-goers, and interested amateurs. The integration of heritage with digital technology has already shown the potential for greatly enhancing many aspects of the research, management, and public involvement in the material remains of the past. However, it is important to understand that ICT is a complex field whose contribution to cultural heritage can only be realized if it is utilized in effective, sustainable ways. It cannot be considered an immediate or magical cure-all. Cultural heritage professionals must understand what ICT can do, and in which situations or contexts it is most effective. With the rapid development of digital applications for historical research and public heritage presentation, the integration of digital technologies into the field of cultural heritage must be undertaken with the full awareness of their potential uses and effects. MacDonald and Alford [1] discuss the opportunities that digital technologies present for the dissemination of knowledge on a scale never before possible, and see this capacity as a key factor in transforming museums. Their vision for a virtual museum goes beyond the digitization of resources in individual museums, to the collaboration of multiple institutions (museums, libraries, archives, historic sites, scholarly societies, etc.) combining their digital resources: the “meta-museum”. The idea of making collections more accessible and disseminating knowledge to the widest possible audience is clearly a positive one. However, several authors warn of the dangers of museums just providing “more information to more people” and not really taking advantage of the interactive capacities of ICT. Donovan [2] warns museums not to think that simply providing access to museum collection databases (and object-centric information) would be enough. He encourages them to provide context, storytelling, and stimulate curiosity, exploration and serendipity, if they want to create compelling online experiences and be of interest to a broad range of users. Likewise, Dierking and Falk [3] emphasize how the capacity of new technology to offer visitors learning options, interactivity and various degrees of depth of information will help museums ensure better understanding in visitors with varying backgrounds, interests, and knowledge levels, therefore increasing conceptual accessibility. Anderson [4] proposes a “learning model” for creating digital content, rather than an “information provision” model. Reaching broader and more diverse audiences; many authors stress the power of ICT to attract new audiences. Certainly, the internet allows museums to reach global audiences, even in their own homes. It can reach people who are not able to visit the museum, or

who are not inclined to do so. And the interactivity of the media is known to appeal children and young audiences. As stated in [1], “...museums cannot remain aloof from technological trends if they wish to attract 21st century audiences. Tomorrow’s museum visitors will be people for whom computers and multimedia have already played a prominent part in their lives through schooling, recreation, and work experience.” However, beyond expanding the geographical and age group reach of museums, will the internet also affect the socio-economic, educational or cultural background of museum audiences? Museum audiences for digital resources are growing fast, but the demographic information about Web users indicate a similar profile to that of the traditional museum-visiting audience in terms of income and education [1], [5]. In some countries this is starting to change. Ross [6] indicates that more than 70% of UK population now has access to Web technologies, from their homes, schools or offices. And soon, he reports, thanks to current developments in technology (such as mobile phones that enable surfing the internet and interactive digital television), and national initiatives that will connect all schools and libraries, a broader spectrum of society will gain access. Creating new relationships with audiences; by helping to change and strengthen relationships with audiences, ICT also have an important role to play in creating the audience-centered museum that current trends in museology propose. Specific audience-centered interpretative strategies where ICT may contribute, as suggested by Morrisson and Worts [7], include: (1) bringing the visitors’ story into the interpretive process (2) connecting the content of the activities to the visitors’ life (3) connecting objects to people, places and purposes (4) connecting people to people, and people to resources (5) facilitating and encouraging playfulness (6) personalizing the message through stories and narrative (7) involving visitors in making decisions, choices and judgements (8) providing multiple perspectives and viewpoints (9) creating responsive environments and (10) providing relevant information. Jackson’s [8] vision for using ICT puts people first, encouraging applications that are user-driven, to create social relationships, and promote participation with the incorporation of users’ expertise and views. He supports the idea of “collaborative knowledge creation” or “open documentation”, which stresses the value of developing knowledge about collections collaboratively with the public (by making specific areas of collection databases open to public contribution). Anderson [9] emphasizes the need to help people learn how to use digital cultural resources creatively, and to ensure that this opportunity is open to groups that the market alone cannot reach. The potential of Web media to change museums’ communication with users in a fundamental way is summarized succinctly by Walsh [10]. He argues that the tone of institutional authority characteristic of museums does not work well on the Web, since its interactive characteristics have great potential to change the museum voice into “an infinitely richer and truer dialogue with the world”. In [11], Museums in the UK offer an interesting field to explore this emerging area of museum work. They operate in a policy

context with a clear national agenda to foster lifelong learning, access and social inclusion. The Department of Culture, Media and Sport (DCMS) requires all government-funded museums and the national museums in particular, to adopt access and audience development policies and to make the best use of ICT. Several DCMS policy documents such as the Learning Power of Museums and Centres for Social Change: Museums, Galleries and Archives for All encourage the use of ICT as an important way of increasing accessibility to museums with the belief that it can help not only to overcome geographical, economic, intellectual and attitudinal barriers to access, but also to reach, involve, and develop long-term and quality relationships with audiences. To develop this potential, the UK government is committed to the provision, and funding, of digital learning networks, the creation of digital cultural content, and universal ICT access, establishing the necessary conditions for the development of the digital dimensions of museums. Networks and projects such as the National Grid for Learning (providing quality digital learning resources for schools and other learning institutions); the People's Network (connecting all public libraries to the internet and providing access to educational content in libraries, museums, archives and learning networks); the 24 Hour Museum (the internet gateway for UK museums, and the first national museum on the Web); or Culture Online (aiming to give both school children and lifelong learners online access to high quality and truly interactive cultural resources). As pointed out in [4], there is great potential for museums to distribute digital learning resources over these networks. With the goal to explore current practices among museums with a strong online presence, a series of semi-structured interviews were conducted with key staff at seven national museums: the Natural History Museum (NHM), the National Maritime Museum (NMM), the Victoria and Albert Museum (V&A), the Imperial War Museum (IWM), the National Gallery (NG), the National Portrait Gallery (NPG), and the Tate Gallery (TG) [11]. According to [11], the museums interviewed have had an online presence since the mid-90s (the Natural History Museum was the first in 1994, followed by the National Maritime Museum in 1996, and the National Gallery and the Tate Gallery in 1998). Since then, all have redesigned and re-launched their Websites at least once. Websites have evolved quickly, from providing little more than visitor information and collection highlights to becoming large and complex sites that present a museum's scope of activity, provide online collection databases, online exhibitions, and learning resources; and, increasingly, building communities of interest with targeted programming. The number of Website visits reported is very high (and growing), in many cases higher than physical visitor figures. What are museums doing to achieve such growth in Web development and such a positive response from visitors? Research interviews revealed some key factors. The museums studied show a very strong commitment to Web development among the direction and senior managers; they have Web strategy groups in place to make sure that policy and strategy for the Website is managed in a cross-divisional way and involve all museum departments; and report a very good integration of Websites into museum mission, goals and

policies. "One of the museum's central roles is to make information about the natural world accessible to a growing audience. Its pioneering Website provides scientific data, educational programmes and resource materials to millions of Internet users across the globe." Natural History Museum Annual Report 1999 "I see our overriding challenges as reinforcing the academic base and ensuring the widest access for visitors of all ages, both for research and for leisure, and I envisage greater use of digital technology as our key strategy." [13] Another key factor is the existence of dedicated departments supporting the Websites with teams of five or six staff with very specific skills in some museums such as the Tate Gallery, the V&A and the National Gallery. Less widespread was the existence of specific Website strategy documents or programming frameworks with clearly defined objectives and activities to guide Web development still at an early stage of development at the time of the interviews. It is clear among the group of British national museums studied, that Websites are becoming central to museum activity. A sign and example of Websites' increasing importance and centrality can be found at the Tate Gallery, an institution made up of a group of galleries. In addition to serving and representing the institution's areas of activity, the Website is seen as a new group location (the fifth, after the Tate Britain, the Tate Modern, the Tate Liverpool and the Tate St. Ives), with its own personality and featuring a distinct programme appropriate to the medium. In [11], the museums' aspirations for Websites are ambitious. Funding is therefore a major issue if they are to fulfill them. Website development and Web teams at the museums interviewed are generally funded by core museum budget. These funds are expected to be complemented with sponsorship and government funding initiatives for specific projects. An interesting and different approach can be found at the Tate Gallery, where a sponsorship package with BT funds the Digital Programmes Department (the staff creating content), contributes cash towards specific Web projects, provides help in kind (hosting the site and the Webcasting streaming media service) and secures marketing for the site (advertises and media coverage). An important and common challenge is to secure major investment, so as to be able to embark on large scale projects such as providing electronic access to museum collections, and developing interpretive and learning resources, which can be very labour intensive to produce. Government funding initiatives such as the New Opportunities Fund and Culture Online play an important role here, making it possible to digitize materials and develop educational content for Websites, at a level that probably would not happen otherwise. According to [11], the museums studied reported focusing Web content development mainly on increasing access and understanding of the collections, and broadening participation among traditional museum audiences. A great deal of effort is being put into making collections available online and developing interactive resources for learning and exploration serving the needs of the general visitor and the specialist alike. More recently, online programming is becoming more targeted, serving a diversity of audiences with projects aimed at specific groups not only core audiences, but also those

usually underrepresented at museums. Museums with art collections have been the first to digitize collections and make them available online, but all the museums interviewed recognized the importance of making collections accessible through online databases, and all of them are working or planning to work towards this goal in the near future well aware of the crucial need of first working on properly documenting and cataloguing the collections. The nature and size of collections are certainly key determining factors. The National Gallery collection is entirely online but it is a small collection of about 2,400 works, whereas the Natural History Museum's collection, for instance, has 70m specimens. The National Gallery, the National Portrait Gallery and the Tate Gallery Websites have invested in extensive and exemplary online collection databases. New data, features and search tools are continually being added to improve the service provided. These Websites offer a range of tools to aid searching and exploration of collections, accommodating different needs, interests and levels of knowledge. They all report high levels of usage of collected information, demonstrating a good public response to this approach. Education is becoming another key factor for Web content development at the museums interviewed [11] with plans to increase the provision in coming years. Online learning resources aim to provide rich contextual information, with different layers of interpretation and entry points, and to encourage people's active involvement in learning. The Victoria and Albert Museum Web projects, for instance, focus on interpretative and learning materials for non-specialist audiences. A major development in this direction has been the transfer of all of the British Galleries' interactive elements to the Website. For school audiences, new materials related to the National Curriculum (targeted to specific ages and educational levels), and new resources for teachers are being created. Good examples are two highly targeted educational interactive elements offered by the Imperial War Museum for children aged 8-10 years old: *Children of the Second World War* and *what was life like in the Second World War?*, which provide images, oral recordings of people talking about their experiences and downloadable resources for teachers. Presented in [12], an interesting case in the trend to provide learning experiences for lifelong learning, beyond formal education, is the Tate Gallery Website, which has recently expanded to offer an e-learning area. An example of material on this portal offering digital learning resources is a learning package about Damien Hirst's "Pharmacy", the first of a series of online projects in which contemporary artists explore and provide information on their works in the Tate Gallery collection. It includes a 360° panorama of the installation; a biography of the artist, with photos and suggestions for further reading; activities and fact sheets for schools and families to help explore the work in more detail; and a discussion area, with different views about "Pharmacy" from the artist and other commentators, in text and audio. The Tate Gallery is developing a groundbreaking project involving a digital educational resource for a visually impaired audience, to help them to explore some of the ideas, innovations and working methods of Matisse and Picasso. In [15], the World Wide Web

(Web) is a system of interlinked hypertext documents accessed via the Internet. With a Web browser, a user views Web pages that may contain text, images, videos, and other multimedia stuff, and can navigate between them using hyperlinks. Today, Web is very much used in conserving both the cultural and natural resources enough to be able to speak about Web-this, Web-that in the conservation of the heritage resources. This is how the technological museum and conservation of the heritage resources can nowadays become compatible. According to the Convention Concerning the Protection of the World Cultural and Natural Heritage, the following are considered as "cultural heritage": monuments, groups of buildings, sites, urban complexes, cultural landscapes, industrial monuments and works of art [13]. Heritage consists of what we inherit from the previous generations and implies a wealth which can be of intellectual, cultural or material nature

III. DIGITAL TECHNOLOGIES

Digital technologies refer to applications, platforms and tools used to create, store, manipulate, retrieve, and transmit information coded in the binary computing system, as combinations of 0 and 1 digits. Digital technologies have radically transformed the way contemporary societies deal with information and communication and feature widely in the methods utilized by contemporary society to produce and enjoy communication flows. Consequently, they are to be found not only in the fields of computing or the computer industry, but in all walks of life—employment, culture, services, public administration, and leisure time (Fig. 1). Digital heritage on the other hand refers to digital content and materials that represent, reflect or describe human knowledge and cultural manifestations, that are invested with cultural value, and considered a legacy that ought to be transmitted to future generations. Digital heritage content can be produced by converting materials originally in analogue format, or can be 'born digital'—objects such as documents, artworks, software or websites that originate in digital format. With the advent of digital technology and the extended practice of digitization of collections, many cultural and heritage institutions create and maintain digital repositories. Digital repositories, also termed 'digital libraries', are collections of digital objects spanning different media formats (text, audio, video, among others) and accompanied by registries, protocols or standards for classifying, storing, preserving, consulting and retrieving data. Most digital repositories are provided with a search interface which allows information retrieval. When offered for public usage, the content of these libraries can be accessed remotely via computer networks. Online catalogues are another way of offering access to information. These are online list-like arrays of items arranged according to pre-determined classification standards and provided with descriptive details. To be effective, online catalogues should be designed in accordance with usability principles (clear structures and terminology, appropriate contextual information) to allow users to effectively search for and retrieve the records without any assistance. Digitization refers to the process of converting analogue to digital data, with the

purpose of enabling data processing, storage, and transmission through digital circuits, equipment, and networks. Digitization is enabled by different electronic devices such as scanners, cameras, and 3D technology. Cultural Heritage digitization is part of today's agenda for many cultural and memory institutions and has two main purposes: (1) providing a wider range of audiences' access to (digital) heritage and (2) assuring long-term preservation for the (digital) objects which are created, so that those objects can be located, rendered, used and understood both in the present and in the future. However, no process can guarantee to be eternally effective as one must consider the implications of fast-changing technology and the possible obsolescence of the electronic devices or the digitalization tools available in the present. Metadata refers to 'data about data', where the root meta—derived from Greek— means 'alongside', 'with', or 'next'. Metadata records display a set of attributes used to describe context-specific resources such as the books in a library, or the items in an archive, according to metadata standards, which are context or discipline-specific. Traditionally, the main use of metadata has been in libraries and archives. Nowadays, metadata are used not only for classifying items in digital libraries and archives, but also to describe the main attributes of web pages and improve usability. The main purpose of using metadata is to enhance information discovery. Achieving this goal becomes a complex task with the proliferation of digital collections and archives, especially when the aim is to improve information retrieval across multiple collections. Metadata harvesting enables information retrieval across multiple collections. It is an automated process by which metadata descriptions from various sources (for instance digital archives and libraries) are combined to design aggregated services. An important aspect for facilitating metadata harvesting is the development of protocols that can enable retrieval and aggregation of data over multiple archives of different kinds.



Fig. 1. Digitized gallery of heritage resources.

IV. CHALLENGES CONFRONTING ICT APPLICATIONS

Scans of historical materials are much larger than one originally thought: hundreds of megabytes for a single page of text and many gigabytes for a single image (Fig. 2). Thus storage is a much greater problem than originally imagined.

Major digital reconstructions of sites, cities now range from 1-10 terabytes (TB). Software continues to change so rapidly that there are serious problems of continued access to digital versions because it is difficult to keep these materials in an up-to-date form. Many born-digital objects, especially in the form of new multi-medial and multi-modal art pose special problems of conservation and preservation. While the new media bring many potential advantages, they also bring dangers. Some of these dangers are obvious and as might be expected these are being addressed on many fronts: e.g. the challenges of permanent storage using new media; challenges of authenticity and veracity. More subtle are those dangers which are not yet clearly recognized. Among which are (1) over zealous commercialism (2) an anti-technology stance of some intellectuals (3) a trend against universal narratives (4) a tendency to perceive the past only in terms of the present (5) a tendency to destroy systematically the evidence and collective memory of the past. The enormous potentials of ICT have inspired many innovations and are leading to emerging fields such as humanities computing, new developments in textual and hypertextual analysis and many new methodological discussions concerning sources, authenticity, veracity and reliability, a range of questions which were previously sparked by the introduction of manuscript and later print culture. At the same time, a number of intellectuals are intuitively against all technology as if this posed a threat to their humanist aims. [14] Instead of seeing the new technologies as extensions of man, as did McLuhan, [15] they perceive technologies simply as a threat to independent thought and insight. Instead of seeing technology as a tool to help in their critical analysis, reflection and synthesis, they see technology as something simply to be opposed. In the past, it was the scholarly world, which helped to articulate and uphold a set of values that rose above the greed and short-sightedness of the everyday to open larger vistas of comprehension and understanding. Ironically, in a world where it is ever more difficult to attain viewpoints that reflect sufficiently developments at a global level, a significant number of scholars are rejecting the very tools that could help them to achieve such comprehensive viewpoints.



Fig. 2. Cupronickel (Photo: Yang Chao, 2014).

V. CONCLUSION

Having considered in detail and subject to an analysis, it was discovered that digital technology application in conserving and preserving heritage resources will continue to face challenges of anti-technology. The enormous potentials of ICT have inspired many innovations and are leading to emerging fields such as humanities computing, new developments in textual and hypertextual analysis and many new methodological discussions concerning sources, authenticity, veracity and reliability, a range of questions which were previously sparked by the introduction of manuscript and later print culture. At the same time, a number of intellectuals are intuitively against all technology as if this posed a threat to their humanist aims. Instead of seeing the new technologies as extensions of man, they perceive technologies simply as a threat to independent thought and insight. Instead of seeing technology as a tool to help in their critical analysis, reflection and synthesis, they see technology as something simply to be opposed. In the past, it was the scholarly world, which helped to articulate and uphold a set of values that rose above the greed and short-sightedness of the everyday to open larger vistas of comprehension and understanding. Ironically, in a world where it is ever more difficult to attain viewpoints that reflect sufficiently developments at a global level, a significant number of scholars are rejecting the very tools that could help them to achieve such comprehensive viewpoints.

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