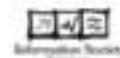


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INTRODUCTION

In previous issues of *DigiCULT.Info* and in *Technology Watch Report 1* (2003) DigiCULT examined the issues of 3-dimensional representations of cultural artefacts and spaces. In this issue the team from Factum Arte describe the creation of a physical 3D replica of *La Dama de Elche*. The story of the sculpture



is well-known as is the impact of its discovery on development of Iberian archaeology. The bust, found on the 4th of August 1897 during agricultural work to create terraces for pomegranate trees at Alcludia, was sold within days to the Louvre and by the end of that month was on its way to Paris. There it remained until it was moved before Hitler's invasion of Paris for safekeeping to the south of France. Early in 1941 following negotiations between the Spanish and Vichy governments the sculpture was returned to Spain. By late June 1941 it was on display at the Prado. Eventually it was moved to the Museo Arqueológico (Room 20) where it now rests behind protective glass. From soon after its return General Franco took advantage of the iconic power of the sculpture as symbolic of the rich and ancient cultural identity and legacy of the Iberians.

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The iconic status of the sculpture has meant that access to representations of it are seen as central to presentations of the local archaeology of the Alicante Region. Indeed the local Museo Arqueológico de Elche in the Palacio de Altamira has a 20th century copy. Given the central importance of the sculpture to the region the newly opened MARQ Archaeological Museum, Alicante (<http://www.marqalicante.com/>) wished to include in a special exhibition a more accurate and recently made replica of the *La Dama de Elche*, but could only create one if it could find a conservation friendly approach to generating the level of recorded detail necessary to fabricate the replica. In the Introduction to issue 4 of *DigiCULT.Info*, we noted the exceptional use of new technologies to improve access and understanding of the archaeological heritage of the region that this new Alicante archaeology museum had already made. In that note we focused on front-of-the-house uses of technology, but they have also made use of cutting edge information technologies behind the scenes and the physical replica of *La Dama* has been made possible by one such technology. It has enabled the high-resolution recordings of original objects, and the rapid prototyping of copies using accurate and automated industrial methods. Whereas in the past plaster casts might have been made of archaeological materials 3D documentation techniques now enable the creation of nearly identical copies of works without exposing the original to risk during the recording process. This was the case with the production of a replica of the *La Dama de Elche*. We tend to frown on replicas claiming that they lack the authenticity and integrity of the original. The team

from Factum Arte argue that the popularity of the exhibition offers at least one challenge to 'the view that replicas are in some way inferior and suggests that they can become a valuable addition to museum displays without the audience feeling 'duped''. In earlier issues of this ejournal we examined the issues of authenticity and integrity from the vantage of our 'written documentary heritage', and in a future issue we will return to this topic taking the concept of documentary heritage in its broadest sense.

While it is recognised that the complexity of archaeological excavations and their records makes it difficult for their results to be published by anyone other than the original excavators, it is also the case that the work of later archaeologists can benefit from returning to the original excavation notes, drawings, and other records rather than relying on the published record alone. Sadly few do so. There are many reasons for this; among them is the fact that too little research has been conducted to make their discovery easy. Work by the EU Culture 2000 programme funded research network AREA-ARchives of European Archaeology, (<http://aphrodite.inha.fr/area-archives/index.htm>) has gone some way to improve knowledge about, study of, and access to archaeology archives across Europe. A series of documentary projects conducted during the second phase of the AREA project has done much to lay a foundation for the proper recording, if only at collection level, of the location and nature of archaeological archives. The Spanish participation in the project led by the University of Jaén inventoried 'Archives of Iberian archaeology' with special focus on those related to the Iron Age.

Among the archival fonds now documented in the AREA database are those related to the accidental discovery of the *Dama de Elche*. Indeed, a contemporary note of the discovery held by the Archivo Municipal de Elche. (Alicante, España) is the source for information about the nature of its discovery.

Imaging work at the *Archivo General des Indias, Sevilla* was one of the earliest attempts to enhance access to archival holdings through the use of digital technologies. The Archives, which consists of some eighty-six million pages of manuscripts related to the Spanish administration in the Americas from the fifteenth to the nineteenth centuries, were from the early 1990s the focus of efforts to improve access and potential use of the collections through digitisation. So far some 11 million pages have been digitised. As well as leading development work in digitisation the *Archivo General des Indias* project has been one of the first cultural heritage projects to tackle the migration of digital resources across file formats and operating systems (see <http://www.erpanet.org/www/products/toledo/Toledo%20Report%20v5.pdf> /). The experiences of this project have provided valuable guidance to other digitisation and migration activities.

The project also pointed the way for the application of ICT to improving access to Spanish Archives. In this issue Elisa Carolina de Santos Canalejo and Blanca Desantes Fernández of Spanish State Archives Bureau describe an even more ambitious project to employ the Internet to bring visibility to the documentary heritage housed in Spanish archives. The AER Project (Proyecto de Archivos Españoles en



Red) aims to make descriptions and increasingly digitised images of documents held in Spanish Archives available over the Internet in a coherent, consistent, and comprehensive way. In its first nine months by enabling virtual visits the AER portal has dramatically increased use of the archives and opened them to new audiences. As well as requiring substantial technical work the authors examine the methodological and practical preparatory work that they needed to do to ensure that the archival descriptions met international guidelines. In addition, the AER Project also aims to ensure that its holdings are effectively used for virtual learning. While many virtual visitors have experience using archives others do not. The AER Project is trying to understand the needs of these users so that they can improve the ways that services are provided and define e-learning tools to support them. Projects on this national scale were envisaged when the Member States adopted the Lund Principles in 2001, but we need many more.

The development of Internet technologies and their emerging patterns of use has not only changed how we present and access information resources, but it has led to the development of an environment that offers us the ability to participate in multiple virtual communities and to do so through one or many identities. The growth of cyberspace studies has become methodologically rich and has begun to form a theoretical grounding. Investigations such as Howard Rheingold's *The Virtual Community* (1993) and Sherry Turkle's *Life on the Screen: Identity in the Age of the Internet* (1995) are among the now classic foundations for cyberspace studies. There is now a steady stream of new studies of cyberculture. In

fact keeping abreast of the current thinking and recent work is challenging. The efforts of David Silver's Resource Center for Cyberculture Studies at University of Washington (<http://www.com.washington.edu/rccs/>) provides an essential monitor of cyberculture research. Recently DigiCULT released its fifth thematic issue discussing *Collaboration and Virtual Communities* (<http://www.digicult.info/pages/Themiss.php>) in the context of the cultural heritage. Susan Hazan, Curator of New Media and Head of the Internet Office at the Israel Museum (Jerusalem) played a crucial role in shaping the preparation and intellectual framework of this Thematic Issue Five. In this ejournal we carry an interview with Hazan in which she examines how virtual communities can generate new social spaces that foster new opportunities for heritage institutions. These virtual communities can be used to promote the growth of new kinds of relationships which can be 'harnessed' by heritage institutions to promote the 'meaningful participation and contribution by the public' and release substantial 'creative energy, generate a broader knowledge-base, and extend expertise across invisible geographic borders' (see Hazan Interview).

In a second interview in this issue Paolo Buonora of the Rome State Archive and the DigiCULT Steering Committee shared with Daisy Abbott his thoughts on developing digital assets to put the cultural heritage in the hands of 'the thousands of people who might never enter our reading rooms'. His interview charts the opportunities created by digital representations of analogue objects and raises questions about whether versatility and new research opportunities give new

kinds of validity to digital copies.

The completion early in 2004 by the National Archives of Scotland of its Scottish Archives Network Project (SCAN) is a formidable success story, about which we hope *DigiCULT.Info* can carry a fuller article at a later date. But for now, suffice it to say that the project owes much of its success to some original thinking by Rob Mildren of the National Archives of Scotland and the exceptional team that he, George MacKenzie, and Ishbel Barnes assembled. Rob Mildren's redefinition of processes, and in particular workflow strategies, enabled the project to digitally image three million pages of archive documents in thirty-six months and has laid a foundation for much more future work in using digitisation to unlock the archives of Scotland and to make them accessible online.

In examining digitisation we tend frequently to focus on the work of the large institutions, such as National Archives. There are though many smaller projects that are worthy of mention and Ivan Grossi and his colleague Anna Nabot have contributed a report on one of these; the work to improve access to the Ecumenical Testimonies at the Cittadella of Assisi (TECA). The project developed core technologies to capture, store and provide digital access to its holdings, it created a digital catalogue of its holdings, and it digitised many of them. If we are to make accessible and visible the rich diversity of Europe's cultural heritage as the Lund Principles encourage then we need many more projects along the lines of TECA. Funding for these will need to come at both national and regional levels. In this case the Italian *Ministero per i Beni e*

per le Attività Culturali (Ministry for Cultural Heritage) provided part of the funding for the project.

E-Learning occupies an increasingly central place in discussions about the Internet and access to the cultural heritage materials. Previous issues have examined aspects of the topic and this issue carries three further articles. In the first of these the team from the Elena project introduce the technologies they are developing to create personalised managed smart spaces for learning. These spaces can be adjusted to profiles of individual learners and their environment. In a second article, colleagues from the GIUNTI Interactive Labs, a learning content management technology developer and vendor, describe their work with RFID tags to create ambient learning and training con-

texts. Through their ASTRAL Pilot the GIUNTI Interactive team is investigating the application of the JADE methodology (Justification, based on Argument, arising out of Discussion, based on Evidence) in conjunction with intuitive interfaces to the web and smart tags within cultural heritage environments. In a further application of portable technologies the MOBIlearn Project sketches the Open Mobile Application Framework (OMAF), a service-based software architecture, they have been developing to support their investigations of the use of mobile technologies in different learning contexts.

DigiCULT continues to extend its network of regional correspondents. Their work is increasingly central to our activities as not only do they contribute quarterly reviews of activities in their countries, but they

point the DigiCULT team to topics and authors for feature articles. Readers will find much in these reports of value as they produce a picture of the extent to which ICT continues to transform management, study, interpretation, presentation, and use and enjoyment of the cultural and scientific heritage across Europe.

There are a few European countries that do not yet have a national correspondent and those interested should contact the *DigiCULT.Info* Content Editor, Daisy Abbott at D.Abbott@hatii.arts.gla.ac.uk. To our current correspondents the Editors wish to extend our warm thanks for all your efforts that have helped to make *DigiCULT.Info* so rich in content.

Seamus Ross & John Pereira
1 April 2004

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LA DAMA DE ELCHE: DIGITAL TECHNOLOGY IN CONSERVATION

ADAM LOWE, FACTUM ARTE



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The original Dama de Elche, limestone with traces of pigment, circa 4th Century BC. 56 x 52.5 x 34 cm. Museo Arqueológico Nacional, Madrid.

In November 2002, Factum Arte (<http://www.factum-arte.com/>) was approached by the Diputación Provincial de Alicante (Provincial Delegation of Alicante) to make a high resolution replica of the Dama de Elche, an Iberian sculpture believed to date back to the fourth century BC. Work on the production of the replica began in February 2003 and was completed by the middle of May. The resulting copy of the sculpture will be the centrepiece of an exhibition at the MARQ Archaeological Museum, Alicante (<http://www.marqalicante.com/>), describing the technology and processes involved in its production. With the full support of Museo Arqueológico Nacional de Madrid (<http://www.man.es/>), where the sculpture is on permanent display, Factum Arte carried out digital 3D documentation of the statue. The digital data was then used to produce a full-scale replica of the sculpture using pulverised limestone from quarries local to Elche. The tests, samples and documentation relating to the production of

the replica will be included in the exhibition along with photographs, a film and 3D animations of the digital data. Copies of the digital data itself were presented to the Museo Arqueológico Nacional as valuable digital archives to aid all future study of the Dama de Elche.

The adaptation of digital technology to document and replicate heritage raises unique challenges that require skills and knowledge from a wide range of disciplines, and involves the adaptation of industrial fabrication techniques, software writing and conservation skills. Factum Arte is a company at the forefront of the use of digital technology in this way. In the two years since Factum Arte was established it has developed a unique working method, analysing the specific needs of each project and developing the hardware and software required whenever they are not commercially available. Factum Arte has also established a network of contacts with universities and research centres in Europe and has close links with companies that are developing



The ModelMaker Scanner recording the surface of The Dama de Elche in the Museo Arqueológico Nacional, Madrid.

and applying new technologies in Japan, Spain and the UK.

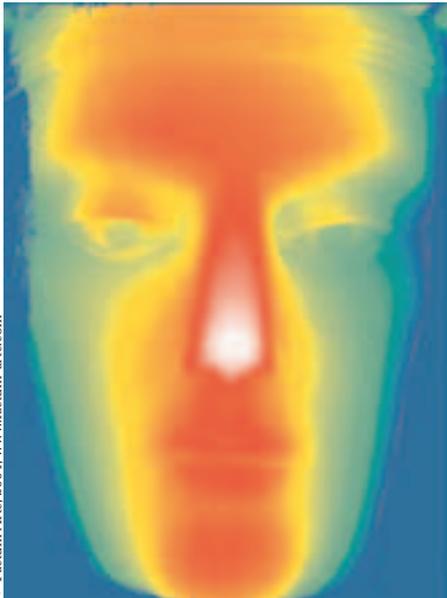
WHY USE DIGITAL TECHNOLOGY?

Traditional moulding and casting techniques can produce very realistic effects but require full physical contact with the original which can result in damage to the surface. An alternative method would be to copy the object by hand in similar materials. Again, the results can be very realistic, but making a copy by hand is a subjective process dependent on the skill of the artist. The digital techniques used by Factum Arte are not only objective, but are also highly accurate. Digital scanning is a fast and efficient way to record an object without requiring any physical contact. This work requires a new understanding of the ways in which information is mediated. The aim is to produce a physical object that retains as many of the characteristics of the original as possible and which under museum conditions looks physically identical to the original. Using a variety of techniques, Factum Arte has already successfully completed a digital replica of a section of the burial chamber of the tomb of Seti I which was exhibited at the MARQ in Madrid. The impressive realism of the replica was achieved by scanning the surface of the tomb at an unmeshed resolution of a tenth of a millimetre – a resolution that had never before been accomplished in practice on this scale. Sixteen months of research were then spent perfecting all the stages from the acquisition of digital data to the finishing of the printed colour gesso low relief surface.



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Data from the Seti Scanner. The data is made up of points of 3D information positioned on a 100 micron grid and requires no meshing or post processing.



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Colour coded data from the Seti Scanner indicating the relief surface. The many different renderings of the 3D data can provide new source material for academics and conservators.

The popularity of the Seti exhibition at the Museo Arqueológico Nacional challenges the view that replicas are in some way inferior and suggests that they can become a valuable addition to museum displays without the audience feeling 'duped'. The technique of digital documentation also has a significant part to play in the study and conservation of heritage, such as the monitoring of deteriorating surfaces and close-range analysis. As our heritage is continually under threat it is clear that there is ample scope for the application of this technology at historic sites around the world.

THE USE OF REPLICAS IN HERITAGE

Copies have been known throughout the history of art, from Roman copies of Greek statues to eighteenth-century imitations of the Roman copies, or as a way for famous works to reach a wider audience. Within the Islamic tradition of miniature painting copying is an accepted means of deepening understanding and appreciation of an established canon of great works. The process of

copying is still used in art academies as a valuable tool for learning about art. Today there are many ways in which copies and reproductions can be used to contribute directly to the protection of art and artefacts and also to aid education and study.

Historic sites and buildings are often decorated with carvings, frescoes or mosaics which, if exposed to the elements, are in danger of severe deterioration or even destruction. However, these artworks can be saved by well researched preservation policies and limiting visitor numbers. In some cases, like the Romanesque frescoes from the church of San Clement in Taull, they have been removed to the protected environment of the Museum of Catalan Art in Barcelona. If they were replaced with an exact replica the visual integrity of the original site would be maintained. On a grander scale, entire sites can be replicated, such as the Altamira caves. These caves and their Neolithic paintings were under threat from environmental hazards caused by heavy visitor numbers. The construction of a full-scale replica, housed in a purpose-built museum at Altamira, has made the caves accessible

while protecting the originals, with the added advantage of all the facilities that a museum can offer.

Reconstructions can also be used by archaeologists and historians to help answer questions about ancient civilisations and how they lived. The use of replicas, rather than original objects, in research and study helps to conserve the originals by protecting them from potential damage from handling. This is particularly important for objects with vulnerable surfaces such as loose or flaking pigment, paper and even metals, which can be corroded by the substances in human sweat. Replicas can also be used in museums as objects designated for handling by visitors. This allows people to learn by touching and feeling, and is also a powerful resource for blind and partially sighted visitors.



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Data from the ModelMaker Scanner. In practice the best resolution achieved with the ModelMaker was 100 microns along the scanning line and 250 microns between lines.



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GATHERING THE DIGITAL DATA THROUGH LASER SCANNING

One of the great advantages of 3D laser scanning technology is that only the laser light makes contact with the surface, allowing even very vulnerable surfaces to be scanned without risk. The lasers used in laser scanning are the same type of low-power red light laser used in barcode readers and CD players and are not capable of generating enough light emission to cause damage. Factum Arte has rejected the use of point lasers and works with strip lasers that spread the light intensity over a strip that varies in size depending on the scanning system. Two different laser scanning systems were used to scan the Dama de Elche: the ModelMaker W, used to scan the overall shape and surface of the sculpture; and the Seti Scanner, used to capture the surface detail.

The ModelMaker W

The ModelMaker W is manufactured by 3D Scanners UK (<http://www.3dscanners.co.uk/>). The system consists of a scanning head mounted onto a Faro arm attached to a tripod. The scanning head is designed to be held in the hand and the path of the laser strip is controlled manually. Using the ModelMaker system, the scanning of the Dama de Elche was carried out in three days. The data was then merged and meshed, using 300-micron mesh,¹ by 3D Scanners using Raindrop Geomagic software.

The Seti Scanner

The Seti Scanner, used to scan the surface detail, is a system designed by Factum Arte. The Seti Scanner is a 3D laser scanning

system that consists of a high resolution Reversa 25 scanning head, made by 3D Scanners UK, mounted onto specially constructed, servo driven xyz linear guides, controlled by a CNC (Computer Numerical Controller). It has a maximum working resolution of 100 microns both along and between the scanning lines and a depth of field of 25 mm. Once the scanner has been set up it scans in a series of horizontal passes. The scanning head emits a single strip of laser light which passes across the surface of the object as the scan-

ning head travels along the linear guide. The position and movement of the scanning head are fully mechanised and controlled by computer. After each horizontal pass the head is automatically repositioned to record another pass. It took about four and a half hours to record the complete face of the sculpture. The Seti Scanner uses Riscan software to capture and display the data but additional software was written by Factum Arte to remove scanner artefacts, reposition the scanning head and merge the data from each pass. This has been an essential part of the work as it was crucial that the data was used in its unmeshed form and that post processing was effectively eliminated. At no point was the data optimised in order to facilitate subsequent processes like 3D printing and routing. The difference between the data recorded with the Seti Scanner and that recorded on a Minolta Vivid 910 is clear if a direct comparison is made between output data.

SOURCING AND TESTING OF MATERIALS

The block of limestone from which the Dama de Elche was carved has been identified as being local to the area around the town of Elche, so fragments that were similarly weathered and had surface colouring that resembled the surface of the sculpture were gathered from quarries in the area. The use of natural materials significantly adds to the realism of the finished replica and, by using stone that is as close as possible to the original, the replica is faithful not only in general appearance but also in physical substance. This also means that the replica will probably age in a similar way. Back at the studio the fragments were pulverised and sieved. Tests were carried out, using



Routed face from the unmeshed Seti Scanner data. The routing was carried out by Delcam UK using a complex routing strategy with a final cut of 100 microns



Z Corp print of the face from the meshed Minolta data. The Z corp print was made in 100 micron layers but compared to the milled data from the Seti Scanner the surface lacks detail and has the appearance of a sucked sweet.

¹ 300 microns is roughly the size of a pin head.

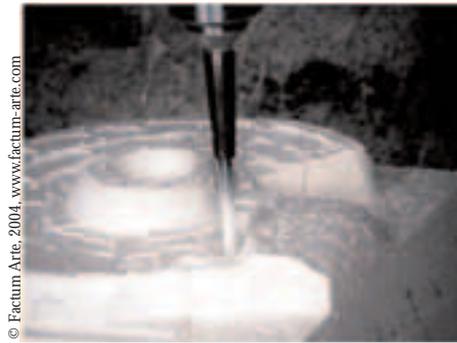
small quantities of resin and conservation mortar as a binder, to find the best grain size to reproduce the look and feel of the original surface. Different earth pigments gathered at the site were also tried both as part of the recipe and as surface treatments. It took over 100 tests to find the best combination of materials.

PRODUCTION OF THE REPLICA

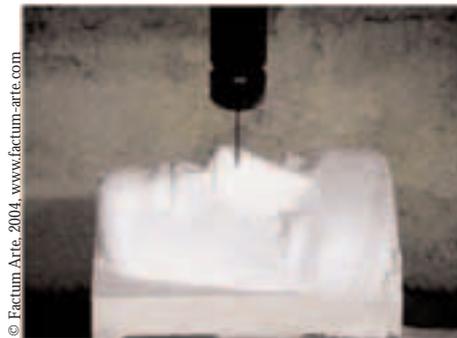
After extensive tests it was found that a combination of techniques would be needed to produce the replica. There are a number of different processes used in industry to produce three-dimensional prototypes from digital data. These processes are referred to as **rapid prototyping**. A model can either be built up in layers using stereolithography, lasersintering and 3D printing or it can be cut from a solid block using industrial milling machines, a process referred to as milling, engraving, tooling or routing. Tests showed that routing was the best approach for reproducing the fine detail that was essential when trying to capture the character of the surface. However, routing is less suited to producing a model in the round, a task suited to the Z Corp 3D printer. Therefore, it was decided to construct a model out of sections of Z Corp and routed data, creating a mould of this model and then casting the entire replica from this mould in a mixture of pulverised stone and resin medium.

3D Printing

The rapid prototyping was carried out by 4D Concepts (<http://www.4dconcepts.com/>) at their workshops in Gross-Gerau, near Frankfurt, using the data gathered by the ModelMaker scanner. From data to model



Each stage of the routing is done with increasingly fine cutting tools. The final pass is with a conical tool with a tip of 100 microns.

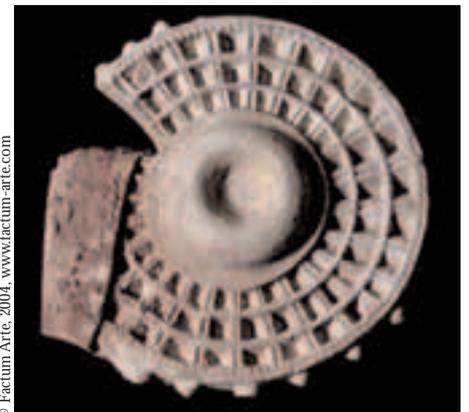


it took three days to create the print using the Z810 3D Printer (made by Z Corporation (<http://www.zcorp.com/>)). The Z Corp 3D printer uses a finely grained plaster-like material. A thin layer of the dry material is spread onto the build area and then water, which acts as a binder, is printed onto the area to be bonded. As soon as this has cured a new layer of powder is spread on top. As the process continues the model builds up layer by layer. When the printing process is finished the build platform is removed and the loose powder cleaned away to reveal the 3D print. The model is then infiltrated with resin to make it durable.

Routed Sections

The routed sections were cut using the data from the Seti Scanner. This work was carried out by Delcam UK (<http://www.delcam.co.uk/>) at their tooling workshop in Birmingham, using a three-axis router. The routing was performed at 100 microns (0.1 millimetres;

roughly the size of a grain of pollen) with no optimising or averaging of the data. Delcam used a complex cutting strategy that involved cutting four times with progressively finer cutting heads on carefully selected areas. The material used was a dense polyurethane board – a standard top quality material for industrial routing. The choice of routing material is critical because it must be dense enough to retain detail and very stable so that there is no risk of distortion through expansion and contraction. A total of four sections were cut in this way. Some initial tests were carried out to cut directly into limestone, with very promising results. However, the loose grain of the limestone resulted in loss of detail and it was considered too impractical to produce the entire sculpture this way within the project timeframe.



The first finished tests of the ear pieces from the Seti data in limestone with pigment. Particular attention was paid to the complex layering of the colour.

ASSEMBLING AND CASTING

THE MODEL

Moulds were made of the 3D print and all of the routed sections. These pieces were then all cast in plaster and the plaster pieces were assembled into a complete model. A final mould was then made from the plaster model and the replica cast from this mould. All of the moulding, casting and finishing stages of the production were carried out at Factum Arte's workshops in Madrid. The replica was cast in a specially



developed recipe of limestone and resin, pigmented to resemble the internal colour of the original sculpture. Hand-finishing was used to colour the surface. Interventions were kept to a minimum so as not to interfere with the objectivity of the digital data.

surface effects have given an insight into the layers of mediation required to replicate the complex textures and colours. Such research is a valuable addition to future studies of the sculpture. The result is the most accurate copy of a sculpture ever made.

The techniques used in this project have much to offer. Replicas have a place, not only in museums, but also as part of a broader management strategy for the future protection and preservation of heritage. The data gathered resulted in an accurate, high-resolution digital record which will



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The finished Z Corp 3D print from the ModelMaker data. The data was output in 3 sections in layers of 100 microns. The two horizontal joints are clearly visible due to slight changes in colour of each section.



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Applying the layer of limestone and water mix used as a resist to match the surface characteristics of the copy to those of the original.



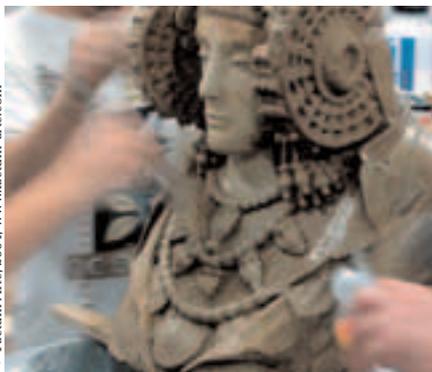
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The finished facsimile in Factum Arte's workshop. Plaster, resin, limestone, mud and pigment.

CONCLUSION

The project to replicate the Dama de Elche was an unprecedented opportunity to document and study this remarkable sculpture. The scanning also enabled, for the first time, a close comparison of two different scanning systems (tests were also carried out using a Minolta Vivid 910 but the data were rejected as the resolution was not acceptable). Each system has its own specifications and limitations which resulted in data sets of differing resolution and quality. There is clearly a need for such objective comparisons so as to verify the capabilities of each system.

The work has necessitated a close examination of the surface, and the tests to try to reproduce the



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Washing the mud from the surface.



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After the direct comparison with the original, small alterations were made using tools specially designed for this work. The tool seen here is a miniature sandblaster.

be a vital archive for monitoring the sculpture's condition. This archive will also serve as an invaluable additional resource for academic and historic research directed towards the study of the Dama de Elche and its place in the history of Spanish culture.

For further information on Factum Arte's other exciting projects, please visit <http://www.factum-arte.com>.

A NEW MARKETPLACE OF IDEAS – HARNESSING VIRTUAL COMMUNITIES TO BUILD NEW SYMBIOTIC RELATIONSHIPS

AN INTERVIEW WITH SUZAN HAZAN

BY JOOST VAN KASTEREN, DIGICULT JOURNALIST

‘The virtual community I have in mind is a marketplace where people barter knowledge, ideas, news and narratives. Intrinsically a social place where people gather with a common sense of purpose, a shared value system and a tacit understanding of the group dynamic,’ says Susan Hazan, Curator of New Media and Head of the Internet Office at the Israel Museum, Jerusalem. ‘For museums, as interpreters of museum collections it can be very rewarding to take part in such informal educational scenarios.’

According to Hazan there is some confusion about virtual communities, because the different categories of communities are often vague. ‘There are digital marketplaces,’ she says, ‘for business-to-business communication, and learning communities where teachers and students come together around a certain topic or course. Other communities evolve to satisfy a specific cultural or social goal. They perhaps fall into the same category as a hobby – an activity you are prepared to invest in, because it fulfils a social or cultural need, not because you have to.’

Virtual communities can be compared to embodied or real life communities but ‘instead of gathering around the water cooler for a chat or dropping into the pub, you can join a community at the click of a mouse from the comfort of your armchair.’



© 2004, Photograph: Amit Gal

Virtual communities extend this metaphor and draw participants into long-term, sustained discussion and interaction. Virtual communities now span the globe, cross geographical and cultural boundaries and reaffirm trans-national and diasporic connections through a common language and shared experiences. At the same time, other communities connect people from different cultural backgrounds across cyberspace to exchange ideas and stories around the same mutual passion – may it be snuff boxes, trilobites or Picasso.

The invisible crossing of national or cultural borders in virtual communities creates new opportunities for museums. Hazan: ‘Through discussions around the digital artefacts, i.e. photographs, audio files, or short movies and narratives, museums forge new connections to the collections

and give voice to new interpretations of the objects. These evolving social clusters can give rise to what the American literary theorist Stanley Fish calls “interpretive communities”,² communities that coalesce around a certain reading of a literary text in Fish’s case or – for that matter – to life itself.’ Such an interpretive community was identified by Janice Radway in her ethnographic study of a group of women romance novel readers.³ Although the number of possible interpretations of the stories was virtually infinite, the women used the texts in specific ways that were meaningful to them, often using the narratives in a surprisingly oppositional way.

²Stanley Fish: *Is There a Text in This Class?: The Authority of Interpretive Communities*. Cambridge: Harvard University Press, 1980.

³Janice A. Radway: *Reading the Romance: Women, Patriarchy, and Popular Literature*. Chapel Hill, NC: University of North Carolina Press, 1991.



Museums can harness virtual communities to build new symbiotic relationships. As collections become accessible online, all members of the community – museum-based curators and educators, and remote visitors – may then share and contribute their own knowledge and narratives to the communal knowledge base. Hazan: 'Virtual communities can be instrumental in expanding our knowledge of the role of objects in daily life, or in collating scientific data distributed over vast geographic distances. By nature museums collect extraordinary objects. They conserve them, display them and interpret them, thus building a knowledge base around them. A virtual community can not replace a museum when it comes to these kinds of

objects, but it can be instrumental in collecting digital artefacts or scientific data, give meaning to them and thus expand shared knowledge and community narratives.'

'Reversing the traditional relationship of museum and visitor,' says Hazan, 'museums can build horizontal fraternities, where leadership shifts from one to the other, depending on the narrative shared by the community, and the goals the group have set themselves. The members of the community offer and accept each other's views seriously. This is the essence of a community, where everybody can be an expert and where each member may learn from one another.'

'The traditional mandate of the museum is to preserve, display and interpret objects. In a virtual community people can bring in their own digital objects and with them their own interpretations. This is a meaningful participation and contribution by the public, which can harness a lot of creative energy, generate a broader knowledge-base, and extend expertise across invisible geographic borders.'

Collaboration and Virtual Communities is the subject of the DigiCULT Thematic Issue available from <http://www.digicult.info/pages/Themiss.php>. For more information about The Israel Museum, Jerusalem, visit <http://www.imj.org.il>

DIGICULT USER SURVEY 2003

By GUNTRAM GESER AND JOHN PEREIRA

In autumn 2003, the DigiCULT secretariat conducted a survey for feedback on how the DigiCULT products have been received so far by users as well as clues as to how to better serve the needs of the heritage institutions throughout Europe and beyond.

A questionnaire was sent to more than 350 institutions who had previously received copies of DigiCULT Thematic Issues, Technology Watch Report 1 and the digital *DigiCULT.Info* newsletter. We kept the questionnaire fairly short, asking for general information on technology use in the institution, the usefulness of the DigiCULT Publications, and some administrative information.

GENERAL RESULTS

Seventy-three questionnaires were returned, of which at least one was from an institution located in each of the following countries: Australia, Austria, Belgium, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Liechtenstein, Malta, The Netherlands, Norway, Slovenia, Spain, Sweden, Sweden, United Kingdom and the USA.

The distribution of the respondents according to organisation type is shown in the following table. This represents the broad range of institutions that make use of the

DigiCULT products:

Ministries and national agencies	12
National libraries	16
Other libraries and library services	3
Museums and galleries	6
National and other archives	4
Federations and professional associations	6
Cultural networks and service organisations	10
Research and teaching centres	11
Commercial companies, consultancies	5
Total	73



In the following sections we summarise the user feedback on four of the questions from the questionnaire.

Who do you consider most likely to benefit from the DigiCULT publications in your organisation?

The answers to these questions varied, but, overall, project managers, policy makers and technical staff of libraries, museums and archives were considered most likely to benefit from the DigiCULT publications (42 respondents). This includes descriptions such as 'Archivists, technical staff and project managers', 'Stakeholders, project managers, technical staff' or 'Business and ICT policy makers, digitisation and e-technologies projects'.

Other answers ranged from 'Everyone in our organisation' or 'From the manager to the employees', one or more departments (e.g. 'Collection and Communication Department', 'E-Access Department', 'Central Management Department', 'Our IT team') to one or more user groups (e.g. 'Librarians, technical staff', 'Managers, archivists', 'Researchers', 'Consultants').

What are the vital questions asked when employing a new technology in your institutions?

The answers to the question on what the institutions consider as the vital questions when employing a new technology may be of general interest. Applying a rather crude categorisation, we can distinguish between respondents who find that their institution acts taking into account:

(a) a bundle of vital questions;

(b) primarily the interest of stakeholders (i.e. user groups, public institutions), possible service improvements, and social impact;

(c) cost considerations, or

(d) another important single factor.

(a) In this category, respondents, for example, mentioned '(1) Relevance to supporting the institution's strategic directions; (2) Benefit to users; (3) Cost; (4) Fit with existing standards and architectures' or 'A number of factors, including benefits to the business, compliance with user needs and strategies, deployment and maintenance costs, integration with existing systems, and value for money'.

(b) Here typical answers were: 'Social impact, interest of stakeholders'; 'Social impact and sector trends'; 'How will it help us provide a better service? How will it help improve value for money?; 'Added value which it provides, in terms of access, efficiency etc.'

(c) For respondents who mentioned only one 'vital question', cost considerations were seen to be the most important single factor when employing a new technology. Typical answers here were: 'Total cost of ownership, with a focus on quality and longevity'; 'Return on investment, competitive edge, cost'; 'Cost aspects and durability' or 'Total cost of ownership, including support costs; functionality; upgrade path; sector trends, e.g. keeping up-to-date with new software releases; scalability'.

(d) Other important single factors inclu-

ded: Standards and interoperability ('Compliance with functional and technical requirements; open standards; sustainability'); Innovation ('The latest models which can be used for our purposes and for the benefit of our members'); Skills ('It is also a question of available manpower'; 'Skills to implement it'); Educational requirements ('Pedagogical factors: improve teaching and facilitate learning'); other, special factors such as: 'Vital question is security' or 'We operate in different countries so how to get all of us to the same level to work together using the same software etc. is a complicated issue'.

Is there any issue you would like to see covered in an upcoming issue of the DigiCULT.Info Newsletter?

The answers to this question reveal that cultural heritage institutions are particularly interested in 'best practice', either in general or related to a specific area of interest (22 respondents). Typical answers here included: 'Best practice project experiences (also bad !!)'; 'Best practices – innovative projects are of most interest'; 'Best practice for easy and low-cost information sharing within existing technologies' or 'Best practices in cross-border projects (museums, archives, archaeology, library)'. Specific areas for which best practices were explicitly sought include: 'Digital library/hybrid library solutions'; 'Retro-digitisation and long-term availability'; 'Archiving electronic publications'; 'Electronic records management' or 'Integrating the management of e-services'.



The other answers form an extensive wish list, the entries of which stem from the broad range of institutions that receive the *DigiCULT.Info* newsletter and other products (see table above). The list contains issues that DigiCULT would very much like to cover more frequently, but for which there is a shortage of in-depth studies, such as: 'Market & business models for cultural applications and services'; 'Concrete implementation reports and ROI analysis'; 'Usability (user) studies' or 'Sector experience in digital media, particularly wireless and mobile delivery'.

The long list of more specific issues illustrates the multitude of technical issues cultural heritage institutions currently are struggling to solve in mission-critical areas. For example, for a National and University Library this includes: 'Digitisation of old and rare books – digitisation of old newspapers – harvesting Web content – protect integrity of electronic documents – access to electronic documents in our own archives – long-term preservation of optical media'.

Some other issues addressed were: 'Document management systems that encompass paper and electronic records'; 'Standards/technologies for moving image and sound'; 'Publication of complex archival material on the Web'; 'Developments in electronic publishing (e.g. licensing agreements)'; 'Ontology and method to combine diffe-

rent collections, which are using different thesauri or coding systems'; 'Interaction/interfacing between digital archiving and learning environment' or 'A shared arts laboratory providing real expert technical help and expertise in the cultural sector'.

However, our readers seem to be aware that *DigiCULT.Info* cannot cover all relevant issues on a regular basis. Accordingly some respondents stated, for example, 'I think it already covers a relevant group of issues'; 'All topics covered by DigiCULT are very interesting'; 'It is OK like it is' or 'Go on as you are doing. I will try to find time to read all that (most of the) interesting stuff.'

General comments on the DigiCULT project/publications?

Finally, what really overwhelmed us were the very favourable and encouraging general comments on the DigiCULT project/publications which we received from almost all respondents.

We had a small number of comments which indicated areas of improvement, but even these were supportive of the project, for example: 'Welcome, although not always easy for staff throughout the Library to understand and benefit from'; 'Professional and communication-aware, maybe not enough technical'; 'Very nicely presented – although very business orientated'.

However, overall, the DigiCULT project/publications were received very well. To give just a few examples: 'Useful!'; 'Very useful'; 'Extremely useful'; 'Efficient, helpful'; 'Very informative and well done'; 'Informative, accessible, well presented'; 'Very high quality and relevant'; 'Clear. To point. Well researched'; 'Good overviews, state-of-the-art, useful'; 'Highly professional, state of the art, artistic design'; 'Brilliant'; 'It's interesting to see best practice and more abstract information about technology next to each other'; 'Very impressed by the range and particularly by the strong base of case study'; 'Good reference sources and links'; 'Very useful – gives an excellent overview of the current situation'; 'The publications are of high quality, very informative and extremely well publicised. Please continue'; 'Keep up the good work'.

We thank all institutions and respondents for participating in the survey, and take the overall very positive feedback as a strong encouragement and commitment for DigiCULT's work in 2004.

CREATING SMART SPACE FOR LEARNING

BY PETER DOLOG (LEARNING LAB LOWER SAXONY, UNIVERSITY OF HANNOVER, GERMANY), BARBARA KIESLINGER (CENTRE FOR SOCIAL INNOVATION, AUSTRIA), ZOLTÁN MIKLÓS (DEPT OF INFORMATION SYSTEMS, VIENNA UNIVERSITY OF ECONOMICS, AUSTRIA), DANIEL OLMEDILLA (LEARNING LAB), BERND SIMON (DEPT OF INFORMATION SYSTEMS)

Although the Internet offers a variety of learning resources, it is often very difficult and cumbersome for the user to identify and select appropriate learning services such as courses, seminars, Web-based training applications or learning material including, for example, specific cultural objects. A restricted overview and lack of information about the quality and reputation of a specific learning service or material reduces the choice among the variety of heterogeneous learning services, and the search and selection process is a very time-consuming task for users.

Driven by these currently existing drawbacks, the Elena project (<http://www.elena-project.org/>) aims at increasing the effectiveness of the learning management process by developing open and intelligent tools for the realisation of 'Smart Spaces for Learning'.

In a Smart Space for Learning each user has his/her own electronic avatar called the 'Personal Learning Assistant' (PLA). This PLA is capable of querying an open network for learner-specific learning services, giving individual recommendations according to the user's profile and even contracting the learning service for the user.

HOW DOES IT WORK?

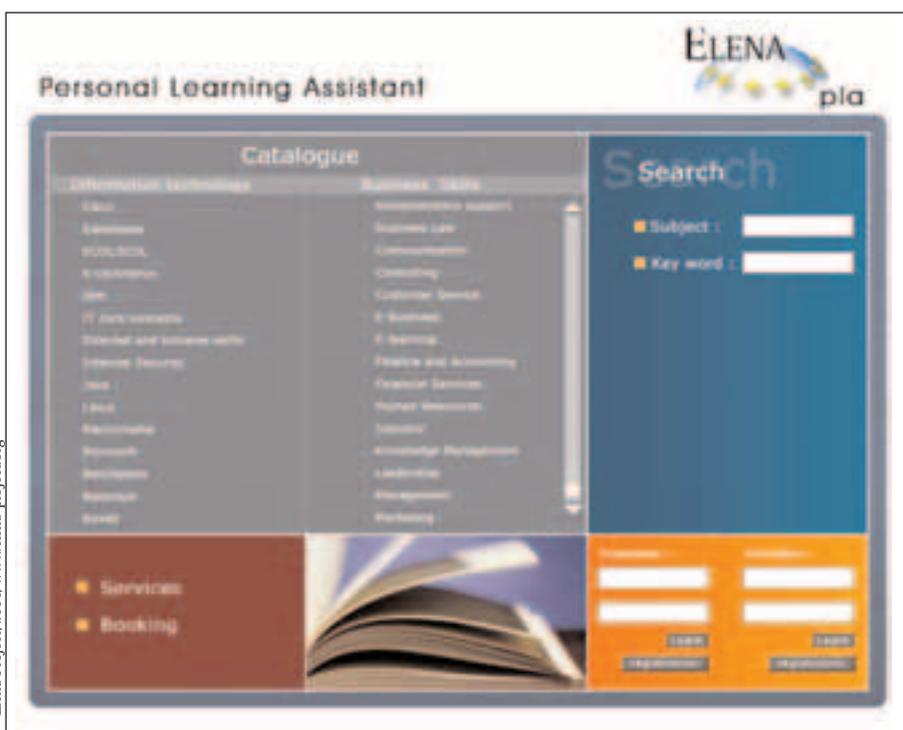
As a first concrete use case we have been focusing on Smart Space for Learning users from the work force in companies. A corporate learner registers at the Personal Learning Assistant (PLA); using the PLA she defines her preferences and background and registers for courses or any other alternative learning activity or learning material. The PLA supports the search for learning services in a variety of sources and frequently recom-



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mends learning services to the learner. It may also provide evaluation or reputation and rating data from the experiences of previous learners. When it comes to the selection of learning services, the PLA supports the confirmation of the selection decision with the user's line managers and human resource developers before booking or contracting the specific learning service. It may even check the knowledge transfer after a learning service has been consumed to help assess the effectiveness of a certain service. Finally the PLA keeps track of decisions, recommendations and successful/failed cases and feeds this information back into future recommendations.

A similar scenario can be envisaged for the individual learner, outside the corporate setting. Any user can enter the Smart Space for learning by registering at the PLA using a normal Web browser. Thus, a user might be interested in ancient history, but does not want to embark on a full university degree. He prefers to enter the Smart Space for Learning using the PLA to find courses that cover specifically what he wants to learn and that meet his preferences.



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Elena Personal Learning Assistant

EFFECTIVE MANAGEMENT OF LEARNING

Returning to the first usage scenario in the context of a corporate environment, the main advantage of such an intelligent service is the improved effectiveness of the training management process. Even in economically difficult times, Europe's companies continue to make significant investments in training activities and skill development processes, since they have realised that human capital is one of the most valuable resources of any organisation. However, it is becoming increasingly important, especially for training managers, to show evidence of the effectiveness of training activities. Interviews with human resource managers have revealed an existing need for flexible tools that support the optimisation of the planning, control and implementation of corporate training. ELENA provides guidelines for semi-structured interviews that help to convey crucial learning management know-how into all spheres of an organisation. Relevant data concerning the evaluation of the learning service, the consumption of the individual learner, the budget, and so on is tracked and can be further processed to optimise the whole process of training management.

OPEN AND INTEROPERABLE

The second main advantage of Smart Spaces is their open interfaces and interoperability with heterogeneous systems. Knowledge resources are important – but scarce – goods in today's information society. Due to the lack of interoperability these resources are increasingly stored in closed systems, such as external and internal course databases, best practice repositories, online bookstores or learning management systems. ELENA opens up these knowledge sources by providing a standardised query application program interface (API).⁴ This standardised API connects heterogeneous knowledge pools. Taking advantage of the Edutella peer-to-peer infrastructure

(<http://edutella.jxta.org/>), educational nodes such as those mentioned above can connect instantaneously to the network and provide their resources. Furthermore, instead of traditional centralised approaches, a schema-based peer-to-peer network like Edutella along with the searching power of the Semantic Web provides a completely distributed solution where content owners do not lose control over their resources.⁵ Such an interoperable network becomes a tremendous knowledge resource, empowering users to reduce search cost and time considerably by browsing through the resources of multiple sites simply by submitting one search request.

INTELLIGENT

Finally, Smart Spaces for Learning have inherent intelligence to personalise the service offers for the individual user. Opening various repositories of knowledge resources and connecting them into a space provides learners with more possibilities to satisfy their demand for gaining or increasing their knowledge concerning a particular area of interest or supports them in solving certain tasks. However, broadening the spectrum of available learning offers also raises a problem of finding appropriate high-quality learning services that satisfy individual demands. To overcome this, intelligent personal learning assistants are capable of handling a learner's profile⁶ and using it to recommend appropriate learning services⁷ and learning path according to the user's needs and preferences. In a corporate setting, the intelligent offer can also be aligned with the overall corporate strategy and specific requirements defined by the human resource or training managers.

Artificial intelligence techniques are employed in this context to realise the matching of knowledge about learners, learning services, and knowledge sources and to provide personalised views over the ELENA Smart Space for Learning. This contributes to effectiveness in corporate settings by reducing the probability of getting lost in the space of knowledge sources and



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by immediate provision of an appropriate learning service needed in a particular context.

Such a personalised view on the concept of space creates a notion of Smart Space for Learning. A space that has been created by connecting various knowledge resources adapts itself to the individual learner through a personalised view. This personalised view then adjusts itself with each change in the learner profile, context and individual user demand.

To find out more about Smart Spaces for Learning, visit the ELENA project at <http://www.elena-project.org/>

⁴See 'Simple Query Interface (SQI) for Learning Repositories' available online at <http://nm.wu-wien.ac.at/e-learning/interoperability/query.pdf>

⁵Cf. Bernd Simon, Zoltan Miklos, Wolfgang Nejdil, Michael Sintek, Joaquin Salvachua, 'Smart Space for Learning: A Mediation Infrastructure for Learning Services' in *Proceedings of the Twelfth International Conference on World Wide Web*, Budapest, Hungary, 20-24 May 2003 (http://www.im-c.de/elena/cms/downloads/p616_simon.pdf)

⁶Cf. Peter Dolog and Wolfgang Nejdil, 'Challenges and Benefits of the Semantic Web for User Modelling' in *Proceedings of AH2003 workshop at Twelfth International Conference on World Wide Web*, Budapest, Hungary, 20-24 May 2003.

⁷Cf. Peter Dolog and Wolfgang Nejdil, 'Personalisation in Elena: How to cope with personalisation in distributed eLearning Networks' in *Proceedings of Conference on Worldwide Coherent Workforce, Satisfied Users – New Services For Scientific Information*, Oldenburg, Germany, September 2003.

USING RFID SMART TAGS FOR AMBIENT LEARNING & TRAINING

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INTRODUCTION

Although technological innovation has developed at an unprecedented pace in recent decades, it has seldom managed to change dramatically the way we teach and learn. In the 1980s, Technology Based Learning (TBL) began to benefit from the advent of standard and affordable multimedia technologies empowering highly effective educational applications (edutainment and infotainment) where people could learn while being entertained. In the 1990s, the rapid uptake of the Web within educational and academic settings also created a disruptive and fundamental leap forward in the levels of pervasiveness and dissemination that designers and teachers could achieve while conceiving technology-supported educational set-ups. Educational technologies are currently beginning a new quantum leap based upon the recent Copernican revolution which has hit the ICT marketplace, namely broadband, wireless, and ambient technologies. New opportunities have now been made possible that dramatically increase interactivity, collaboration and personalisation, and can be used to create a technology-enabled educational experience.

This article presents the ASTRAL[®] Pilot (Ambient Smart Tags Repositories for Art Learning) designed and implemented by GIUNTI Interactive Labs within the framework of the **WebKit - IST-2001-34171** project (<http://www.projectwebkit.com/>). The ASTRAL Pilot aims to achieve major results in the development of intuitive physical interfaces to the Web by means of tangible user interfaces (TUIs) and smart tags,⁹ and groups leading educational, aca-

demic, and software development partners Europe-wide.¹⁰

The ASTRAL[®] Pilot

As a learning content management technology developer and vendor, and the digital arm of a large educational and cultural heritage publishing group, GIUNTI Interactive Labs joined the WebKit project to take up and exploit

Evidence) was migrated from the original TUIs (used by academic partners) to a TUI- and Radio Frequency Identification (RFID)-based location learning application. This application exploits the Learn eXact Learning Content Management System platform (<http://www.learnexact.com/>) and its powerful Mobile eXact layer (developed by GIUNTI within the MOBIlearn project: <http://www.mobilearn.org/>)¹¹ to help

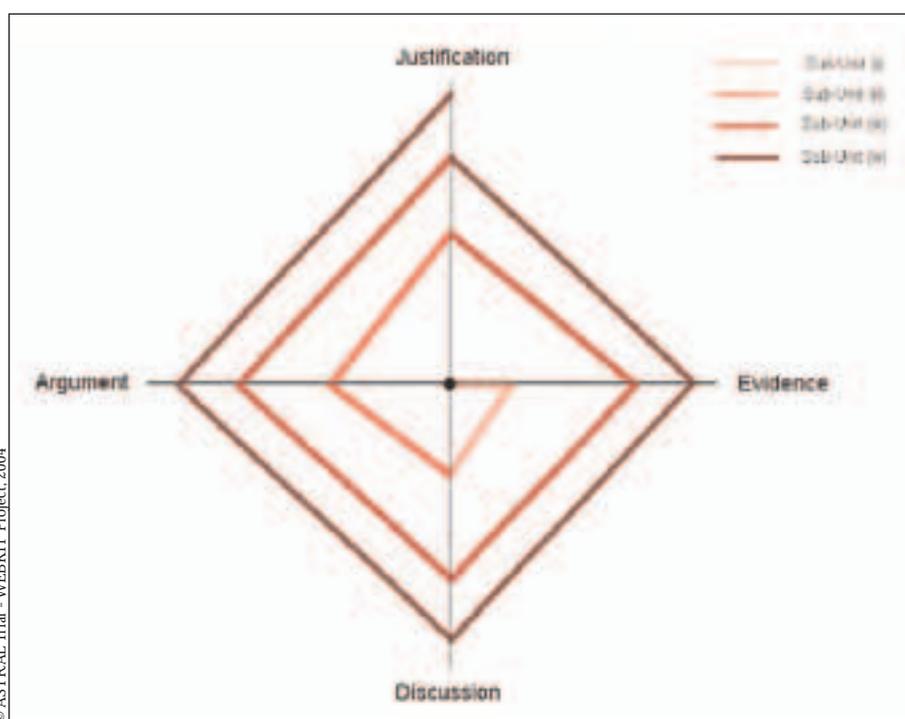


Fig. 1 - The JADE Educational Model for Experience Based Learning

the innovative approach to teaching initially conceived by Warwick and Cambridge Universities. This work was focused on the development of a formal method based on a simple process in which pupils face problems and co-operatively formulate and justify answers. Within the scope of the ASTRAL[®] Pilot, JADE methodology (**Justification**, based on **Argument**, arising out of **Discussion**, based on

⁸<http://www.giuntilabs.com>, <http://www.imsglobal.org>

⁹DigiCULT Technology Watch Report 1 (<http://www.digicult.info/pages/techwatch.php>) includes more information on these topics in Chapter 3: Smart Labels and Smart Tags and Chapter 5: Human Interfaces.

¹⁰The partners include: the University of Strathclyde (<http://www.strath.ac.uk/>); the University of Cambridge (<http://www.cam.ac.uk/>); the University of Warwick (<http://www.warwick.ac.uk/>); Central Research Laboratories (<http://www.crl.co.uk/>); Geneva University (<http://www.unige.ch/>); iTel (<http://www.itel.gr/>); EAE (<http://www.projectwebkit.com/projectpartners/eae.php>) and Neurosoft (<http://www.neurosoft.pl/>).

¹¹For more on the MOBIlearn project, see 'The Service-based Architecture of the MOBIlearn project' also in this issue.



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Fig. 2 - The Wi-Fi Master[®] process based on the Learn eXact[®] Mobile module

increase the learning potential of museums.

The JADE process is structured as: seeking evidence; discussing achieved results; formulation of arguments; and the formalisation of justifications for the stated arguments based on available evidence. JADE is iterative even if phases are performed sequentially and enables cycles of knowledge acquisition, assessment and evaluation, the refinement of a pupil's ability to manage learning. This process can be performed without the support of computers and is general enough to fit very different application fields; however, in WebKit the process relies upon multi-sensorial stimuli through computer-mediated exhibits.

GIUNTI's goal was to prove that JADE could be used commercially to deploy a 'smart tag'-enabled scenario of its Wi-Fi Master[®] (Wi-Fi Museum Access Services for Training & Education through digital Repositories) process (Fig. 2), integrating the Learn eXact[®] content management suite with location-based repositories of learning objects and user profiles. This would enable 'ambient learning' set-ups, for example, the museum scenario presented below.

Therefore, in the ASTRAL[®] pilot, JADE

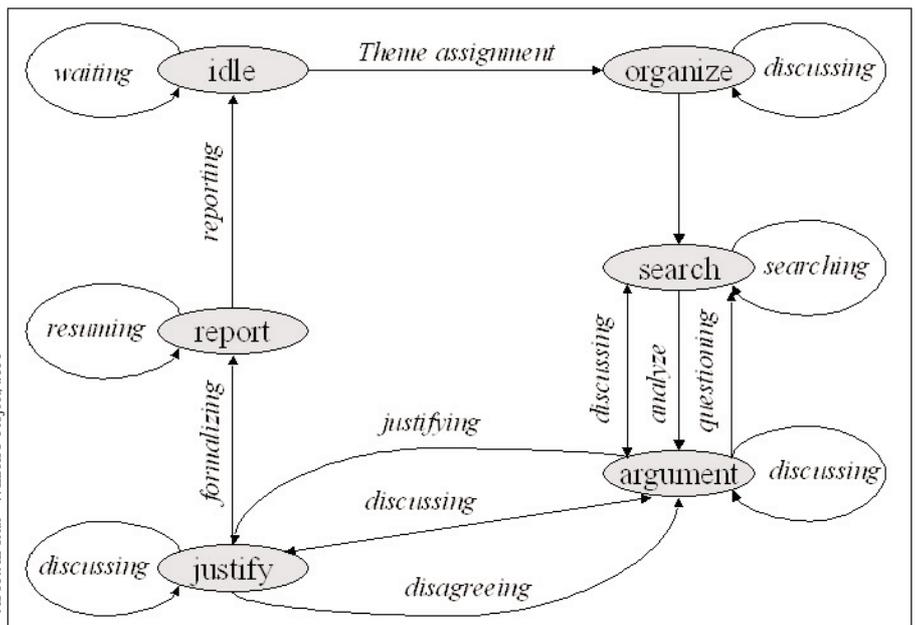
underpins co-operative research work at a specific museum or institution (hereafter referred to as *@playground*) with co-operative reporting work at school (from now on referred to as *@school*) structured in steps, with associated assessment, tracking and evaluation activities. It is possible to assess pupils' beliefs, initial and acquired knowledge (with a set of multiple choice questions), as well as pupils' capability of understanding content (by examining how

many documents not relevant to the topic have been consulted during the process), co-operation activities, and verbal activities (on the basis of performed activities). The integration of JADE into ASTRAL[®] used the mapping shown in Fig. 3.

EXPERIMENTATION DESCRIPTION - MUSEUM SCENARIO

Within the Wi-Fi Master[®] set-up for WebKit (i.e. the ASTRAL[®] Pilot), co-operative research work outside the school (*@playground*) and co-operative reporting work *@school* were defined. Environments involved will have relevant objects tagged with RFIDs, and paper/computer-based sources will be accessible. Users may be equipped with palmtop devices and there should be a server devoted to:

- delivering content in relation to interaction with an object (context-aware delivery);
- managing searches through available content;
- collecting and tracking users' interaction during the visit;
- making available experiment resources such as browsed content or generated statements.



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Fig. 3 - ASTRAL[®] implementation of the JADE Process (state diagram)

Operations carried out by pupils will be tracked. Data collected will be evaluated according to **'behaviour'** (by teachers) and **'knowledge assessment'** (multiple-choice questionnaires). It is assumed that several classes and teachers will be involved along with the psychological support from schools.

Steps within this learning scenario could be detailed as follows:

1. **Define research work, groups and co-operation rules.** The class tutor will devise possible experiments to carry out, main topics, and reference material, relevant to the students' overall state and special needs (if applicable). S/he will organise groups or encourage pupils to set up their own groups depending on their ages. The tutor will also assign a set of framework rules for the co-operative work.
2. **Liaise with 'playground' staff on content, logistics, activity schedule and overall planning.** The tutor agrees details of the experiment with playground staff, gives any special instructions to pupils and sets up a working environment based on what is available at the playground plus what is available to pupils in terms of sources of information (e.g. books, articles, documentaries and the Web).
3. **Assign pupils the research work and rules.** The tutor assigns the rules, defines

possible group sizes, and provides guidelines on available time and resources and how research should be reported. S/he informs pupils about monitoring procedures, safety instructions (if needed) and other relevant guidelines. A set of questionnaires, specifically designed for the experimentation, will be assigned and completed during the major phases of the experiment. Its main scope is to gather feedback on infrastructure quality, usability, acceptance and structure. It is expected that pupils will achieve an overall (majority) consensus on their results for the final report and that minority reports will be incorporated as notes, remarks or comments. This is part of the learning process related to co-operative work. After completing the previous steps the tutor can assign the actual research.

4. **Discuss the theme and organise work.** This phase is expected to be open and informal. Much of it will take place without the tutor's supervision, although some planning may be done during class work just prior to the experimentation. The tutor can monitor pupils' decision processes, methods and achieved results (especially as the pupils must respect the given set of rules).
5. **Collect evidence before entering the playground.** Pupils will exploit available sources (e.g. text books, library sources,

newspapers, magazines, documentaries and other audiovisual materials). It is expected that the collection process will also involve access to other sources like the Internet, friends and parents, while the pupil is at home, resulting in a set of raw reference sources. It will be necessary to agree on a policy (that will have to be followed in the whole experiment) so that collected data will be available to the entire group. Content provided could comprise quizzes, descriptions, images and other information on the *@playground* objects. Quizzes will be focused to assess current knowledge on the subject and raise questions and curiosity.

6. **Access the playground and collect further evidence.** We assume that experiments take place in a specific environment (e.g. a science museum is the overall location – specifically two neighbouring rooms where objects related to measures: time, space, volumes, weights, are exhibited) even if this is not at present connected to a real playground. A set of objects within the exhibition are available in this environment. Workstations will be present as a support facility and pupils/visitors will be equipped with Personal Digital Assistants (PDAs). A logical path to maximise experiment gain is sketched (see Fig. 4 – Xs represent expected interaction points); however,

Museum Research Example

- Title:** Measures (measurements of space and time throughout history)
- Objective:** Pupils should compare acquired knowledge in the science field with acquired knowledge in history and find out the present state of the measuring environment with particular focus on space and time.
- Rationale:** The research work will be organised in conjunction with science and history professors. Pupils will be granted basic knowledge on measures (names, values, correspondences). They will be acquiring information on relevant measurement systems adopted in certain time periods and their basic structures and characteristics. They will collect information on relationships between systems and civilisations. Students must discover how systems were managed, what kinds of object were used and so on in the experimental phase (when they can actually access models and physical objects used for measuring). It is expected that in the science course they will see the various systems still in use and their interrelation but not the historic background. In the history course they will learn about old measurements and their equivalence to modern systems. Students must identify relationships between past and present systems, equivalences between values, and links between names and objects used for the purpose.
- Constraints:** Pupils should have completed several units dealing with science and history. Visits to the playground cannot be organised before completion of the aforementioned units. Pupils must report (in written form) after the experiment. It is expected to have cross co-operation between science and history teachers.

pupils are free to follow a different path. Behaviour will be evaluated with the 'expected path' representing a reference model. Each workstation is equipped with an RFID reader to be used in combination with tagged objects and the pupils' PDAs to perform special operations. We assume that the pupil holding the PDA will be the rapporteur and must store data (e.g. statements or comments) and retrieve data. For this purpose, s/he will be provided with representation of a data disk (which is directly connected to the storage trigger using RFID). Furthermore the rapporteur could have a virtual key that will enable him/her to access the virtual working environment, a representation of a set of paper sheets to request printouts, a magnifying glass to be used to retrieve more information, and a question mark to ask the system for help. (This is an example of one potential interface.)

7. Discuss the collected evidence.

Discussion will take place largely under the tutor's supervision allowing monitoring of learning. Pupils discuss collected information and share their evidence with the group. Discussion should result in a set of commonly agreed sources and pieces of evidences that will constitute the basis for further learning. It is expected that pupils achieve a certain degree of consensus while taking note of dissonant point of views.

8. Argue results. Pupils must co-operate in order to define the set of statements they want to use as the basic structure of their final report. During this phase pupils structure their thoughts and find ways to clearly expose them.

9. Justify work and results. Pupils must find a consensus on how to use their evidence to support their statements. They must note disaccordings points of view and present the underlying reasoning behind their conclusions.

10. Expose results. Pupils prepare their written report based on previous stages of work and convey to the appointed

rapporteur all of the evidence, statements and related sources used. The finalised work will be presented to the tutor along with all the evaluation questionnaires that the pupils have completed in the various steps of the process.

These activities can be divided into several teaching goals:

- **'Organise'** activities (steps 1 – 4 of the above scenario) increase users' ability to find and understand information as well as to collaborate effectively. This phase allows tutors to assess and evaluate users' initial knowledge and beliefs, information retrieval abilities, rule retention, group organisation and overall achieved results while tracking performed activities (e.g. chat, mail, forum), time spent per activity and accessed content.
- **'Search and Select'** activities (steps 5 – 6) facilitate better management of finding and selecting information and a development of ICT skills. This phase allows assessment of users' initial knowledge and beliefs, the information selected and overall results, while tracking search and viewed content, time spent per activity and number of iterations.
- **'Analyse'** activities (steps 7 – 8) help students raise, understand and demonstrate opinions and enable tutors to assess and evaluate selected, discarded and retained information, developed arguments and overall achieved results. This phase allows tracking of performed activities, viewed and stored content,

time spent on the activity and number of performed iterations.

- The **'Resume'** phase covers step 9 and will enable written skills acquisition/reinforcement. It will be possible to assess and evaluate stored information, developed arguments and summary, plus the overall phase result. Tracking will focus on performed activity, stored content, time spent per activity and iterations.
- Finally, the **Expose** phase (step 10) will enable verbal skills acquisition/reinforcement while granting assessment and evaluation of exposition quality and style.

CONCLUSION

Current project achievements are extremely encouraging and well in line with technology and market evolution. The ASTRAL[®] case proves that it is possible to further enrich the offer of real content narrowcast initially in the cultural heritage environment, but potentially to many and varied environments of interest. The adoption of both location-based and context-aware solutions opens up new opportunities to exploit content, granting personalised and timely delivery. Furthermore, using ASTRAL[®] it will be possible to encourage a museum environment to be a lively and entertaining place where users can discover the pleasure of learning while amusing themselves and interacting with people and the environment itself. In this sense, using ASTRAL[®] helps us begin the move towards ambient intelligence.

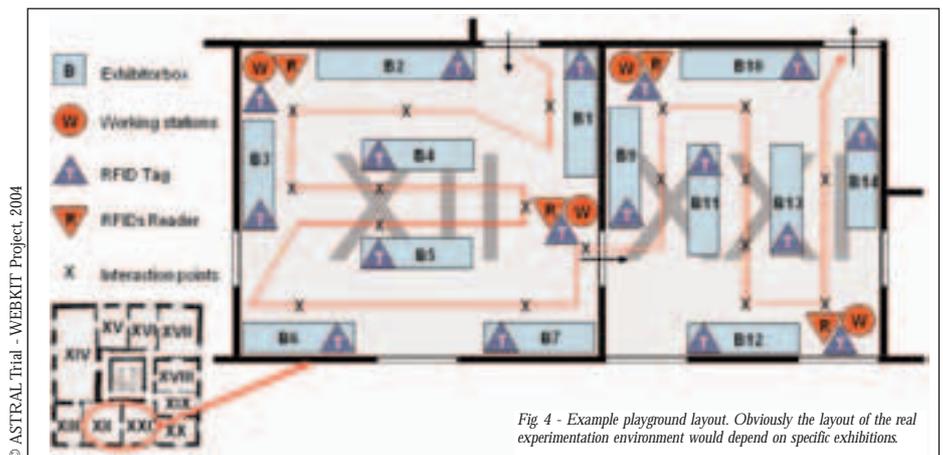


Fig 4 - Example playground layout. Obviously the layout of the real experimentation environment would depend on specific exhibitions.

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THE SERVICE-BASED ARCHITECTURE OF THE MOBILEARN PROJECT

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MOBILEARN is a project within the Fifth Framework Programme of the European Union. Its objective is to investigate the use of mobile technologies in different learning contexts. In order to achieve this, a service-based software architecture is being developed. In the following article we describe the architectural approach taken within the MOBILEARN project and some of the experiences gained.

INTRODUCTION

Mobile devices like Smartphones, PDAs, wireless connected Tablet PCs, and notebooks provide, in principle, ubiquitous access to distributed knowledge resources. This opens up new possibilities for learning, not only in an institutional context but for the everyday learning activities motivated by interest, curiosity or professional needs. In an early stage of the MOBILEARN project it was decided to develop a service-based framework to investigate these possibilities. The project is currently in the final stage of designing its system of services.

The MOBILEARN Project

The MOBILEARN project (<http://www.mobilearn.org>), begun on 1 July 2002, brings together 24 partners from six European countries and

Israel in a joint effort to investigate the use of mobile technologies for different learning settings. In addition to these European partners, MOBILEARN collaborates with partners from the United States and Australia. The project is co-ordinated by Giunti Ricerca (http://www.mobilearn.org/partners/consortium/partner_list/giunti.htm). It is important to note that the MOBILEARN partners come from quite different communities – pedagogy is represented as well as technology, academia and industry. MOBILEARN intentionally concentrates not on the usual institutional learning scenarios. The basic strands to be investigated in the project are:

- museum visitors with specific interests being supported in their learning;
- non-healthcare professionals needing to learn about health problems for personal reasons;
- experienced managers or first semester students attending MBA university courses needing assistance to adapt quickly to the opportunities offered by the university.

MOBILEARN undertook the development of a technology that supports selected learning scenarios in these fields in a prototypical way. It is planned to test these prototype tools with small groups of learners in order to gain a better under-

standing of the possibilities they offer and of the challenges posed by further development.

In the first year of the project, the emphasis was on the investigation of user needs. A considerable number of usage scenarios in the aforementioned fields was collected from the consortium members and associated partners, and revised after discussion. Development began on a single MOBILEARN system that would support all four core scenarios decided by the team (and also any other scenarios created from combined activities of the core scenarios). In parallel, project partners continued to develop software and to augment it with features that were likely to be needed in the project. The most important software tools, which were also used for early prototype testing, were:

- a learning management system;
- a collaboration system;
- a context awareness system;
- a mobile video delivery system.

A special workpackage on system integration investigated state-of-the-art technologies in order to come up with a suggestion for an architecture.

Designing the MOBIlearn Architecture



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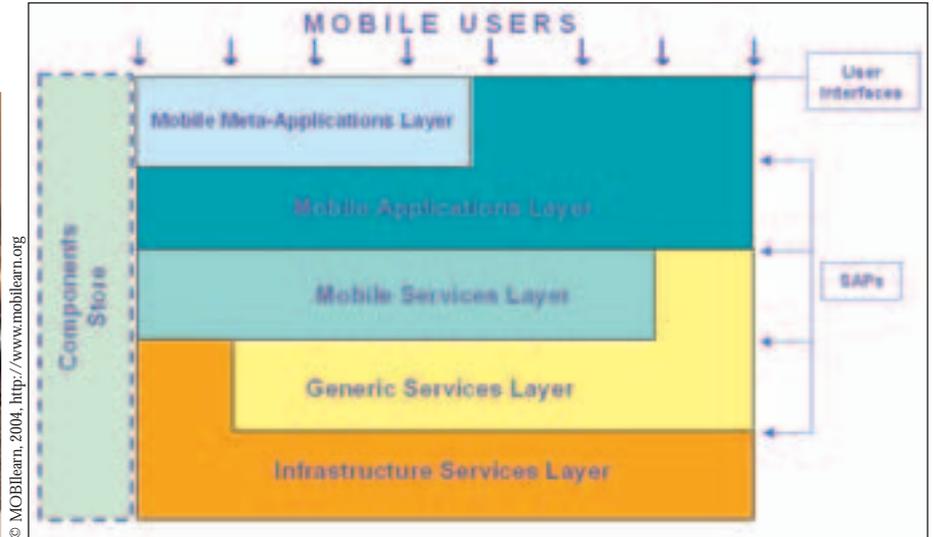


Figure 1. The OMAF Layers

MOBIlearn's Open Mobile Application Framework (OMAF) was proposed after six months of work.¹² Further work then concentrated on defining the required mobile and generic services. Looking back, it seems remarkable that this service-based design was confirmed at the project meeting without an in-depth discussion. This was probably due to the fact that the consequences and the significance of the proposed usage of a service-based framework were not realised by many of the partners. This may be explained in part by the mixed technical competencies available in the project and by the predominant effort (at that time) of analysing the demands from a user point of view. It took until project month 12 to realise widely within the project that this approach, while being very much in line with current trends in software development, posed a number of additional challenges.

¹²The experienced reader may note that there is a considerable similarity with the framework proposed by the Open Knowledge Initiative (OKI) led by the MOBIlearn partner MIT. This is intended in order to foster future co-operation between both projects.

Service-based architecture	
Challenges and Obstacles	Benefits
There is currently little technological experience in designing a service-based system	Applications for different scenarios can be easily assembled from the various services
Software development tools are just beginning to support the development of individual services and there is almost no tool support for the development of a complete system of services	Additional services, including those from other parties, may be integrated relatively easily
The usefulness of a system of services is hard to evaluate by the representatives of the potential end-users	Existing systems can be reused by wrapping them into service envelopes. This allows each service developer to use the most efficient tools and programming languages for his/her purpose. Re-implementation in a common programming language is avoided
In addition to the co-ordinated development of a system of independent services, this poses new challenges to the project management, especially in taking care of the emerging dependencies between different services and workpackages	The project management can concentrate on the co-ordination of the design and implementation of the mutual service calls, and leave issues of data structures and algorithms to the implementing teams
Having independent services which communicate through the exchange of messages poses problems of distributed data storage and synchronisation The large communication traffic between the services may pose efficiency problems to the overall system	MOBIlearn services may be reused outside the MOBIlearn project through their open communication interfaces The high-level design of the system of services allows an early analysis of the emerging system and its comparison with the requirements from the users' point of view

The advantages detailed above led the consortium to confirm the service-based approach. At this time it was also discussed whether the project would build a set of *Web* services. Participants were concerned about a lack of sufficient experience with the development of this kind of service and it was agreed that the service-based OMAF approach would implement features of *Web* services only as far as they are needed for the project. For example, there is no need for MOBIlearn to support complex service discovery or billing procedures, and MOBIlearn services could be easily augmented (outside the project) to convert them into full-featured *Web* services. The remaining core parts of the development of services – e.g. establishing communication channels, exchanging messages – are sufficiently well understood within the consortium to proceed on a solid base.

Once relieved of the need to struggle with coordinating interior details of the individual services, the project management could concentrate on the design of the *system* of services.

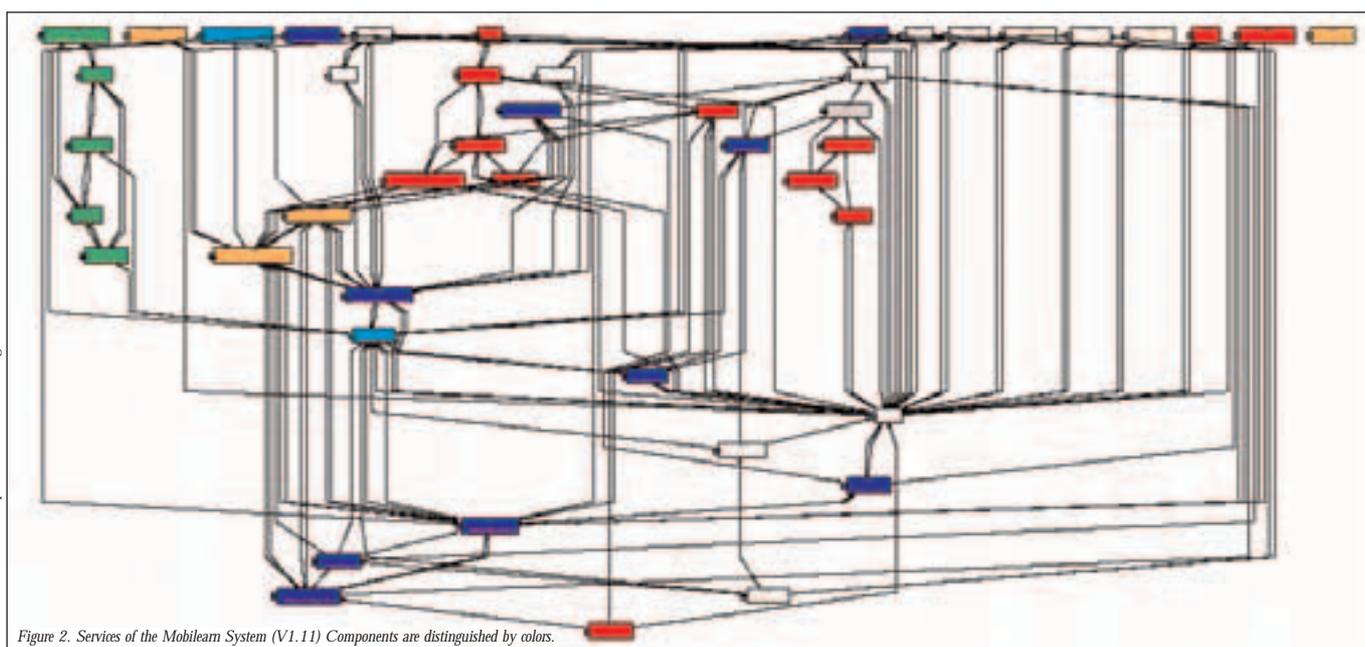
Designing the MOBIlearn System of Services

The starting point of the design of the system of services was the collection of core scenarios, isolated from the user requirements collected in the first project phase. Initially, it was planned to describe these scenarios as UML use cases. However, this turned out to be too time consuming, requiring too much additional discussion (especially on the degrees of precision and granularity required) between those investigating the user needs and those having to design the services. Therefore, it was decided to proceed on two parallel tracks.

The first track continued to collect requirements from the end-user side and add them to a database, maintained by The Open University UK (<http://www.open.ac.uk/>). A *Web* interface allowed partners to add requirements at any time. Every so often a revision of the database evaluates the requirements uploaded and forwards them to the partners concerned with implementing the respective MOBIlearn services. This activity is important to test the achievements of the project against the

actual user needs. The second track concentrated on the design of the system of services. This was developed directly from the selected core scenarios and it quickly became apparent that designing software for educational purposes requires a special competence to translate between the world of education and the world of software implementation. UML diagrams have been helpful as they depict important features of the design under development in an understandable, graphical way. Different interpretations of requirements and possibilities were resolved by interviewing respective experts in the consortium.

Therefore, helped by the use cases, the implementation group broke down the scenarios into activities. A set of services was designed so that all specified activities could be supported. This set of services was then structured into a number of components so that the responsibility for the development of the services of a single component could be assigned to one workpackage of the project. Each service was augmented with a verbal description of its role and the team defined which other services it would call. This led to the network of dependencies depicted in Fig. 2.



It was verified that the system is free of loops and the overall response time was satisfactory. Although up to this point the design had been demand driven, the team now began to prepare the formal specification for the implementation. The central documentation (maintained in MS Word for ease of use) was restructured to reflect the system of services from the point of view of the services providing the expected operations.

The MOBIlearn Software Documentation

In order to fully utilise the development of individual services concurrently at independent sites, the consortium agreed on a standard form of design documentation. The MOBIlearn Software Documentation has three main parts:

- *The Software Requirements Specification* gives high-level documentation that facilitates the communication between users, developers of scenarios and software developers.
- *The Component Design* breaks down the Software Requirement Specification into a set of components that can be implemented separately. This facilitates the communication between software developers located at different sites.
- *The System Status* section provides a survey of all involved services and operations and their interrelations. A table of problems is available to coordinate testing of the system.

Main usages of this documentation are:

- to agree on the functionalities to be provided;
- to facilitate communication between services that are developed concurrently at different sites;
- to determine correct behaviour of the operations to be implemented;
- to set the quality standards to be achieved;

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- to provide a framework for software testing;
- to monitor the status of implementation.

In order to achieve these goals, the documentation must be unambiguous, complete, and easily accessible by all. It was maintained in a single Word file, standardised using templates for specifying services and operations, and reporting bugs and requests. A special MOBIlearn menu added to the Microsoft Word menu bar offered easy access to these macros. To ease communication among the project partners and allow automated analysis, each component, service and operation was assigned a unique identifier. For example, the identifier AB_CDE+02 denotes the second operation called by the service CDE from component AB. These identifiers allowed for easy regrouping of information according to different needs (which was especially useful during the design process when the view of the documentation was changed from the ser-

vice consumer's perspective to the service provider's perspective) and ensured that duplication of information was avoided while being easily accessible.

It took some effort to keep the software documentation in a state that made it suitable for automated maintenance and automated analysis tools, but the standardisation and minimum of ambiguity proved to be very worthwhile.

Summary

The design of a service-based system offers significant benefits for the development of complex applications in a distributed way. However, it also poses considerable challenges to the co-ordination of the project. The MOBIlearn project has found ways to manage the design of such a service-based architecture successfully, using UML and a specially designed documentation method, and taking care in planning the future needs of the project.



Sections and elevations of the facade of the San Agustín church in Barcelona drawn by Pedro Bertrán. Year 1748. Plans on canvas Archive of the Crown of Aragón: Maps and plans, 57.

THE AER PROJECT (SPANISH ARCHIVES ON THE NET)

ELISA CAROLINA DE SANTOS CANALEJO & BLANCA DESANTES FERNÁNDEZ,
SPANISH STATE ARCHIVES BUREAU

- members of the public so that they can better defend their rights;
- 4 to disseminate its high-quality cultural content over the Internet in the Spanish language;
- 5 to better preserve and disseminate the content of the Archives through digitisation.

THE CONTENT OF AER

The AER platform makes standardised pre-existing State Archive databases available over the Internet and links archival descriptions to a digital image of the document. AER provides instant, free access to over 14 million images of documents and descriptions from anywhere in the world, 24 hours a day. To achieve this, the project developed a methodology and digitisation plan structured around specific criteria:

1 Described and organised documentation:

To digitise material that had already been described and was in an organised form, and to establish links between the text databases and the images.

The AER Project (Proyecto de Archivos Españoles en Red, Spanish Archives on the Net, http://aer.mcu.es/sgae/index_aer.jsp) is a worldwide pioneering project whose fundamental purpose is to make the content of Spanish Archives available over the Internet, incorporating both descriptions and digitised images of documents kept in the main Spanish Archives.

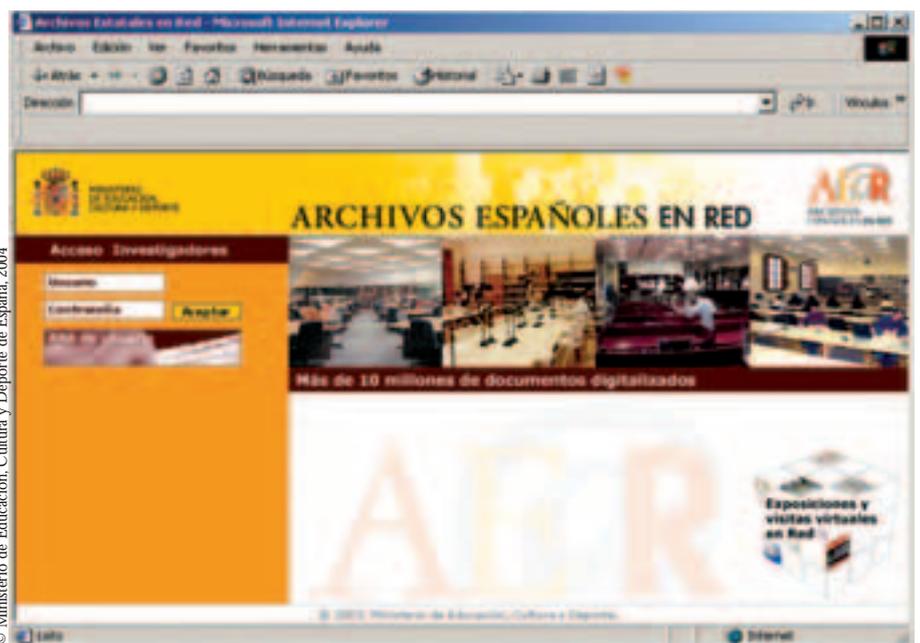
OBJECTIVES

The AER project was developed by the Spanish State Archives Bureau of the Ministry of Education, Culture and Sport in response to the need to tackle the challenges to archives presented by new information technologies.

The objectives of the AER project are very clear:

- 1 to provide instant free access to the Spanish Archives for the international research community and members of the general public;
- 2 to facilitate and promote research work;
- 3 to bring the Archives closer to

AER is giving enormous visibility to the documentary heritage housed in Spanish Archives over the Internet. Of the various 'memory' institutions, archives are perhaps the least well represented on the Internet and the least likely to make use of the new possibilities offered by Internet technology. Archives must accept new challenges, play a more active role in the dissemination of information, and respond to ever more demanding and qualified user demands.



Main AER (Spanish Archives on Internet) Screen.



2 Preservation of content:

To preserve documents for future generations by creating high-quality digital copies.

3 Demand from researchers and the general public:

To digitise the most frequently consulted resources and records to protect them from possible damage and excessive handling.

4 Records that form part of common history:

To promote the digitisation of documental resources of interest to other countries. For this reason the digitisation of documentation from the General Archive of the Indies (which houses documentation from the Americas and the Pacific where historical, cultural and linguistic ties are particularly strong) has been given priority. Digitisation of the rest of the State Archives has begun, with emphasis placed on common European history (General Archive of Simancas) and the cultural and commercial environment of the Mediterranean (Archive of the Crown of Aragon).

5 Records media and format:

To digitise iconographic documents (e.g. parchment, glass plate, posters, and maps) that are difficult to handle or particularly delicate and fragile

6 Other means of reproduction:

To take advantage of earlier alternative

work and media (e.g. microfilm or slides) that allow rapid, cheap digitisation of sufficiently good quality for the Web (hybrid projects).

The impact of digital technology on the dissemination of the cultural content of archives, libraries and museums has been revolutionary and is still difficult to evaluate. However, the advantages of digitisation for access are clear and we can say that the digital age and virtual culture are closely linked. Online Treatment of Digital Images: To make the retrieval of images as user-friendly as possible, they are displayed by means of a plug-in added to the browser (Internet Explorer) which is automatically installed on the user's PC the first time an image is accessed from AER. It allows the user to perform a number of manipulations on a particular image without affecting the original file. One new feature of this image treatment is that it is integrated into the user's browser and does not require external processing or image-editing programs, or involve the complicated manipulation of copies on the hard disc. The plugin supports a wide range of the most popular image formats including JPEG, GIF, TIFF, BMP, and PSD for black and white (bitonal), grey-scale, and colour documents, and provides anti-aliasing for smooth presentation of the picture at any size the user choo-

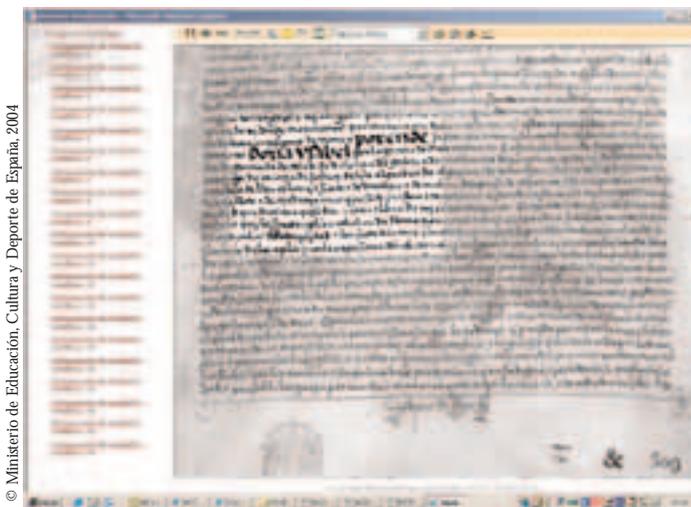
ses. It also supports multipage formats.

Several cursors are provided for selecting an area, zooming in or dragging the image across the screen. The user can apply a variety of filters to the selected area to improve the readability of a particular document. These filters can be applied in three different intensities to modify brightness and contrast, enhance inks, smooth stains and background and so on. They can be applied in additive mode or reset at the user's convenience. Images can also be rotated or presented in reverse polarity if necessary (very useful for negatives, for example).

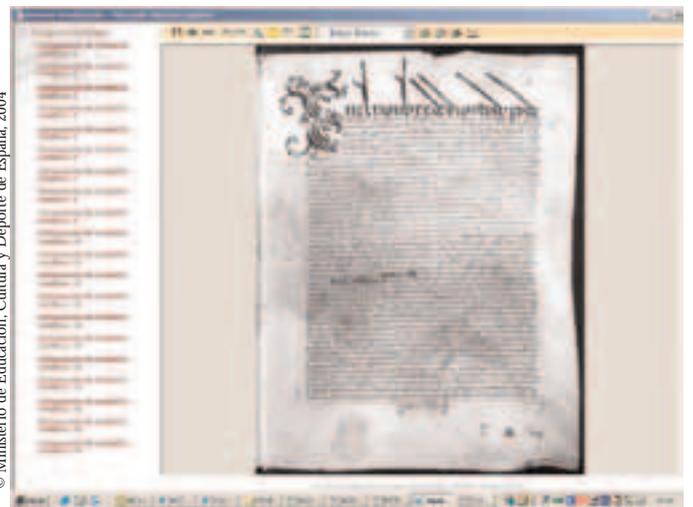
This tool for the consultation of digital images on screen is both useful and user-friendly for researchers and members of the general public alike. To prevent financial gain by third parties and to protect the copyright of some documents, the program does not allow the image to be downloaded or printed.

VIRTUAL ACCESS

Access to documents on the Internet facilitates and develops scientific, cultural and technical research and makes it possible to serve researchers from all continents continuously. This virtual access leads to some major changes in the sphere of research:



On line treatment of digital image



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- In Archive-user identification and accreditation, the 'physical' National Researcher Card has evolved into the 'virtual' National Researcher Card where the user fills in a form with his personal data and areas for research.
- The conventional researchers' room has been replaced by a virtual researchers' room which has allowed us to develop a new space on the Net where resources from many different Archives can be consulted. The AER project currently offers digital versions of documents housed in eleven different Spanish State Archives.

AER also incorporates a use and access statistics module (including a user profile, areas of research, most requested documents, and frequency of access) which allows us to be in constant dialogue with the research environment. The statistics module has made it possible for us to monitor the use of and access to the AER portal.

The results of the evaluation of access have been spectacular. Between 1 April and 31 December 2003, there were 203,410 visits to the AER portal; more than 17,500 users have registered and used the search screens 611,629 times. These figures would be unimaginable in terms of actual presence at the Archives. Visits are consistent around the clock, as when daytime is drawing to a close in Europe Internet consultations are just beginning in Latin America. Of the European countries, visits to the portal are most frequently made by users in Italy, Portugal and France. The high number of visits made by users in Latin American countries, in particular Argentina and Mexico, is significant. It is also worth mentioning that 632 users from the United States of America have registered.

Our evaluation has shown that this development of access to the Archives is a far-reaching development in the right to information, making collections accessible to thousands of new people.

Just as we try to remove any architectural barriers that prevent access to disabled users wishing to visit our Archive buildings, we must also serve disabled Internet users and remove any barriers to their virtual visits. We intend to adopt the recommendations and requirements of international standards for Web accessibility (among others, Web Content Accessibility Guidelines, <http://www.w3.org/TR/WAI-WEBCONTENT/>) in order to provide a high-quality site not only in terms of content but also with regard to access mechanisms.

STANDARDISATION OF THE DESCRIPTION AND ORGANISATION OF KNOWLEDGE

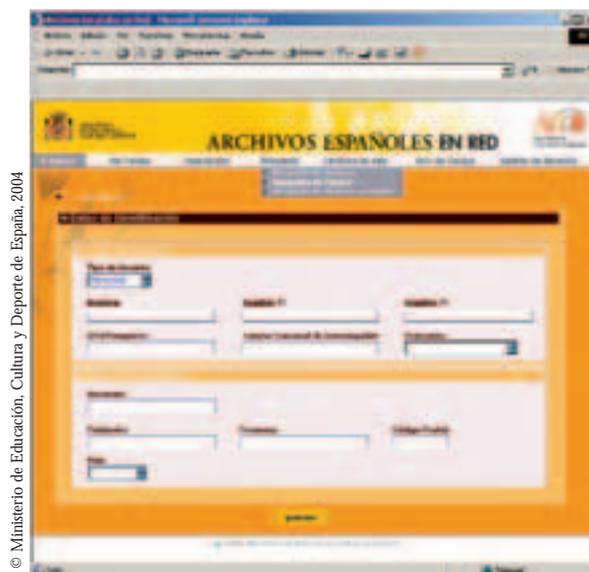
In order to develop the contents of AER, major preparatory work on the archival description of records has had to be carried out to bring them into line

with international standards. This was an onerous task of standardising and adapting old but valid descriptions to the new information structures of the International Archival Description Standards: ISAD (G) and ISAAR (CPF).

The role that the Spanish Archives can play in the dissemination of cultural heritage in a digital context is especially relevant as the Archives' organisation of knowledge is structured in a way that resembles the structure of the Web:

- 1 Archive information is structured in a hierarchical manner applying a multi-level rule describing the most general to the most particular (ISAD (G)).
- 2 Contextual information is fundamental to archival description and, furthermore, standards have been established (ISAAR (CPF)) to deal with the problem of context.

One of the fundamental challenges of the Web is the contextualisation of objects and integration of these contexts within information structures. The hypertextual nature of these Web sites can be an effective tool in this respect but theoretical reflection is also required. The AER portal has taken these concepts into account and allows the user to browse hierarchically by means of a tree that contains the whole logical structure of the Archive being consulted. In any search result, resources are not presented in isolation just as a collection of objects, but are contextualised according to the level of description and logical structure of the Archive.



AER Screen (Virtual Researcher Card)

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Archives must contribute in this way to make the Web more intellectual and to participate more actively in the space known as the noosphere (the part of the world of life that is created by man's thought and culture).¹³

A PROJECT THAT IS AWARE OF THE VIRTUAL LEARNING ENVIRONMENT

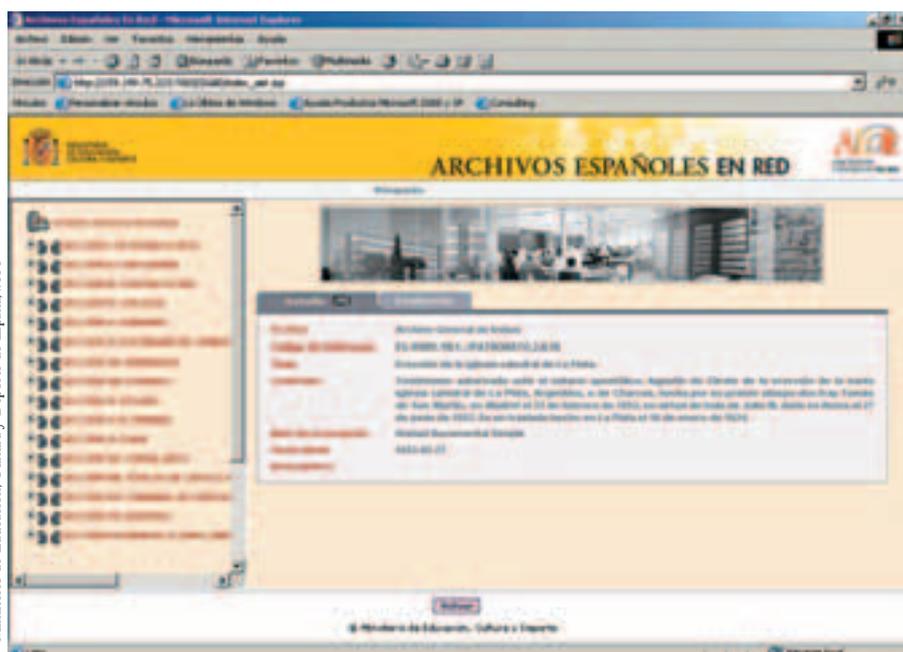
As already mentioned, one of the basic aims of the AER project is to facilitate and promote research. In many cases, visitors to the portal are traditional users of the Archives such as students, teachers, or researchers who are taking advantage of the new dissemination resources available, but there are also Internet users who are not acquainted with the contents of archival institutions first hand. Our development process involves accepting and identifying different cultural perspectives and needs since we are witnessing the appearance of a virtual user whose profile we do not know but who we do know is interested in high-quality content of a cultural nature over the Internet.

This is why the search processes within the AER application have been carefully planned and evaluated. There are two options for search criteria:

- 1 **Simple search:** aimed at the typical Internet user most interested in general search areas.
- 2 **Advanced and specialised search:** aimed at researchers and archivists, it allows more complex and in-depth consultations combining different criteria.

The use of free-text or pre-established search parameters has also been studied. Special care has also been taken to design clear help screens to facilitate the use of the application and access to information.

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Search Result: Description in context

Tools such as the Researcher's Diary have been developed to facilitate research by specialised groups of users. This allows researchers browsing through AER to manage their searches for documents and images over time. Its main purpose is to update the record of useful searches carried out by a user so that s/he can work on them subsequently. It records both the subjects that have been searched for and the reference numbers of documents obtained as a result of the searches, making it possible to monitor the documents consulted and record any comments relating to resources of interest. Collaboration between heritage and e-learning sectors has been promoted at all times.

AER is not a closed project: it is constantly being updated and new functions are being developed to help researchers get the best out of archival resources. Current functionality allows the researcher to request copies of documents, ask for printed copies or copies in digital format to be sent out, request certificates, reserve documents prior to visiting the actual archives and request the develop-

ment of a researchers' forum for communication with the community of users.

AER INTRANET

AER incorporates an intranet to facilitate all internal management including the organisation and description of documentary resources, movement of resources, standardisation, management of copying and restoration of documents.

The spirit and purpose of the project is that it should be extended to include other Spanish and Latin American archives, thus creating a space that could be called the 'Iber-Archives', the consolidated key to which is the Electronic Guide to Spanish and Latin American Archives. For this reason, a network of Archives has been configured based on a communications infrastructure with sufficient capacity to allow the exchange and consultation of information between different Archives and the Ministry of Education, Culture and

¹³ For more on the 'noosphere', see the Global Consciousness project at <http://noosphere.princeton.edu/>

Sport. With an integrated online system, the Archives administration can monitor its resources and develop short- and long-term management plans.

TECHNOLOGICAL OVERVIEW

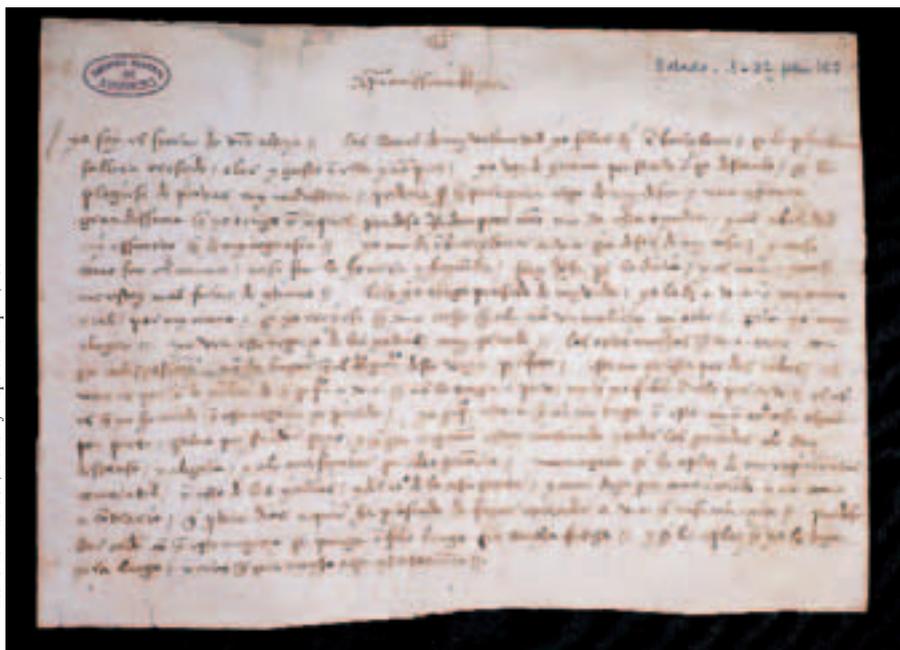
AER was developed with the Java 2 Platform, Enterprise Edition (J2EE: <http://java.sun.com/j2ee/>), the standard for developing multi-tier enterprise applications. The J2EE architecture defines a client tier, a middle tier (consisting of one or more sub-tiers) and a backend tier providing services of existing information systems, meaning that various parts of an application can run on different devices. J2EE simplifies enterprise applications by basing them on standardised, modular components, by providing a complete set of services to those components and by handling many details of application behaviour automatically. Thus, AER is built on a robust and flexible platform which allows choice among different products and vendors.

The main components of AER architecture are:

- BEA WebLogic™ Application Server.
- Documentum™ Enterprise Content Manager.
- Oracle™ Database management system.

At present, all of these companies are market leaders and have been chosen to ensure optimum performance. However, AER architecture can be implemented using other solutions, for instance Open Source products, as long as they are J2EE compliant. AER implements XML technology to enable information exchange and interoperability with other applications, and AER components are also compatible with Dublin Core interoperable metadata standards.

AER is closely following the evolution of new concepts such as the



Letter from Christopher Columbus to Queen Isabel the Catholic, defending the exploration of the New World. Year 1501. General Archive of Simancas: State, 1st-2nd. p.165.

Semantic Web with a view to incorporating them gradually into its platform. It has been developed in synergy with other major European projects such as the Lund Plan offering an advanced (in terms of quantity and quality) digitisation

AER is a flexible, ongoing project committed to meeting the challenges associated with making the content of the Archives available on the Web, eradicating the digital divide, and creating access for all to heritage over the Internet.



"Three Small Children from Madrid, one with a slice of bread in his hand", by Kati Horna. Year 1937. General Archive of the Spanish Civil War: Photographic collections, Kati Horna, 213



Figure 3. A browser view of a fonds archival description



Figure 4. PDF output produced by an XSL-FO transformation

'Regia delegazione del censo' contained in the partition 'Antichi regimi' of the Como State Archives. In Fig. 4 the same fonds are presented in PDF format.

Thanks to the use of XSL-FO, it has also been possible to show, using different typographic conventions, all the modifications performed on the descriptions of the archival material. Figures 5

and 6 show the PDF layouts of the original and the updated versions of the Bologna State Archives

In the fonds 'Governo provvisorio austriaco' it is possible to see:

- the removal of some series (strikethrough text on green background);
- the insertion of new series in the

- updated version (blue colour text);
- the modification of some elements in the unit of description (bold text).

In conclusion, the use of a standard model, such as the Encoded Archival Description, and the standard mark-up language XML made this digital version of the Guida Generale extremely accessible and interoperable, and potentially independent from specific software solutions. This is largely because the data are indexed by a native XML database engine and so are left 'as they are' in XML format, making it possible to reuse them at any time.

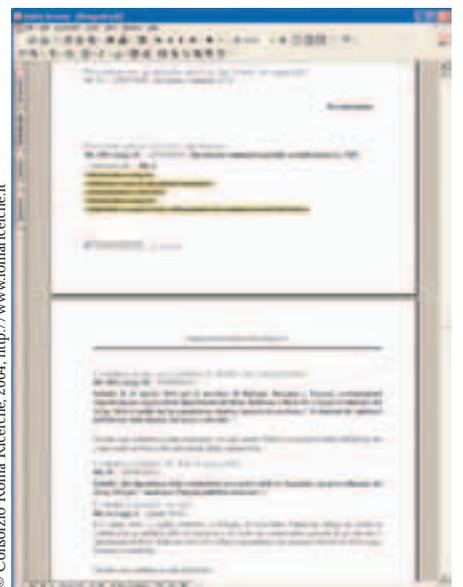


Figure 5. PDF representation of the (modified) original version

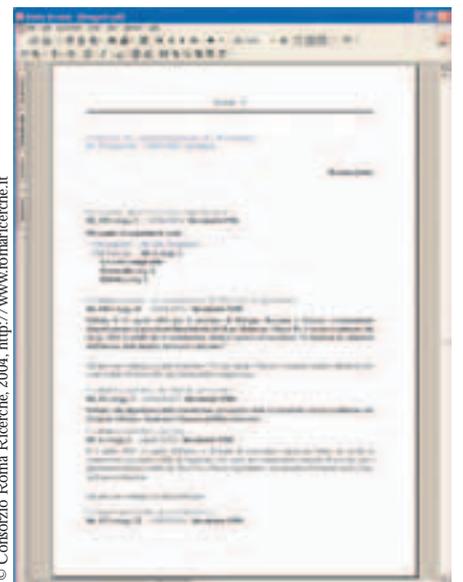


Figure 6. PDF representation of the updated version

OPEN SOURCE TOOLS

RSS NEWSFEED AT THE ARCHAEOLOGY DATA SERVICE

ADS has set up two syndicated newsfeeds, one for news and events, and the other containing information on new collections added to the ADS Web site. Updates are transferred by including a very short (invisible) script within the HTML code of any Web page which displays a list of headlines and links to the pages where further information can be found. When data are altered, or new information is entered, the updates are syndicated to anyone using the newsfeed, keeping remote Web sites up to date without the need for repeated editing.

This Open Source tool is constructed using the RSS standard version 1.0. RSS (which stands for Really Simple Syndication) is a Web content syndication format which conforms to the XML 1.0 specification and is based on the Resource Description Framework (RDF). Each RSS file contains a list of items, each of which is identified by a link and has metadata associated with it. The most basic metadata supported by RSS includes a title and description for the link; in news headlines these first paragraph or a summary, for example.

Information from both ADS newsfeeds and instructions on how you can include the headlines in your own Web page can be found at <http://ads.ahds.ac.uk/rsscode.html>. More general information about the RSS specification can be found at <http://web.resource.org/rss/1.0/> and links to RSS resources, tutorials, news and tools are available from RSSInfo (<http://blogs.pace.com/rss/>). Syndication such as this benefits organisations in terms of eliminating obsolete information, standardising formatting of 'list-type' information, reducing time spent editing Web pages, and improving the quality of the information presented.

NWA TOOLSET

Web document archives can be very complex, comprising large numbers of documents, objects which are separate and yet part of the document (e.g. images displayed within a Web page) and several different versions of the same Web document (for example, documents downloaded from the same URL on different dates). Last December, the Nordic Web Archive (<http://nwa.nb.no/>) released the NWA Toolset, a freely available solution for searching and navigating archived Web document collections.

In development since November 2000, the Toolset was built using PHP, Perl and Java and utilises open standards like the http protocol and XML. It is used through a Web browser and requires no special plug-ins.

The NWA Toolset consists of three main parts:

- 1 The Document Retriever delivers archive objects and associated metadata to the Exporter and the Access Module upon request. It is adaptable to fit the needs of different archives.
- 2 The Exporter transforms archived objects and associated metadata into an intermediate XML format named the NWA Document Format. The NWA Document Formatted document collection is then fed to the indexer of a search engine.
- 3 The Access Module interfaces both the search engine and the Document Retriever, thus giving the user the possibility to search, browse and navigate the archived Web documents.

The Toolset can be adapted to fit the needs of individual Web document archives and, when used in conjunction with a Web archive, a search engine (and abstraction layer), becomes a useful support

tool in the fields of harvesting and archiving Web documents. The NWA Toolset is licensed as Open Source under the GNU General Public License (GPL: <http://www.gnu.org/licenses/licenses.html#GPL>). It can be downloaded from <http://nwa.nb.no/> or SourceForge (<http://sourceforge.net/>).

THE PAPER AND INK OF THE FUTURE?

Newly released into the field of polymer electronics is a rollable display technology suitable for reading e-mail, and potentially maps or e-books, which takes up no more space than a pen. The black-and-white displays are 320 x 240 pixels, have a resolution of 85 ppi, offer four shades of grey and contain nearly 80,000 thin-film transistors. The flexible, active-matrix backplane is roughly a quarter the thickness of a sheet of paper and is attached to a thicker front-plane of reflective electronic ink.

The flexibility of the displays allows them to be tightly rolled up for carrying or storage. This is made possible by 'electronic ink' developed by E Ink (<http://www.eink.com/>) where transistors are used to switch pixels under an electric field, the particles becoming stable when the power is switched off. These active-matrix displays are therefore ideal for low-power mobile applications.

Polymer Vision (<http://polymervision.nl/>), established by Philips Research, is initially manufacturing only 5000 of the new 'electronic paper' displays per year, but is confident that their updateable convenience will result in the development of the technology into the future.

XENA: ELECTRONIC NORMALISING TOOL

ADAM RUSBRIDGE, ERPANET DIGITAL PRESERVATION TECHNICAL ANALYST

There are currently few practical solutions to the problems of format obsolescence faced by the digital preservation community. As discussed in Issue 4 of *DigiCULT.Info* with reference to the BBC Domesday project, inaccessible information represents not only a great waste of time and money, but the potentially permanent loss of our cultural heritage.¹⁴ To help safeguard against this danger, the National Archives of Australia (<http://www.naa.gov.au/>) have produced XENA (XML Electronic Normalising of Archives),¹⁵ an Open Source tool designed to respond to the specific requirements of the institution. This approach is attractive: although research of the broader topics in this field are required and under way, smaller, manageable and practicable institutional solutions will not only inform this research but will take steps now to help ensure the adequate preservation of our digital heritage.

The Open Source development of the tool allows and assists a wider development community base who produce an increased number of ideas and methods, and enables a variety of institutions to freely develop additional modules for their specific institutional needs. The approach taken by the NAA is to normalise a record, capturing its inherent 'essence'. Normalisation is the conversion of the source object from the original format into an XML-based archival format.¹⁶ Upon retrieval, transformation occurs converting the XML into an appropriate format for viewing. This one-step procedure prevents the repetitive cycle of migration.¹⁷

At the present time XENA normalises eight file formats. It is expected that over time additional modules will be added to enable a wider variety of formats to be handled. Currently, the NAA expect that 80% of their records will be contained within these eight formats. If additional institutions were to incorporate the tool in their own preservation strategy, the Open Source development and documentation methodologies would assist the production of the required additional normalising and transformation modules.

Converting into institution-specific formats is of concern, as this may force a persistent reliance on XENA. The current implementation of XENA also relies on OpenOffice (<http://www.openoffice.org/>) to normalise binary-object documents. Should an external program be used over which the developers maintain no control? The XML-based format and open XML schemas used will hopefully allow the development of alternative software utilities to interpret them. The cynic in me does not believe that one software package will be maintainable indefinitely, and therefore this approach will be beneficial in the long term. However, if a software package will itself become obsolete, the question is raised: why perform this normalising work at all? The NAA say that, rather than providing indefinite access, they aim to maintain access to the records for twenty years. This is a goal which I believe is feasible and allows appropriate initial solutions to the problem which can be extended as our understanding of the issues develop.

XENA is implemented in Java, with comments included within the code. As with any

long-term project, it is important to ensure that the comments provide a suitable explanation to the code. Could a programmer without prior knowledge of the project pick up the work in five years' time and continue working on it? A primary complication in digital preservation is lack of documentation, such as that for format specifications and ambiguous code. A preservation tool must not be allowed to contain or produce similar difficulties.

The XML structure is, very generally, defined as follows. A <package> is comprised of <meta-data> and <content> fields; alternatively it can contain further <package> entities. Zero or more <meta-data> fields can be included and entries can conform to many metadata schemas. A <content> field contains the primary information to be preserved. In some cases, the <content> will contain a <base64> encoded version of the binary file. This is a content transfer encoding standard, here used to allow the object to be stored in a non-binary form. In other situations, a normalised hierarchical XML file will be stored. For example, a <database> may contain multiple <tables> each of which adheres to a certain <dataset>.

¹⁴See 'Overcoming the dangers of technological obsolescence: Rescuing the BBC Domesday project' and 'Techniques and Challenges of emulating obsolete software'. Interview with Paul Wheatley in *DigiCULT.Info*, Issue 4, August 2003, http://www.digicult.info/downloads/digicult_newsletter_issue4_lowres.pdf

¹⁵To view project files, visit Project:XENA at <http://sourceforge.net/projects/xena/>

¹⁶Cf. http://www.naa.gov.au/recordkeeping/preservation/digital/xml_data_formats.html

¹⁷These ideas are discussed in more detail in 'An Approach to the Preservation of Digital Records', an NAA Green Paper at http://www.naa.gov.au/recordkeeping/er/digital_preservation/Green_Paper.pdf



This loose specification will allow multiple versions of an object to be stored in a single structure, allowing each applicable preservation metadata record to accompany the appropriate version of the object. Packaging the preservation metadata together with the object will increase the usage that can be obtained from this metadata information. However, storing all of the metadata for an object, such as bibliographic metadata allowing resource discovery, also has disadvantages. For example, searching would be inefficient due to the presence of large content data fields.

It is possible to use the tool to batch process files. This is an important addition in a situation where large

quantities of files are to be manipulated. However, a command line interface (which would be useful when developing and testing a streamlined workflow script combining several procedures of ingest) was not available.

To make the best use of a preservation tool, an export facility may be required. Although XENA is not strictly intended for use as a migration tool, it is likely that a user will expect to use stored content outside the program. For example, users may want to include archived images within reports and newspaper articles. An export facility is required to enable this. The output formats selected could be open standards. However, this raises more questions, such

as: does the normalisation process lose information and prevent this? How should these new output objects be handled?

The XENA tool has been designed to apply to the workflow model applicable in the National Archives of Australia. The Open Source nature of the tool will allow it to be extended to apply to broadening situations and allow a variety of developers to address specific issues of concern to them. Among the steps being taken to preserve our cultural heritage, XENA and its development principles form an addition that should not be overlooked.

DIGICULT CULTURAL HERITAGE EVENTS AND RESOURCES

EVENTS

The DigiCULT Forum maintains a database of up-to-date events within the cultural heritage sector (<http://www.digicult.info/pages/events.php>). Some significant events for the future include:

Workshop: European Cultural Heritage: RTD Challenges Ahead

Dates: May 28, 2004

Venue: Congress Centre Graz, Austria

Jointly organized by the Austrian Ministry of Transport, Innovation and Technology and JOANNEUM RESEARCH in collaboration with the European Commission's IST Programme. The workshop will bring together international expertise in content technologies for cultural heritage to better understand the role of cultural institutions and leading edge technology. The workshop intends to map the ground for the next stage of structures for an effective sharing of resources, the development of new services, enriched interactive environments, and possible contributions in the support of community memory. Departing from an overview of current international developments, building

blocks of a future research agenda shall be highlighted. Two separate Work panels will address 'Preservation and Integration' and 'Knowledge and Presentation'. For further information please visit our website www.joanneum.at/eculture. Participants are asked to register on the website.

DRH2004, Digital Resources for the Humanities

Dates: 5-8 September 2004

Venue: University of Newcastle, UK

Themes for 2004 include: methods in humanities computing; cross-sector exchange between heritage, national and local government, and education bodies; broadening the humanities computing base; and new forms of scholarly publication.

More information can be found at <http://drh2004.ncl.ac.uk/>.

RESOURCES

The DigiCULT Resources database (<http://www.digicult.info/pages/resources.php>) also continues to grow and now has a Search facility. Some valuable resources which deserve further dissemination are introduced below.

- Several very useful papers have been released on the EDNER (Formative Evaluation of the Information

Environment) site representing key issues. These papers are intended to distil formative evaluation questions on topics that are central to the development of the UK's higher and further education Information Environment. They are presented as short check-lists of key questions and are addressed at developers and practitioners. This resource, recently added to DigiCULT's database, can be found at: <http://www.cerlim.ac.uk/edner/ip/issue-papers.html>

- Another excellent resource is the Tutorial on Digital Preservation Management, which is free to access at: <http://www.library.cornell.edu/iris/tutorial/dpm/index.html>.
- PRONOM is a database that holds information on technical dependencies that affect access to electronic records. It was developed as a support tool by the UK National Archives who are now hoping that PRONOM can benefit the wider digital preservation community. PRONOM is available from: <http://www.records.pro.gov.uk/pronom/> and feedback on the tool can be sent to pronom@nationalarchives.gov.uk

NEWS FROM DIGICULT'S REGIONAL CORRESPONDENTS



GREECE

Cultural Information and Digital Technology: seminar series at the Foundation of the Hellenic World

The use of digital technology and the promotion of cultural information are the subjects of the new seminar series organised by the *Foundation of the Hellenic World* (<http://www.fhw.gr/>). These seminars are a continuation of the *Cultural Convergence and Digital Technology* congress (<http://www.fhw.gr/conferences/ccdt/>), which took place in May 2003. They will address themes ranging from the digitisation of collections and monuments to the use of VR systems and 3D GIS in excavation sites. The seminars target a very broad audience from the education and research communities, as well as a variety of other professional areas (arts and media, ICT sector, architecture, museology, history and archaeology).

For the complete seminar series timetable and further information (in the Greek language only), see: <http://digitech.ime.gr/>

Michael Dertouzos Competition

The Michael Dertouzos Awards, entitled *IT with a Human Face*, have been announced in conjunction with the *14th World Congress on Information Technology* (WCIT 2004), which will take place at the Convention Centre of the *Athens Concert Hall* (<http://www.megaron.gr/>) on 19-21 May 2004. These prestigious awards fall under the umbrella of the *Human-centred IT Environments and Applications* WCIT working session, and are dedicated to the famous Greek computer scientist and technology humanist Michael Dertouzos.

The awards are open to students and young researchers working in the field of information technology with emphasis on the human interface of computing systems and innovative IT-based technologies. The submission deadline for abstracts is 26 March 2004. For further information on WCIT, see: <http://www.worldcongress2004.org/>



HUNGARY

The Electronic Comintern Archives available in Budapest

The Communist International (Comintern), founded by 52 representatives of 35 parties and organisations in March 1919, ruled over the international Communist movement through its 70 partners for almost a quarter of a century. It was dissolved in 1943. The documents testifying to its organisational life, to the public and secret debates, to decisions made behind closed doors and deliberately leaked, were immediately transferred to the Central Committee of the Communist Party of the USSR and later to the Central Party Archive of the Institute of Marxism-Leninism. The documents were classified 'Top Secret' and as such were inaccessible even to researchers. All the documents of the Communist International (written in about 90 languages) would make a line 15 kilometres long if placed side by side in archival boxes. The entire collection is shelved in the storage rooms of the Russian State Archive for Social and Political History (RGASPI), successor to the Central Party Archive. The documents comprise 220,000 files and 22 million pages in all. Without a user-friendly, electronic catalogue this mass of material, this trackless forest of documents, is unmanageable not only for researchers but even for specialist archivists. The frequent reorganisations of the Comintern headquarters in Moscow

and the conspiracy-laden norms of illegal activity abroad created even more confusion within the structure.

In 1992, the German historian Professor Weber asked the Council of Europe to intervene to save the Comintern Archive in Moscow, which was endangered by political changes. The Council of Europe requested the help of the International Council on Archives who, at the end of 1992, initiated discussions about the possibility of creating an electronic catalogue which would eventually provide easy access to this unique set of archival holdings. The idea was based on the model and technology of the Sevilla Archivo General de Indias, which was created to celebrate the 500th anniversary of the discovery of America. ArchiDoc (<http://www.canteco.net/>), a complex software package which can handle the catalogue, digitisation and Research Room requests, was developed by the Spanish Informatica Corte Inglés in the early 1980s and continually upgraded to keep pace with the rapid development of information technology.

The Framework Agreement of 1996 envisaged the creation of an electronic database of the 220,000 Communist International files (about 20 million entries) and of 1,000,000 digitised images of the most frequently researched documents. Seven years later, on 27 June 2003, RGASPI inaugurated the electronic version of the Comintern Archives, which is now freely accessible from the Reading Room for researchers and the interested public.

Under the leadership of the international board INCOMKA, the eight Partner Organizations (the Federal Archives of Switzerland; the Federal Archives of Germany; the Archives of France; the State Archives of Italy; The Ministry for Education and Culture of Spain; the National Archives of Sweden; the Library of Congress, US; and the Open Society

Archives, Budapest) lined up not only to sponsor the project, but to offer their own services and know-how in order to bring the catalogue into being. For example, the Library of Congress carried out the transliteration of 173,000 personal names into Latin script and translated into English the institutional and subject descriptors. The proofreading of the transliterated names alone required half a year.

In each of the eight Partner Organizations a standalone workstation was installed, where the 20,000,000 entries and the 1,000,000 images are freely accessible. The organisations make photocopies of the images on request but under the agreement the workstation may not form part of any external network system. Organising free online access to the database is under consideration.

From December 2003, as a result of this exemplary international project and the outstanding work of computer technologists, the database, an indispensable tool for research into the history of the twentieth century, is freely and publicly accessible in the Open Society Archives, Budapest (<http://www.osa.ceu.hu/>).



ITALY

Cultural Heritage Digitisation in Italy: An Overview

Policy Scenario

The Italian cultural heritage sector is one of the richest in Europe for collections and holdings of libraries, museums and archives. However, the policy scenario for digitisation has been characterised by fragmentation of initiatives, due to the many projects and personnel involved. The principal actor in cultural

heritage is the Minister of Cultural Heritage (Ministero dei Beni Culturali – MiBAC: <http://www.beniculturali.it>). MiBAC includes all the operative sections of the Ministry itself, i.e. the eight General Directorates¹⁸ and the four Central Institutes that deal with different aspects of Italian cultural heritage.¹⁹ Other important actors are the Regions and the local governments (Provincia, Comuni). They are autonomous in the framework of State legislation, and are responsible for the management of most cultural resources. The Universities and the Minister for Innovation (Ministero dell'Innovazione, <http://www.innovazione.gov.it/>), involved respectively on important change factors such as e-Learning and e-Government, are also active in promoting digitisation projects.

The European Minerva Project (<http://www.minervaeurope.org/>) has been extremely influential in the last two years and its Coordinator is the General Secretariat and the Cabinet of the MiBAC. Its focus is on the Lund principles²⁰ and the resulting Lund Action Plan. In order to implement the Action Plan in Italy, the Minister has developed:

- **a National Commission**, chaired by the Italian Representative of the National Representative Group (NRG), Rossella Caffo, for harmonising policies and programmes on digitisation of State and regions and to constantly update the National Policy Profile;
- **three Italian working groups**, working in close co-operation with the European workgroups within Minerva, on: Web site quality; benchmarking and good practice; and metadata and inventories/accessibility.

During the Italian Presidency of the European Union, the Minerva project organised a series of digitisation events that were important for stimulating co-operation in Italian digitisation projects and programmes. The Parma conference on Quality of Cultural Web sites constitutes the most important event carried out by the Minerva

Project in this period and resulted in the Chart of Parma. This document has the objectives of consolidating the position of the NRG group at European level and of obtaining political recognition within national governments, through the adoption of Minerva Project results and recommendations.

Digital collections

While the MiBAC and Regions have been engaged in digitisation projects for converting print-based collections into digital images, Universities and Public Administrations have been stimulated to enhance their institutional services and activities through digitisation. An up-to-date list of digitisation projects can be found at <http://www.minervaeurope.org/publications/globalreporthtm/italy.htm>, some of which are summarised below.

MiBAC DIGITAL COLLECTIONS

The national digitisation programme undertaken by the MiBAC is called *Italian Digital Library (BDI)*²¹ and is led by the Central Institute of Union Catalogue (Istituto Centrale Catalogo Unico, ICCU, <http://www.iccu.sbn.it/>). It aims to digitise and put online a selection of the Italian libraries' heritage collections. The project started on the basis of a feasibility study²² funded by MiBAC at the end of 1999, concerning digitisation initiatives at national and international levels. The first collection to be digitised is the hand-written historical catalogues of 29 Italian libraries, which will make available bibliographic information regarding ancient works held in Italian libraries but not yet in an online catalogue.

¹⁸Libraries and Cultural Institutes, Archaeology, Archives, Museums, Cinema, Performing Arts, Architectural and Landscape Treasures, Contemporary Architecture and Art.

¹⁹Restoration, Union Catalogue of the Italian Libraries, Cataloguing and Documentation, Book Pathology.

²⁰The Report on Lund principles is available at: http://www.cordis.lu/ist/ka3/digicult/lund_p_browse.htm

²¹The BDI was financed with more than €5 M funding for the period 2001-2003.

²²An English summary of the feasibility study is available at http://www.ifnet.it/elag2002/papers/pap1/studio_BDI/pt_0_Summary_eng.zip or for the full study, visit http://www.ifnet.it/elag2002/papers/pap1/studio_BDI/



Another priority for the BDI is the digitisation of musical heritage in State public libraries, music conservatories, municipal libraries and historical archives.

At the moment, the BDI is involved in several projects including, among others, the National Library of Turin, the Marciana Library of Venice, the Estense Library of Modena and the National Library of Rome. The co-operative organisation is centralised on a Steering Committee with experts and representatives of Universities and Regions; the Committee has the role of selecting the projects submitted by state libraries, local libraries, cultural institutions and universities to be funded by MiBAC. The central administration of the BDI Project supports promotion and co-ordination activities and provides software for the database management and implementation of the Web site, while the libraries choose and index the material to be digitised. The planned BDI portal will provide an inventory of the ongoing digitisation activities, while trying to avoid duplication. During 2004, ICCU will be involved in the integration of the BDI with *Network turistico culturale* (NTC), approved by the Interdepartmental Committee for the Information Society.

Archives and museums have been building digital collections, most of which are co-operative projects. The SAN project (*Sistema Archivistico Nazionale*: <http://archivi.benculturali.it/notbiblio.html>) will build an information platform for the national archives heritage, both to respond to user needs and to optimise the data management of the State archives throughout the country. This platform, based on the ISAD and ISAAR international standards for archives, on the OAI metadata protocol and on an XML base, is in an experimental phase.

The *Istituto Centrale per il Catalogo e la Documentazione* (Central Institute for the Catalogue and Documentation, ICCD, <http://www.iccd.benculturali.it/progetti/index.html>) has realised the SIGEC Sistema Informativo del Catalogo Generale

(Information System of the General Catalogue), which represents a reference model in terms of the organisation of the inventories and cataloguing of cultural heritage objects. At the moment, efforts are being made to integrate with the Risk Map of cultural heritage (<http://www.icr.benculturali.it/rischio/rischio00e.htm>), an initiative that aims to guarantee the protection of territory and provide the Central Administration with tools for scientific and administrative activities.

The SITIA project (Sistema Informativo Territoriale Integrato per l'Archeologia, <http://www.archeologia.benculturali.it/>) focuses on the application of new technologies to the representation and management of archaeological heritage, in order to prevent the risk of loss and plan financial and administrative initiatives. SITIA will allow an easy information exchange between different administrations and will also define the basis on which the Italian Archaeological Map will be elaborated.

Among the main national projects, the *Commando Carabinieri Tutela Patrimonio Culturale*²³ aims to prevent crimes against cultural heritage, prosecute these crimes, and recover heritage items and objects of art. The *Commando* utilises the databank of stolen heritage items, a large database which is updated daily with regard to items removed in Italy and items taken abroad through communications circulated by Interpol. There are currently 94,500 recorded events and descriptions of approximately 2,200,000 objects with more than 220,000 images in the databank.

RESEARCH COMMUNITY

Universities in Italy have been involved, in the past ten years, in the realisation of consortia for digital library development. The Universities Consortia have been specialising in co-operative acquisition of digital resources²⁴ and in the support of the creation of digital content.²⁵

One of the biggest evolutions of scholarly

communication is the impact of institutional or *tematic* deposits, based on the OAI protocol. Many Italian research institutions have made available an institutional OAI archive to enable the submission of scientific publications produced within the institution. However, academic authors' reactions to OAI initiatives are cautious, and the documents collected are not numerous, especially because electronic publications are still seen to lack credibility. Among the Open archives initiatives in Italy, the ERCIM project (European Research Consortium for Informatics and Mathematics, <http://www.ercim.org/>) was the first to be developed. Realised by the CNR Institute IEI of Pisa, the project is gathering a collection of digital documents, searchable in combination with the other archives of the Networked Computer Science Technical Reference Library (NCSTRL, <http://dienst.iei.pi.cnr.it/Dienst/UI/2.0/Search?tiposearch=&langver=it>).

A growing phenomenon in Italian universities is the digitisation of learning materials and lesson plans. This material (generically called courseware) is increasingly being included in the Web sites of professors and departments, and in some cases is organised

²³Division of Carabinieri responsible for protection of cultural heritage, at http://www.carabinieri.it/carabinieri/drvisapi.dll?Mlval=tpc_search

²⁴CILEA (<http://cdl.cilea.it/>), CIBER (Coordinamento interuniversitario banche dati ed editoria in rete) del CASPUR (www.caspur.it) and INFER-CIPE (Italian National Forum on Electronic Resources, Cooperazione interuniversitaria per i periodici scientifici, <http://www.infer.it/verbal.html>)

²⁵The important CIBIT consortium (<http://cibit.humnet.unipi.it/>) brings together 24 Italian universities and has prepared a digital library that contains 253 classics of Italian literature. Digital Math Library (<http://www.cab.unipd.it/progetti/dml.php>), financed under the Sixth Framework Programme of the European Union, aims to digitise all the scientific literature of interest on the subject. Numerous entities are involved, including libraries, universities, publishers, projects, and national and international mathematical associations. Initiatives limited to internal co-operation within individual university institutions for the digitisation of printed works are not lacking. In this case, the most important projects in terms of resources used are those of the Universities of Bologna (<http://www.cib.unibo.it/BibliotecaDigitale/dl1/>) and of Padova (<http://bibliomedia.cab.unipd.it/perl/mhorse?lang=it>), both managed by the universities' libraries systems.



at an institutional level.²⁶ Digital collections and digital libraries have often been created for supporting eLearning, examples being: E-Form (<http://www.eform.it/>) and ICOLN (http://www.italicon.it/index_biblio.asp?AR EA=06&SECTION=MNURISORSE&SECTIONID=02). The most innovative educational experiences, including lesson plans, are collected from INDIRE, a research Institute on education, in the GOLD project (<http://gold.indire.it/nuovo/>).

PUBLIC ADMINISTRATIONS

Over the past two years central government and local governments have responded to the challenge of modernisation through the implementation of many eGovernment initiatives designed to improve the services delivered to the customer (citizen or business). In this process of eGovernment, many changes are being introduced to the ways public service staff work, and fundamental to these new ways of working is sharing the workflow of digital documents. This will have a particular impact in archives, and a standardisation programme is under way for the realisation of the informatic protocol, the digital signature and other important factors involved in the Information Society. In 2002 the Minister for Innovation developed the *Guidelines for Development of the Information Society* in legislation and a number of programme and administrative documents for the reorganisation of information and communication flow in the public sector.

Accessibility, benchmarking and quality evaluation

The lack of a discovery tool is the biggest weakness of many digital collections already built. It is a strong barrier to accessibility, together with limited user skills. It should be stressed that most of the digitisation projects in Italy are concerned with developing a digital collection and not a digital library service for particular user needs. Information literacy is not considered a priority, and is not usually taught.

Efforts to look into benchmarking and qua-

lity evaluation have started recently. An official working group on benchmarking within MiBAC has been established (under the impetus of the NRG in the European Minerva Project) in order to coordinate evaluation activities at national level. The group is made up of representatives from both central and local administration and demonstrates a shared interest in improving digital collection services. The first benchmarking questionnaires (devised by the European Commission within the eEurope initiative) were sent to a number of Italian institutions in March 2002. The questionnaire was divided into two parts: the first regarding quality aspects, the second oriented to the quantity of data collection. Data collection was seen to increase in 2003. This benchmarking model will form a basis for creating a national network for evaluating digitisation projects.

Research activities on digitisation

Research communities in universities and research institutions have been heavily involved in research projects about digitisation at international level. The problem is that disseminating and communicating research results to the communities involved in digitisation projects has been limited. It should be said that most of the research activity is at technological and interface level and not at user level, for example investigating user behaviour and use of existing digital libraries.

An important role could be maintained in the future by the *Osservatorio dei Programmi Internazionali per le Biblioteche* (Observatory for International Libraries Programmes, <http://www.opib.librari.beniculturali.it/>), whose mission is the dissemination of information about international research programmes. It acts as a link between institutions through participation in CULTIVATE-EU (Cultural Heritage Applications Network, <http://www.cultivate-europe.org/>).

MAIN DIGITISATION TRAINING ACTIVITIES

The most evident weakness of digitisation projects in Italy is that the training or re-

qualification of staff is not considered a central issue that needs to be addressed for the success of any digitisation activity. It could be said that education in this field is often poor and the problem was discussed in Parma at the First International Conference of Employers and LIS teachers (<http://www.aldu.unipr.it/master>).

It is worth highlighting the international collaboration of the University of Northumbria and the University of Parma to provide criteria and methods for the management of a digital programme.²⁷ Training courses on digitisation issues are periodically made available from the IEI-CNR Institute at Pisa.

Conclusion

In conclusion, there is significant interest in digitisation projects both within Italy and for the impact of international and European Union projects. Much effort has been expended on building digital collections but the accessibility and availability of digital library services is still poor. The emphasis on benchmarking of digitisation projects and quality evaluation of cultural content could provide a positive stimulus in improving the existing experiences. Information literacy is still relatively neglected and few users are able to access digital collections easily. The user is considered important in research community projects; however, university consortia have not fully considered the potential of digitisation in the evolution of scholarly communication. The situation is dynamic and quickly improving with the push of eGovernment and eLearning strategies.

²⁶It is worth mentioning the sites of the Università di Roma (http://lettere.uniroma1.it/ELFS/Homepage_ELFS.htm), the Università di Milano regarding publications out of sale of the *Metid of the Politecnico di Milano* (<http://www.unimi.it/ateneo/filarete/default.htm>, <http://www.metid.polimi.it/>), the Università di Bologna (<http://amscampus.cib.unibo.it/>) and the University of Parma (<http://dSPACE-unipr.cilea.it:8080>)

²⁷See <http://www.aldu.unipr.it/master/index.php>



LITHUANIA

EU Structural Funds

In May 2004 Lithuania joins the European Union, so the most relevant topic in recent times has been EU Structural Funds and their administration. A seminar (held in Utena on 28 November 2003) aimed to bring together national authorities and the library community and was organised jointly by the Communication faculty of Vilnius University (<http://www.kf.vu.lt/>) and Utena M. Miskiniu public library, and sponsored by Open Society Fund Lithuania (<http://www.osf.lt/>). The organisers performed an extensive study on the opportunities to benefit from European funding. The report included a description of the main priorities of the Single Programming Document for 2004-2006 in Lithuania and potential niches for the participation of the library community. Analysis of the funding strategy had shown that, on the one hand, there are multiple options for libraries to participate with projects on the promotion of information literacy, creation of Lithuanian electronic content and services, and solutions to increase social cohesion. On the other hand, the challenging aspect of the document is the absence of focus on culture or cultural institutions. The formulations of priorities are very broad, so there is a danger for libraries 'to fit everywhere or nowhere'. Seminar discussions highlighted a number of problems and possible solutions such as complicated project administration procedures and the need for the smaller libraries to collaborate with local authorities, and the lack of communication and consultations with the representatives of government bodies. Productive meetings with authorities were not the only outcome of the event; the organisers developed a Web site for the library community with all the necessary information (including the study of

opportunities and challenges for libraries) on Structural Funds, which can be found at <http://www.utena-on.lt/esf/> (in Lithuanian).

Virtual Library Portal

The Virtual Library Portal (<http://www.library.lt>) was launched by the Lithuanian Academic Library Network in autumn 2003. The portal is powered by MetaLib software (<http://www.aleph.co.il/metalib/>), which provides users with a unified, friendly interface and enables them to perform searches across diverse resources (e.g. library catalogues, databases, subject gateways, newspapers, and images) that are normally accessed from a wide variety of institutions. The portal offers personalisation tools such as saving of search results, tracking history of searches, and setting display options.²⁸ The Virtual Library is one of the initiatives of the Lithuanian Academic Library Network (LABT, <http://www.labt.lt>), which consists of the libraries of sixteen universities, nine colleges, 29 state research institutes and the Library of the Lithuanian Academy of Science.²⁹ The organisation aims to provide users with easy and unified access and search facilities by promoting library automation, electronic services, and further development of the academic libraries network.

On 22 January 2004 the joint presentation of the Lithuanian (MetaLib) and Russian (SIGLA, <http://www.sigla.ru>) virtual library portals and possibilities for data interchange was held in the Library of the Lithuanian Academy of Science (<http://www.mab.lt>). The Russian virtual portal Sigla is a joint project of the Moscow M.V. Lomonosov State University Scientific Library (http://www.lib.msu.ru/index_ehtml) and the Library Computer Network (<http://www.bks-mgu.ru/>). Sigla performs searches in over 1000 Russian and world library catalogues. The event was of practical benefit to the participants who were mostly library professionals working with electronic catalogues every day. It was demonstrated that both Russian Sigla- and Lithuanian Aleph-based library systems were capable of exchanging bibliographic records by converting

them to UNIMARC format and adding them to the electronic catalogue.³⁰



NETHERLANDS

This first Dutch contribution to the DigiCULT regional reports provides a brief sketch of the current cultural heritage landscape and its major landmarks, including the emergence of digitisation policy, the major institutions, and new initiatives.

Towards a Coherent Digitisation Policy

The potential of digitisation as a means to open national collections of cultural heritage to the general public as well as professionals and special interest groups was fully recognised by the Dutch government in the close of the last century. The need to proceed in a coherent and co-ordinated manner, in other words to start developing policy, was discovered when the first wave of 'digitisation' initiatives yielded a plethora of incompatible collection management databases, CD-ROMs, Web sites and scattered collections of digital images in a wide variety of formats and other digital manifestations of objects, or information about objects.

In 1999, a new centre of expertise, the Netherlands Digital Heritage Association (<http://www.den.nl/>) was set up to co-ordinate digitisation initiatives in the heritage field, transcending different sectors. Important heritage institutions, the National Archives, the National Library, the Netherlands Institute for Sound and Vision

²⁸For more information, see MetaLib: the library portal: <http://www.exlibris.co.il/resources/metalib/metalib.PDF>

²⁹See LABT projektas: http://www.labt.lt/index_projektas.php?psl=projektas.php

³⁰Information was kindly provided by Audrone Steponaitiene, Information Systems Department, The Library of the Lithuanian Academy of Sciences, <http://www.mab.lt>



(NIBG), and the National Institute for Art History (RKD) and the National Institute for Cultural Heritage (ICN) formed the board of this organisation and were to guarantee its impact and secure its vanguard position.

Government funding

Meanwhile a slightly growing government budget was allocated to the cultural heritage field, directly, and through subsidies distributed by the Mondriaan Foundation (<http://www.mondriaanfoundation.nl/>), a private organisation with strong government ties, managing a range of funds designed to stimulate and support high-quality cultural production in the Netherlands. Its Fund for Public Oriented Digitisation is closely monitored by a committee consisting of members from heritage institutions with a long experience in digitisation, and other experts in the field.

Another important body in this regard is SURF, the higher education and research partnership organisation for network services and ICT. SURF acknowledges the added value of using digitised cultural heritage for education and research and earmarked funds to support a vast array of projects. They include studies on Digital Rights Management and the construction of the SURFnet Video Portal (<http://www.surfnet.nl/en/innovation/surfworks/svp/>), providing the academic community with seamless access to hundreds of hours of archive material.

Major joint initiatives

Collection management information was the first logical choice of many institutions when confronted with the task of creating public access to digital assets. One of the first institutions that approached the matter from a different angle was the National Museum of Natural History, Naturalis (<http://www.naturalis.nl/>). Based on Web site users' feedback, staff at Naturalis reasoned that a focus on knowledge, rather than on collection management information, should be the central concern of public-oriented digitisation. Together with the National Museum of

Anthropology, the National Museum of Archeology and a recently founded technology company, Naturalis initiated the 'Leidse Poort' project (<http://www.leidsepoort.nl>), a knowledge-oriented experiment to create an interoperable knowledge base, fed by the three different institutions, their knowledge and collections. Naturalis also used this model to connect a variety of organisations in the field of nature, the environment and natural history into a nature-oriented knowledge infrastructure. The potential of this initiative, which could be of general interest within the context of the emergent knowledge economy, has led the Ministry of Economic Affairs to invest successfully in three more experiments with this organisational model and its technological base.

The vast and ever growing collection of Dutch audiovisual heritage is safeguarded by The Netherlands Institute for Sound and Vision (NIBG, <http://www.nibg.nl/>). With financial support from the government, NIBG started an ambitious project that will eventually support flexible online access to its holdings of legacy material and the daily broadcasts on radio and television. In the iMMix project, NIBG co-operates with the public broadcasters and also seeks ties with commercial broadcasters. Central to iMMix is the IFLA-FRBR metadata standard, modelled to meet the demands of the audiovisual domain.

In the two years following its inception, the Netherlands Digital Heritage Association has created a 'reasoned' portal on an increasing number of collections, supporting queries, but also offering virtual exhibitions, an agenda and an intuitive fuzzy query tool. The main strength however lies under the surface, because this portal, Cultuurwijzer (<http://www.cultuurwijzer.nl>), 'plugs into' the infrastructure that also supports the innovative experiments initiated by Naturalis.

Furthermore, in 2000, a large government-sponsored project, 'Memory of the Netherlands', initiated and managed by the Royal Library, was launched as another attempt to create an extensive digital collec-

tion using material from various sources and institutions, in a co-ordinated and standardised way. Participants in this initiative are supplied with digitisation guidelines and management models.

Recent actions

In 2002, a first and full-grown policy framework was elaborated.³¹ The policy states that digitisation, whatever its rationale or purpose may be, has to secure a steady increase of a national collection of digital surrogates, which can be re-used and hence should conform to certain standards, demands of durable management and accessibility.

Recently the Dutch government has announced its intention to increase investments in infrastructure programmes and quality assurance for digitisation. The need for clear standards, implementation scenarios, management models and innovation certainly also guides the identification of research objectives. A parallel approach, in which the development of new environments of knowledge transmission is paired with the creation of digital resources, is expected to characterise this promising policy period in the history of Dutch digitisation.

Later this year, an IT research programme for digitised cultural heritage will be launched with the support of the Netherlands Organisation for Scientific Research (now, <http://www.nwo.nl>). A consortium of IT research institutions, leading cultural heritage institutions and a number of commercial parties in the Netherlands will collaborate in this ambitious so-called DPL³² Light programme. DPL Light will develop new methods and techniques in the domain of multimedia and agent technology to support the cultural heritage sector effectively in their interaction with (among others) researchers and the general public. Much is expected from this initiative which will run until 2009.

³¹See <http://www.cultuurtechnologie.nl/policy.htm>

³²DPL = Digital Production Line. It is called 'Light' because an earlier, more extensive programme, did not receive the support needed.

The Lund Action Programme and the Dutch presidency in 2004

The Netherlands is participating in the EU Lund Action Programme, managed by Minerva. The Dutch government has actively adopted and adapted the Benchmarking Framework to identify good practice, to monitor progress and to assess the effectiveness of its recently formulated digitisation policy. In a draft 'Position Paper on EU Added Value and Post Lund Strategy' the Dutch National Representative outlined its vision of a 'Digital Continuum of European Cultural Heritage', an area of interconnected digital resources. Questions of interoperability, quality and permanence (durability and preservation) are central to this vision. During its EU presidency in the second half of 2004, preceding the meeting of the National Representatives Group, a conference focusing on these issues will be held at The Hague.



POLAND

News

The Polish Internet Library (<http://www.pbi.edu.pl>), established in December 2002, has increased its collection of digitised items from the recently reported 260 to over 9000 items! A list of currently available titles can be accessed from the homepage.

The Polish Ministry of Culture has joined the MINERVA project. Brief reports about digitisation in Poland were presented at the MINERVA meeting in Parma along with other NRG reports. Participation in this important programme should help to co-ordinate digitisation in Poland, especially in co-operation within the European network.

Museum of Computer Technology

21 January saw the opening of the first Polish

museum of computer technology at Komputer Expo 2004. MBM Ontrack, the organisers of the museum, collected over 100 unique computer hard disks and other pieces of memory. Among the most interesting objects were ferrite memory from 1970 and punched cards from 1978 for the IBM S/360, Polish Odra and Russian RIAD JS-R32 main frame computers, Hungarian 8-inch diskettes, and magnetic tapes. There are also some unique disks: one weighing 32 kilos built with nine 15-inch plates, and a 34-year-old IBM 391X disk with 60 MB memory.

All the resources have been collected since October 2003 and come from a variety of sources. The museum is located in Katowice, an urban district of Poland, at the headquarters of MBM Ontrack, a company that offers data recovery services, <http://www.mbm.com.pl/>.



SERBIA AND MONTENEGRO

Digitisation in the National Library of Serbia³³

The National Library of Serbia took its first steps in the field of digitisation a few years ago, and aimed to build a Digital National Library of Serbia, a virtual institution parallel to the physical one – the true library without walls. We are now getting a little closer to this idea and have a huge number of scanned pages, a few international project collaborations, and the special Department of Digital Library which is dedicated to taking care of digitisation from paper to the digital collection.

For the first time, in 2002 we started to digitise systematically for our own project

Technical Protection of Library Materials. We had problems with damaged daily newspapers from the beginning of the twentieth century, which were frequently sought by users. The project includes microfilming and digitising these old newspapers, *Politika* and *Pravda*. The number of scanned pages is now about 23,000. The pages are scanned at 300 dpi and are migrated onto DVDs from time to time, meaning that our users can read these digital documents while we are still researching software for Web access. The problems encountered were largely due to the Cyrillic alphabet and the poor condition of analogue material.

The Retrospective Conversion Project resulted in a digitised *Printed Catalogue of Books on Languages of Yugoslav Nations and Nationalities* from 1868 to 1972. Volumes are scanned, available on the Web as images and searchable from the Web page: <http://nainfo.nbs.bg.ac.yu/katalog>.

For one private research project (on wars in Yugoslavia in the 1990s), several thousands of pages from the daily newspaper *Politika* between 1990 and 1995 were scanned, after careful selection of articles about the destruction of Yugoslavia. This digital material is currently held on compact disks, awaiting a software solution for Web access.

We are participating in two international digitisation projects: first the International Children's Digital Library Project (ICDL, <http://www.icdlbooks.org/>) for which we have already digitised 80 of 100 children's books; secondly, the Million Book Project (<http://www.archive.org/texts/collection.php?collection=millionbooks>) for which we are selecting the books to present in this world digital library.

The National Library of Serbia strongly supported the idea of constituting the National Centre for Digitisation in Serbia (<http://www.ncd.matf.bg.ac.yu/>) from the

³³Information from Tamara Butigan-Vucaj, Department of Digital Library, National Library of Serbia, Belgrade.



beginning. We recognised in the Centre the real partner for building our digital library, implementing the standards for digital documents, and developing software and hardware solutions for digital collections. There was recent co-operation between the Library and the Centre in testing *Greenstone*, the Open Source software for digital libraries, downloadable from <http://www.greenstone.org>. This software is very close to being used in the Digital National Library of Serbia – the interface has been translated into Serbian and demo collections have been created. Along with the National Centre for Digitisation, we are considering the possibilities of writing our own software for a digital library, which could meet our needs regarding Serbian, Cyrillic and the representation of documents.

Digitisation in the National Library of Serbia will continue into the future. We have

a lot of holdings to digitise, which have huge cultural value for a wider cultural space. We hope that Serbian cultural heritage will become a part of the world's digital treasures and will be physically protected at the same time.

Event

NEW TECHNOLOGIES AND STANDARDS:

Digitization of National Heritage 2004

Dates: 3-5 June 2004

Venue: Belgrade, Serbia and Montenegro.

The aim of this conference is to present and exchange experiences with new information technologies, standards and other fields in the area of digitisation of cultural and scientific heritage, and to facilitate future co-operation.

For more information, please visit <http://www.ncd.matf.bg.ac.yu> or e-mail ncd@matf.bg.ac.yu.

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DISTRIBUTED PROOFREADING

It is possible that, instead of outsourcing time-consuming proofreading of digitised documents, projects and institutions could now benefit from free proofreading by enthusiastic volunteers. Project Gutenberg's Distributed Proofreaders (<http://pgdp.net/>) have set up a model where scanned images are presented online with raw OCR'd text and volunteers are encouraged to proofread texts through their browsers. This model is now being used not only by the PG e-books project (<http://gutenberg.net/>), but by several other projects including the Christian Classics Ethereal Library (<http://ccel.org/>), Project Runeberg (<http://runeberg.org/>), and Meyers Konversationslexikon (<http://meyers-konversationslexikon.de/>).

Lars Aronsson, of Project Runeberg, states: 'The method makes a lot of economic sense, not only because it uses volunteers, but also because it allows a separation, in space and time, of the physical, mechanical, and potentially automated scanning from the manual and time-consuming labour of proofreading.'

For more information, see 'Distributed Proofreading' by Dr G. B. Newby and Charles Franks, available online at: http://www.ils.unc.edu/~gbnewby/papers/jcdl_newby_dp-charlz3.pdf

NEW REPORT ON THE INFORMATION LANDSCAPE

The Online Computer Library Center (OCLC, <http://www.oclc.org/>) has assembled the knowledge and expertise of over 100 experts from around the globe to produce a high-level view of the current information landscape. The report, entitled 'The 2003 OCLC Environmental Scan: Pattern Recognition', considers the issues faced by libraries, museums and archives, based on the input of information professionals along with detailed research. The OCLC hope that the report will assist in planning strategies for the future and encourage a healthy discussion within the sector.

The report can be viewed online or ordered as a print copy by visiting <http://www.oclc.org/info/escan/default.htm>. With the Association for Library and Information Science Education (ALISE, <http://www.alise.org/>), the OCLC has announced several new research grants in the area of Information Science Research. For more details, visit <http://www.oclc.org/research/announcements/2004-01-09.htm>



POSSIBILITIES AND MANAGEMENT OF OUR DIGITAL ASSETS

PAOLO BUONORA, DigiCULT FORUM STEERING COMMITTEE
INTERVIEW BY DAISY ABBOTT.

The original goal of many digitisation projects – like our Imago project in the Rome State Archive (<http://www.asrm.archivi.beniculturali.it/English/descrizione.html>) – is to provide virtual access to materials. While this has the obvious benefit of putting cultural heritage within the reach of the thousands of people who might never enter our reading room, there are also many resulting benefits for which projects aim. In many ways, fragile documents are protected by the fact that only a specialised section of the public accesses them. Virtual materials can be used in lieu of original documents, thereby preventing damage, which means less expense for restoration, and a digital asset can take on part of the role of the object it represents, to the point that digital objects can not only be viewed and interacted with, but actually sold in their own right. A digitisation project clearly has many subtle and far-reaching advantages for people wishing to use its material. Internet access saves time and money as documents can be accessed from anywhere in the world, and allows users to search for certain items without knowing necessarily where they are held (for example, through a Web search engine: the problem is that important digital resources for cultural heritage are hidden in the ‘deep Web’, therefore Web search engines do not provide a full solution at the moment). Digital objects can also be used in ways which are physically impossible for the real objects themselves – computer aided text searches of OCRed documents or ‘zooming in’ on images – which both speed up and ease traditional research methods, and create new methods of digital research.

It is for this reason that I believe that digital assets should not be referred to, or thought of, as ‘surrogates’ – a definition

which implies inferiority to the original. We have to be clear that using a digital object is inherently different from using the original, both in form and in experience, but that it can also *offer* more than the original document, as technologies of ‘enhanced vision’ and 3D simulations show. Providing a good digital ‘copy’ is not enough; we must appreciate that a user approaches a digital object in a different context from the one he is used to – virtual access dematerialises the content – therefore it would be useful if we could also attempt to emulate the real, ‘natural’ research activities happening in our reading rooms (e.g. face-to-face exchange of opinions and information between researchers). It is extremely difficult to ‘digitise’ the experience and practice of people,³⁴ therefore it is difficult to find a balance between expanding research possibilities and losing the traditional context. As an example, consider cartographic documents: using a large map, finding a path between point A and B is a process of trial and error. Unless you can reproduce actions in a digital way (e.g. with zooming and navigation software), digitising an image of the map will be useless for this purpose because the user will not be able to carry out the same actions in the digital context.

It is important to remember that, in the cultural heritage sector, we cannot hope for major technological developments in the field of humanities only – we adapt for our purposes technologies developed for other (not necessarily commercial) sectors. High-quality scanning devices, developed in space agencies, are now prevalent in our field and have been adapted, for example, with specific digital formats for cartography. My own work in digitisation has identified the importance of appropriating technologies for use in Digital Assets Management Systems,

specifically for collections of digital images.

Until recently images were usually only available in low resolutions on Web sites. There were three primary reasons for this: image server technology was not available, the necessary network bandwidth was lacking, and content owners wished to manage access to their resources. The solution to the technical problem of managing very large format images came from the space satellite world. For military or geographical purposes, assembling and managing large images is crucial; the development of sensors capable of recording substantial levels of detail required newer software technologies which could build a large image piece-by-piece and retain detail. This was the origin of multi-resolution formats, which store several different resolutions of the subject in a single file – or in a hierarchical structure of files. The first civil context to adopt this approach was cartography – modern cartography remains oriented to vector rather than raster representations.

In 1996 the Library of Congress (<http://www.loc.gov/>) decided to digitise its map collections at a high resolution and to allow free access (including image download) to the general public.³⁵ To make the project viable they adopted MrSID, a multi-resolution format from

³⁴Although a simple discussion list is a very powerful tool to exchange research experience, for example, the Lineamenta project <http://www.biblhertz.it/italiano/home/default.htm> planned to make a permanent forum for virtual readers.

³⁵See *Creating and Distributing High Resolution Cartographic Images* by David Yehling Allen, in RLG DigiNews, August 1998, 2/4 (available on <http://www.rlg.org/preserv/diginews/diginews2-4.html#feature>), and the American Memory Web site: <http://lcweb2.loc.gov/ammem/gmdhtml/gmdhome.html>



Lizardtech (<http://www.lizardtech.com/>). The project was a success and its approach became a reference standard. This approach has been widely imitated although it is limited by the fact that in most cases high resolution images are unnecessary; they are expensive for the provider and slow for the user if image server technology (which could provide faster access to a very big multi-resolution file than to a medium-size jpeg file) is not available. The other most used format for high-resolution images is ECW by ER Mapper (<http://www.ermapper.com/>), which is mostly distributed in the modern cartographic service world. In Italy a national portal which provides access to our official cartography is available from <http://www.atlanteitaliano.it>.

Different approaches to multi-resolution images are the use of a hierarchically organised common image format (such as that used in the Imago II project in the State Archive of Torino (<http://ww2.multix.it/asto/ricerca.htm>) and other Italian State Archives) or the development of a bespoke multi-resolution solution. XLImage software (<http://www.xlimage.it>) developed in Florence for cultural heritage applications is one example.³⁶

My experience managing the migration of 130,000 images from the State Archive of Rome (<http://www.asrm.archivi.beniculturali.it>) into MrSID format showed that this process is very time consuming and would be impossible without appropriate technology (the Lizardtech Encoder 4.0 in our case).

In this context the problem is a lack of choice. For example, JPEG 2000 (<http://www.jpeg.org/jpeg2000/>),³⁷ which should include wavelet compression and multi-resolution functionality, is not yet widely used by software developers. However, Daniel Lee, of the ISO's JPEG group, states that 'JPEG 2000 offers a very comprehensive set of features in a single format and obviates the need to maintain two sets of files for each image. I definitely

recommend that cultural heritage institutions use JPEG 2000 as a single preservation and delivery format' rather than keeping master files in a TIFF format and supporting an expensive storage system.³⁸

I believe it is possible for image server technology to effectively balance access with financial protection of the digital assets³⁹ provided that we remember free access by online users is not intended to meet the same needs as services provided to professionals or commercial users. Another benefit of including image server functionality in a DAMS is the possibility of combining image and text formats for digitised documents, increasing research functionality as discussed above. Lizardtech's DejaVu format (http://www.lizardtech.com/solutions/doc/ifilter_plugin.php) achieves this by having two layers, a photographic layer with a highly compressible text layer 'hidden' underneath. This solution was used by both the National Library of Prague (<http://www.memoria.cz/>) within the UNESCO Memory of the World Programme and JACAR of Japan Archives (http://www.jacar.go.jp/f_e.htm) who have made available roughly three million images of finding aids and other documents.

The combination of image server technologies with Digital Asset Management Systems creates an environment in which the image assets can be managed to deliver a range of functionalities to a diversity of audiences.

³⁶Cf DigiCULT.Info, Issue 1, July 2002, p. 8: <http://www.digicult.info/pages/newsletter.php>

³⁷The main company developing JPEG 2000 at the moment is Luratech in Berlin: <http://www.algovision-luratech.com/>

³⁸Please see 'Editor's Interview: JPEG 2000. Dr Daniel Lee, ISO SC29/WG1 (JPEG)' in *RLG DigiNews*, vol. 6/6, December 2002:

<http://www.rlg.org/preserv/diginews/diginews6-6.html>

³⁹Cf Guntram Geser 'Case Study: Octavo - Bringing the Capabilities of Advanced Digital Media to Rare Books and Manuscripts' in *DigiCULT Thematic Issue 2*, December 2002, p 27: <http://www.digicult.info/pages/Themiss.php> and Octavo Web site: <http://www.octavo.com/>

WORLD SUMMIT ON THE INFORMATION SOCIETY

The United Nations World Summit on the Information Society (WSIS) took place in Geneva on 10–12 December 2003. Heads of State and Government and senior ministers from around the world discussed a Declaration of Principles governing the global information society and a Plan of Action to guide countries in their activities. This hugely significant event is thought by many to have been the most important political event dedicated to the Information Society since the European Commission coined the phrase in the mid-1990s.

A second session of the World Summit will take place in Tunis in November 2005. Please see <http://europa.eu.int/rapid/start/cgi/guesten.ksh> for more information.

THE TECA PROJECT: ECUMENICAL TESTIMONIES AT THE CITTADELLA OF ASSISI

ANNA NABOT (GALLERY CURATOR, CITTADELLA OF ASSISI) & IVAN GROSSI (PROJECT MANAGER, TECA)



© Pro Civitate Christiana, 2004

Purificato, Domenico - Gesù divino lavoratore - olio su tela (100 x 70cm) 1956

The Cittadella of Assisi

The Pro Civitate Christiana, found in the heart of Assisi, is an association of men and women who wished to experience modern everyday life as part of a religious community and live together as a group of worshippers. Founded in 1939 by Giovanni Rossi, a priest from Milan, the association built a sort of modern Abbey, la Cittadella, for people from many different regions to come together to talk. The Abbey offers roof gardens, meeting rooms, a theatre, and a museum, the Christian Observatory. The museum was designed so that its visitors could better appreciate, surrounded by a unique silence, the beauties of art and nature. The museum's collections have a Christian theme. It is divided into three sections, a library, an art gallery and a record library.

- The Library holds some 70,000 books on Christianity and every year organises seminars where philosophers, writers,

researchers from different cultures, religions and races are invited. The Library also holds a set of early printed books (17 of the sixteenth century and 31 of the seventeenth century).

- The Gallery of Contemporary Art holds some 4500 paintings, sculptures, and ancient and modern engravings, mostly depicting the life of Jesus and with a particular theme of Jesus as the Divine Worker. The majority of these holdings were produced specifically for the Gallery by artists such as Giorgio de Chirico, Carlo Carrà, Ottone Rosai, Mario Tozzi, Francesco Menzio, Aligi Sassu, Agenore Fabbri, and Fausto Pirandello. The Gallery also holds many works by other contemporary artists. The collection is not exclusively contemporary and includes some 1600 engravings from the sixteenth to the nineteenth centuries and the complete set – one of the few in the world – of Georges Rouault's 'Miserere' (58 engravings which were produced between 1922 and 1928).
- The Record Library has over 10,000 items in its collection including an important collection of 78 rpm records (1618 items), mostly of sacred music. As with the art gallery's holdings, some items were expressly created. Examples include modern recordings of oratori composed by Bertolucci, Renzi and Rota for the annual Seminar on Christian Studies.

The TECA project

At the end of 1997, Ivan Grossi submitted to the management of the Pro Civitate Christiana the draft of a project to promote these special collections, which are not yet well known throughout Europe.

The proposal concentrated on ways to achieve the following goals:

- digitisation of the most important items in each collection and making them accessible over the Web;
- creation of a digital catalogue of items collected under the three sections (Gallery, Library and Record Library);
- creation of an integrated information system for the three separate sections of the Cittadella and its management over the Web.

After the initial proposal, it took roughly a further four years to raise funds. The Italian *Ministero per i Beni e per le Attività Culturali* (Ministry for Cultural Heritage) funded the project under the framework of Law 513/99. The part of the project financed by the Ministry ended on 31 December 2003.

The Gallery of Contemporary Art

To help promote the collections of the Gallery, the project aimed at digitising a significant subset of the masterpieces to create an archive of high-resolution digital objects. Basing an estimate on the funds which were made available, a subset of 2692 items were selected, including paintings, sculptures, ceramics and majolica (tin-glazed earthenware). A set of very precious ancient engravings was included in this subset (see Chart 1). Objects were digitised using a professional camera (Cambo) provided with the Better Light Super 8k scanning back and stored in uncompressed TIFF format. The computer used was an Apple Power Mac G4/733 with Adobe Photoshop v. 6.0 software. Quality testing was achieved with a Barco reference calibrator V Monitor. Most items were digitised directly; however, a small set of sculptures was located outdoors, which necessitated capturing images of them on 10x12 film. These photographs were then scanned by a professional external service.

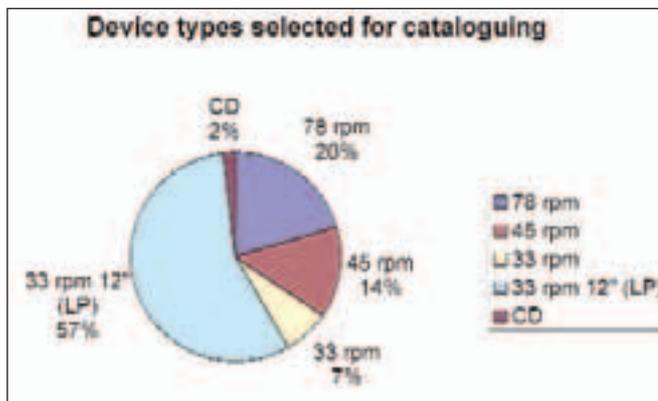
For each of the selected types, the number of shots had been previously defined (see table). For items comprising several different parts (e.g. Via Crucis) it was decided to take a general view shot and a supplementary image for each component. In a few selected cases it was also decided to include a specific shot of certain details.

Type of item	Number of shots
Painting	1
Sculpture	6 (every 60°)
Bas-relief	3 (0°, +45°, -45°)
Ancient engraving	1
Medal	2 (recto and verso)
Shot(s) per type of item	

Almost all paintings were digitised without the frame, with the exception of artworks where the frames were selected by artists themselves (for example, De Chirico's masterpiece) or where removing the frame could have compromised the integrity of the painting. Quality was specifically tested to ensure the high standard of these digital objects. Due to the very high resolution of the scanning process, a supplementary check was introduced in addition to the standard quality checks. Each image was enlarged on the Barco monitor as much as possible to check whether dust or small liquid drops were recorded during the digitisation process. Viewed at very high enlargements, these impurities can be detected as they split light into the three basic colours.

Subsequent to the digitisation process, the digital archive contains three sections:

- the high-resolution section holds 3300 uncompressed digital objects in TIFF format;
- the medium-resolution section holds the same number of digital objects but they have been compressed by approximately 90% and are stored in PNG format;
- the low-resolution (thumbnail) section stores all 3300 digital images in JPEG format which are compressed by 80% more than the PNG files.



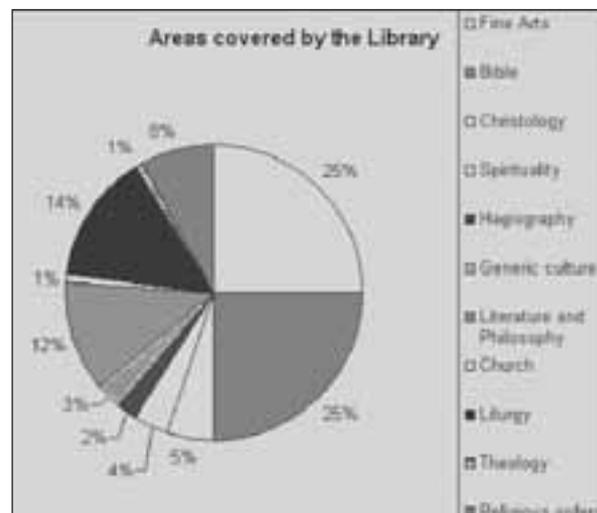
The storage environment for these digital objects is provided by an Oracle DBMS. A specific naming system was set up to make access to each digital object unambiguous. From the file name it is possible to find out the following information directly: the catalogue number of the work, the resolution, the angle of view, whether this is the general view or a smaller part of the work. Each work is assigned a cataloguing record (according to national standards).

Thanks to an agreement with the Umbria Region Library System (URLS), it was possible to integrate catalogue records for around half of the library's collection (nearly 35,000 records). The library is quite specialised, with over three quarters of its books on Fine Art, the Bible, Liturgy, Literature and Philosophy. The library catalogue is available via OPAC on the URLs. As previously mentioned, some of the material selected for digitisation was a small set of seventeen early printed books (Cinquecentine) containing around 3400 pages. Every one of these pages has been digitised and will be available through the project portal. Each page will be water-marked with the Rea Compressor software. For budgetary and size reasons, fourteen of the books were

digitised to include two pages per digital shot, although all of the larger volumes have only one shot per page. Two of Cinquecentine's books (*Vita di Giesu Christo Nostro Redentore scritta da Landolfo di Sassonia dell'ordine certosino*

(printed in Venice, 1570) and *Del trattato della grandezza della Terra, e dell'acqua, di M. Alessandro Piccolomini, a Monsignor di Corfu* (printed in Venice, 1558)) will shortly integrate each page as a full-text version hidden behind the digitised page, which will allow a full-text search. These images show the front covers of the Cinquecentine texts which will have full electronic text attached.

As already mentioned, the Pro Civitate Museum (the Osservatorio) includes a section for audio records. The collection was begun in the early 1940s and since then it has developed according to the main goal of the founder of the Pro Civitate Christiana, i.e. to create a modern Abbey open to all arts and to all religions. The TECA project ensured that an updated online catalogue was created (which will be available shortly at the project portal:





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Piccolomini, Alessandro - Del trattato della grandezza della terra e dell'acqua - Venezia, Giordano Ziletti, 1558



© Pro Civitate Christiana, 2004

Landolfo di Sassonia - Vita di Gesu Cristo - venezia, Iacopo Sansovino Il Giovane, 1570

<http://www.prociutate.assisi.museum>). It was also important that digital copies (analogue to digital) of most rare or damaged records were created. It was mostly the oldest 78 rpm records which were digitised. It is planned that these digital copies will be made available to users of the record library, which will help to preserve these precious records. The analogue to digital conversion is still under way using a suite made by a laser record player: ELPj (<http://www.elpj.com/>).

The suite comprises an analogue/digital converter at 48 kHz and a DTRS tape recorder at 24 bits. Very damaged records will be digitally restored, but the process has not yet been started mainly due to different opinions among experts on the opportunities and philological correctness of the restoring process.

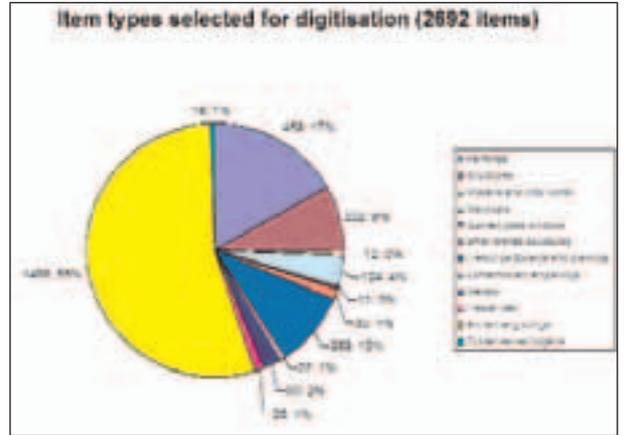
The TECA project has created a digital catalogue for 7963 of the 10,000 museum artefacts as demonstrated by the chart above. As is apparent, over half of the objects are engravings, but many other types of artwork have been included also.

The project portal:
<http://prociutate.assisi.museum>

Now in an advanced testing phase, the project portal will soon be available at the address above. Through this portal, all digitised objects will be available and can be accessed using a powerful search engine which operates across all archives with the exception of the Library archive. Sections devoted to news and to virtual visits are easily accessible on the home page. On the same page there are links to the Ministry of Cultural Heritage, the URLs (Umbria Region Library System), the Cittadella Library Catalogue and all Umbria libraries catalogues, the Umbria Region



Carra, Carlo - Fuga in Egitto - olio su tela (50 x60 cm) 1958



Portal for Culture and Tourism (<http://www.umbria2000.it>) and the Diocesan Museums Network (DMN) Web sites.

The technology behind the portal includes a content management system that allows curators and librarians to continuously maintain updated portal content.

Conclusion

The Ministry-funded part of the TECA project started formally in October 2001 and ended in December 2003. The project will continue for about twelve more weeks to complete all formal activities related to copyrights and the testing of the portal. The Library Catalogue was implemented by Conser – Perugia; the Digital Photographs were taken by Roberto Vaccai and Mauro Scarpelloni; Ancient Engravings have been catalogued by Beatrice Cuniberti – Florence; The Gallery Catalogue has been implemented by Francesco Santaniello – Terni; Cinquecentine's have been digitised by AM Automazione Microfilm – Bologna; the Record Library Catalogue has been implemented by Associazione Multimedia – Perugia; Analogue to digital records conversion by University of Perugia; the design and implementation of the Web portal and of the content management system are by Horizons Unlimited – Bologna; and the design and management of the information system by Cittadellamultimediale – Assisi.