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EPOCH

**Excellence in Processing Open
Cultural Heritage**

Network of Excellence
Information Society Technologies

**D.2.9 Research Agenda v2
(including background from Sector Watch)**

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Contents

Contents	ii
Executive Summary	5
1. Introduction.....	6
2. Lessons from the DigiCULT Forum’s roadmapping work “The Future Digital Heritage Space”	9
2.1. Developing a systematic and broad enough framework	9
2.2. Ensuring a high level of participation and expertise.....	10
2.3. Establishing instruments	11
3. Maturity life-cycle	12
3.1. Overview of the model.....	12
4. Characterisation of communities represented.....	16
4.1. Preparing FP7: Brainstorming meeting on “Digital Libraries and Living Heritage - The user as creator” (Luxembourg, 27th – 28th Feb 2006) [1]	16
4.2. EPOCH WORKSHOP, ICCROM, (Rome, Italy, 5th – 7th March 2006) [18]	17
4.3. New Heritage: Beyond Verisimilitude, a conference on cultural heritage and new media (Hong Kong, 12th - 14th March 2006) [2]......	18
4.4. Grand Challenges in Computer Science Conference (Glasgow, Scotland, 22nd - 24th March 2006) [3, 4, 5]......	18
4.5. Preserving Our Past workshop (Birmingham, England, 29th March 2006)	20
4.6. EPOCH Research Agenda Workshop “Research challenges and time horizons” (Florence, Italy, 2nd – 3rd April 2006) [7]......	20
4.6.1. From Common Infrastructure to Grand Challenges	22
4.7. European Workshop on Culture and Technology (Pistoia, Italy, 8th – 9th April 2006) [8]	23
4.8. UK Arts and Humanities Research Council, ICT Research Methods Network Expert Seminar on Virtual History and Archaeology (Sheffield, UK, 20th - 22nd April 2006). [9].....	23
5. An Analysis of the characteristics of different perspectives.....	24
5.1. Perspective 1 – Technology companies.....	24
5.1.1. R&D driven companies.....	24
5.1.2. Market driven companies.....	25
5.2. Perspective 2 – Cultural heritage institutions	27
5.3. Perspective 3 – Cultural heritage expertise & service centres.....	29
6. An integrating framework.....	30

7.	Conclusions.....	32
7.1.	Grand Challenges as stimulus for the next generation of cultural heritage ICT	35
7.1.1.	Considering the incubation times of IT innovations.....	35
7.1.2.	Inter-disciplinary perspectives of Grand Challenges in cultural heritage ICT	35
8.	References.....	39
8.1.	Organisations and projects mentioned.....	40
8.2.	Other Related Literature	41
9.	Appendices:.....	43
	Appendix 1: Background document for the EC FP7 Brainstorming meeting “Digital Libraries and Living History” (Luxembourg, 27th -28th Feb 06).	44
1.	Objective	44
2.	Participants.....	45
3.	General background	45
4.	Organisation.....	45
5.	ANNEX 1: DRAFT AGENDA	46
	Appendix 2: Proposed grand challenge: Bringing the past to life for the citizen	49
	David Arnold,	49
	University of Brighton	49
1.	Character and Rationale.....	49
1.1	The vision.....	50
1.2	The tasks	50
1.3	Differences from existing six proposals	52
2	Proposers.....	53
3	Evidence of a UK community.....	53
4	Developing the proposal to full status	54
5	Matching the Characteristics of a Grand Challenge	54
6	Comments on Criteria of Maturity.....	55
7	Interesting Quotes/Facts.....	57
7.1	On Tourism	57
7.2	On Heritage in Education/Social Engagement	57
8	Bibliography/References.....	58
	Appendix 3: Preserving Our Past Workshop.....	59
	Appendix 4:.....	102
	Programme	102

Monday 3 April.....	102
6. WORKSHOP 1 EPOCH PROJECT	102
Appendix 5: EUROPEAN WORKSHOP ON CULTURE & TECHNOLOGY	105
Appendix 6: AHRC ICT Methods Network Expert Seminar on History and Archaeology	108
Appendix 7: Details on the DigiCULT Forum’s roadmapping work “The Future Digital Heritage Space”	113
Thematic areas	113
Online consultation	114

Executive Summary

The EPOCH activity in defining a Common Research Agenda is an integral part of fostering the development of a European Research Area in research on the support of ICT for Cultural Heritage. The principal benefits of a Common Research Agenda on research and technological development in cultural heritage ICT are in helping to shape the priorities for research effort, investment and formulating policy.

The last few months (February - April 2006) have been a very important period, internationally, for the development of research agendas for the support and interaction of the cultural heritage sector with technological solutions. A number of communities have been meeting and discussing their priorities for the next few years. They represent different constituencies, have different perspectives and different time horizons, but underneath the surface they are united by many of the challenges they face.

All of the following meetings have discussed research priorities in one form or another, with participation from EPOCH partners:

1. EC FP7 brainstorming workshop “Digital Libraries and Living History” (Luxembourg, 27th Feb 2006) [1]
2. EPOCH WORKSHOP, ICCROM, ROME, 5th – 7th March 2006 [18]
3. New Heritage Conference: Beyond Verisimilitude (Hong Kong, March 12th - 14th 2006) [2]
4. Grand Challenges in Computer Science Conference (Glasgow, Scotland, 22nd -24th March 2006) [3]
5. Preserving Our Past workshop (Birmingham, England, 29th March 2006) [6]
6. EPOCH Research Agenda Workshop (Florence, Italy, 2nd – 3rd April 2006) [7]
7. EUROPEAN WORKSHOP ON CULTURE & TECHNOLOGY (Pistoia, Italy, 8th - 9th April 2006) [8]
8. UK Arts and Humanities Research Council, ICT Research Methods Expert Seminar on Virtual History and Archaeology (Sheffield, UK, 20th - 22nd April 2006). [9]

In addition, the range of participants and their inputs into the debate means that previous contributions through the Sector Watch Activity in EPOCH [10], through the Digicult Research Agenda work [11,12] and through the Interactive Institute’s work on Museum Visitor Studies [13] have been contributed to the discussions and are referred to where appropriate here.

The report describes these developments and considers the range of communities represented to define a meaningful and integrated structure. This structure is proposed as the basis to develop a coherent Common Research Agenda, to which the many communities can relate their own interests and priorities. In this way the report seeks to contribute to progress across a broad front, by alleviating issues of fragmentation and duplication of effort, through the encouragement of cross-referencing and collaboration.

1. Introduction

The EPOCH activity in defining a Common Research Agenda is an integral part of fostering the development of a European Research Area in research on the support of ICT for Cultural Heritage. The principal benefits of a Common Research Agenda on research and technological development in cultural heritage ICT are that it can

- provide cues for RTD investment decisions by funding agencies by identifying critical research strands, current limitations and gaps, and ways to leverage RTD investments by coordinating research activities.
- be a useful tool to mobilise stakeholders and form project consortia to target identified key RTD challenges.
- provide the members of the ERA community with a longer term sense of purpose and direction to research planning, independent of the short-term priorities of individual funding agencies.
- stimulate monitoring progress along the way, and help to identify required related activities, such as provisions and measures for fostering the uptake and broader use of research by technology companies and cultural heritage organisations.

In this way the existence of a Common Research Agenda is expected to also foster a better cohesion of the communities involved, yield more efficient spending of the available funding, and result in better and more sustainable IT based solutions.

The last few months (February - April 2006) have been a very important period, internationally, for the development of research agendas for the support and interaction of the cultural heritage sector with technological solutions. A number of communities have been meeting and discussing their priorities for the next few years. They represent different constituencies, have different perspectives and different time horizons, but underneath the surface they are united by many of the challenges they face.

This report discusses the following meetings at all of which there has been EPOCH participation and all of which are informed by participants with substantial experience of previous work in assessing research directions and communities requirements. All of these meetings have discussed research priorities in one form or another:

1. EC FP7 brainstorming workshop “Digital Libraries and Living History” (Luxembourg, 27th Feb 2006) [1]
2. EPOCH WORKSHOP, ICCROM, ROME, 5th – 7th of March 2006 [18]
3. New Heritage Conference: Beyond Verisimilitude (Hong Kong, March 12th - 14th, 2006) [2]
4. Grand Challenges in Computer Science Conference (Glasgow, Scotland, 22nd - 24th March 2006) [3,4,5]
5. Preserving Our Past workshop (Birmingham, England, 29th March 2006) [6]
6. EPOCH Research Agenda Workshop (Florence, Italy, 2nd – 3rd April 2006) [7]

7. European Workshop on Culture and Technology (Pistoia, Italy, 8th – 9th April 2006) [8]
8. UK Arts and Humanities Research Council, ICT Research Methods Expert Seminar on Virtual History and Archaeology (Sheffield, UK, 20th-22nd April 2006). [9]

In addition, previous contributions through the Sector Watch Activity in EPOCH [10], through the DigiCULT Research Agenda work [11, 12] and through the Interactive Institute's work on Museum Visitor Studies [13] are taken into account. Two recent EC Reports on consultations have given some indications as to current thinking in the setting of research directions for the Framework 7 program [14, 15]. All these largely European initiatives complement others in North America, in particular the Commission on Cyberinfrastructure for the Humanities & Social Sciences [16].

This report begins by reviewing the lessons learnt in the conduct of the DigiCULT Forum's roadmapping exercise and then introduces a model to assist in understanding different constituencies' perceptions of the maturity of particular research directions. The various meetings listed above are then described in order to analyse the characteristics of each constituency.

The combination of the model of the research maturity life-cycle and the characteristics of the constituencies provides the basis of a consistent framework into which particular agendas can be placed. The report outlines this framework and begins the exercise of organising the various developments into a meaningful and integrated structure in order to develop a coherent Common Research Agenda, in which the many communities can see the relationship of their own interests and priorities to those of other groups. In this way the report seeks to contribute to progress in general, by alleviating issues of fragmentation and duplication of effort through encouragement of cross-referencing and collaboration.

Much of the content of the debate is relevant to areas well beyond the specific EPOCH remit of the "physical heritage of monuments, sites and museums" and into areas associated traditionally with the term "digital libraries". However, the powerful overlap in the areas of collections management and of the documentation of physical cultural heritage in monuments, sites and museums means that it is prudent to view the specific agendas in an integrated way.

Of particular importance in this respect are considerations of the research agendas and domain expectations driving the current developments in standards for collection descriptions – metadata. Here the requirements for long term interoperability could become potentially jeopardised by significant investment from different starting perspectives and the lack of an early consideration of a unifying approach.

After a short introduction, the next section analyses the various meetings from the point of view of the participating communities' disciplinary interests and objectives. The next section develops the notion of maturity in technological development in the context of the application of technologies to cultural heritage issues, and further extends the notion to a maturation life-cycle for conceptual developments in the thinking of those interpreting and communicating the significance of cultural heritage. This is followed by a

presentation of a potentially useful framework in which to categorize the various contributing agendas.

The report concludes by considering the recent guidance published on the research directions for FP7 and considers this guidance in relation to the longer term needs for research in ICT-enhanced cultural heritage. Finally, a brief outline of further work proposed to take the work forward and a set of appendices is included with some relevant documents from the events.

2. Lessons from the DigiCULT Forum's roadmapping work "The Future Digital Heritage Space"

In this section we briefly present some interesting results of the DigiCULT Forum's roadmapping work on RTD for future cultural heritage ICT, while details on this work, such as the thematic scope and online consultation are included in the Annex.

The DigiCULT Forum project was a FP5-IST supportive measure which from March 2002 to December 2004 monitored, discussed and analysed existing and emerging technologies likely to benefit the cultural and scientific sector in Europe and beyond.

In December 2004, the DigiCULT Forum project in their series of thematic issues published a research and technological development (RTD) roadmap, The Future Digital Heritage Space, with the aim to depict the possible future of digital cultural and scientific heritage in the next 10-15 years. [41]

Presenting and discussing some results of this roadmap should provide for a better understanding of the challenges implied in establishing the Common EPOCH Research Agenda.

We address the following three challenges:

- Developing a systematic and broad enough framework,
- Ensuring a high level of participation and expertise,
- Establishing instruments for a regular RTD roadmapping activity, including tools for assessing and reporting on progress.

2.1. Developing a systematic and broad enough framework

The Future Digital Heritage Space distinguishes six, partly overlapping thematic fields: "Intelligent heritage", "Contextual cultural information", "Natural and enjoyable interaction", "Create/recreate - 3D/VR/AR", "Large-scale & distributed systems" and "Persistent and perpetual access [to digital heritage resources]" (brief descriptions of these RTD fields are included in the Annex).

The results of the roadmapping work were published as a report of 80 pages, which was rightly termed by the authors "an expedition" to chart the mentioned six thematic "territories". The report did not have the ambition to create a systematic framework for in-depth interrelation and discussion of the findings.

Rather, for the six RTD areas it presented summaries of expert input to an online consultation and tabular overviews ("navigators") which give a condensed overview of what the experts thought could be achieved in the RTD areas over the next 10-15 years. Those tables contain a brief summary of what the experts considered to be the current limitations or barriers, and group the experts' suggestions on how to tackle them into the phases 2005-2009, 2010-2014, 2015 and beyond. The timeframes indicate until when a

certain methodological and/or technological gap could be closed or some other RTD breakthrough be achieved.

As a general framework, the authors used the IST Advisory Group's concept of Ambient Intelligence which informs to some degree the IST priority of the European Union's Framework Programmes for RTD (cf. [44, 45] and subsequent reports).

Related to this concept, they considered how a digital heritage space could emerge which is capable of handling increasingly complex information environments, applications and resources - within a wider landscape of ambient intelligence infrastructures. These would be provided by the ICT industries and include ever more massive distributed and embedded computing and communications, smart devices, novel interfaces, positioning and context-awareness technologies, etc.

Furthermore, the publication highlights the importance to involve heritage experts in cultural "experience prototyping", a new way of developing ICT applications which has been strongly suggested by the IST Advisory Group. (cf. [45, 47])

The rationale for this is that too often purely technology-driven projects, proof of concept with little cultural heritage basis and other shortcomings, have hampered the creation and dissemination of RTD results that should find their way into the heritage sector.

Therefore, the publication noticed the importance of new forms of collaboration and true interdisciplinary efforts, in which experts and practitioners from – and clients of – cultural and scientific heritage organisations (e.g. curators, archivists, educational programme managers), arts & humanities scholars and students, and experts from cultural hotspots such as historic city centres or larger heritage sites should be involved in a more effective way.

While this represents a stimulating contribution to a broader discussion on the possible role of ambient technologies in heritage environments, and on new forms of interdisciplinary collaboration, the expedition report, due to the broad thematic scope, could not have hoped to come up with a systematic description of how the future digital heritage space could evolve from the ongoing RTD efforts in the areas addressed.

The lesson that may be drawn from this is that EPOCH is well advised to consider a useful framework for the Research Agenda that is on the one hand broad enough to cover all relevant areas of RTD, and, on the other hand, conceive of a systematisation of the interrelationships between these areas to allow for observing achievements at their intersections as well as possible gaps in joint research that should be filled. A major basis for such a systematisation may form the architecture of interrelated components of the Common Infrastructure.

2.2. Ensuring a high level of participation and expertise

The Future Digital Heritage Space to a large extent builds on the results of an online consultation in which 64 researchers and professionals in cultural heritage ICT participated. Although the list of participants includes many renowned experts, it cannot be said that for each research theme of the consultation enough participants from the relevant research communities could be involved.

However, the summarised “Experts’ Views” and tabular “Navigators” provide a good starting point for further and more detailed discussions of some of the themes. A major limitation here is that the DigiCULT Forum project did not concentrate on EPOCH’s core field of tangible heritage (monuments, archaeological sites and related museums).

The lesson that may be drawn from this is that the EPOCH Research Agenda activity will need to ensure a sufficiently high participation of researchers with acknowledged expertise in the main areas of interest.

2.3. *Establishing instruments*

The DigiCULT Forum’s roadmapping work was a one-off exercise carried out in the last phase of the project in order to provide an outlook on what to expect in the future with respect to cultural heritage ICT. The major function of the DigiCULT Forum was to provide a technology watch mechanism (expert meetings, reports, thematic issues and an e-journal) on existing and emerging technologies likely to benefit the cultural and scientific sector. Its core target group were not research & technological development communities, but policy and institutional decision-makers, cultural networks, IT-staff in cultural heritage organisations, and digital curators, archivists and librarians.

Due to this orientation, the project could not implement a regular RTD roadmapping activity and develop tools for assessing and reporting on progress.

3. Maturity life-cycle

A major component of the Common Research Agenda is to recognise that different communities have differing perspectives on the perceived maturity of individual technologies. These perceptions have a fundamental impact on the communities' perception of the usefulness of pursuing a topic and hence on the priorities embodied in the agenda. For these reasons we are developing a model of the technology maturity life-cycle to serve as a tool to collect the views and assessments of the different communities and, in order to provide a consolidated shared framework, to summarise the different perspectives.

3.1. Overview of the model

As a starting point for developing such a framework we use the standard process model of how technologies develop and gain a broader level of use (cf. Rogers 1962, 1995; Moore 1991; Hudson 2002).

The standard process model does not include the research and technological development which gives rise to new technological methods and prototypes, which we include in the diagram below.

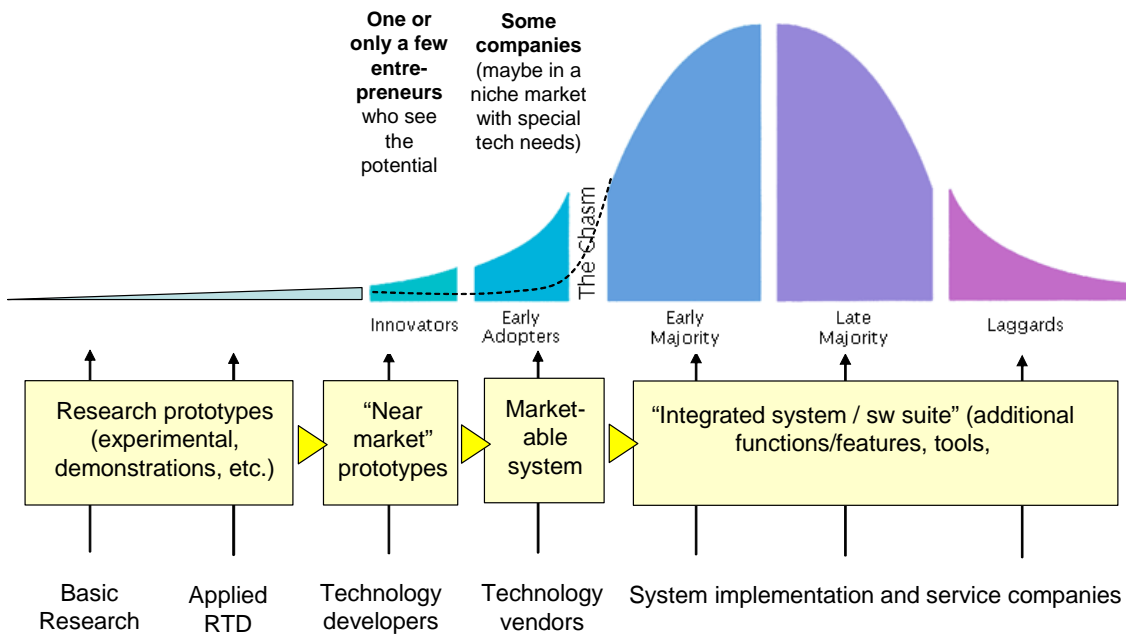


Diagram: Salzburg Research, 2006

The standard process model starts once technological research and development has reached a functioning and tested (prototype) solution, which is adopted by one or more innovative companies in search of a competitive edge. Then, industry solutions appear which usually target larger organisations, and find some early adopters, based on a more stable and scalable solution. Next, competing industry solutions appear which may also target smaller organisations, and are adopted by a much broader group of organisations, the so-called ‘early majority’. Then, the mature and well-served technical solution will

find a large, perhaps industry-wide ‘late majority’. Finally, even the most confirmed sceptics will decide to use it.

The process model developed by Geoffrey More (1991) specifically for “high-tech products”, such as content management systems or new consumer devices, identifies a “chasm” between on the one hand the first users (innovators and early adopters) of such products, which may still to some degree be immature, and, on the other hand, later customers who will only adopt a mature product.

Similar to this observation we understand that there is often a similar “chasm” between, on the one hand, plausible-in-principle solutions or prototypes developed in the framework of projects and, on the other hand, complete, turn-key software offerings – systems and tools that a user community needs and would like to use.

In most technology areas this gap is closed by certain types of technology companies who form an “interface” between RTD, market, and innovation-oriented customers (innovators and early adopters). However, as further discussed in a later section, such an “interface” has not so far evolved to a sufficient degree in the field of cultural heritage ICT (see: Non-RTD perspectives: Technology companies).

In the EPOCH Research Agenda activity [7, 18] discussions have started from the basis of asking “users” as represented by cultural heritage professionals via their user requirements, for perceptions of the priorities that they would place on particular developments. However the lack of technological awareness in such groups can mean that their conceptualisation of what might be considered a research issue represents real challenges, but challenges that a computing researcher would regard as operational. At the same time, the technologist’s view of a real research topic is perceived by the cultural heritage practitioner as verging on science fiction. From their own perspectives both views may well be right.

Thus, some “blue-skies” research may be undertaken (for example the investigation of some interesting properties of a new material). After a potentially substantial period of research the issues may become more engineering orientated (for example “can the material be manufactured in sufficient quantities, economically?” or “what is its environmental impact?”). As these issues are resolved successfully, the material may become usable in the redesign of particular equipment, with commercial interests bringing the new material to market in innovative and attractive products. Only at this stage will the original blue-skies research be turning into applications with economic return for the original research.

This research cycle may have taken a significant time during which the will to pursue the original line of research needs to be maintained if the initial promise is to be realised. Of course, in many cases initial promise will not be realised because it may be found that the initial concept failed to take into account some important factor and the research demonstrates that this factor is so intractable as to negate the potential benefits of the line of enquiry. Maintaining a decision to invest in particular lines of research is an issue of judgement, based on perceived benefits relative to perceived or actual costs.

Such judgement is often exercised for a combination of political as well as economic reasons, and as with all political decisions the one to progress will normally be made based on widespread support for the potential benefits, that is widespread in terms of those who contribute to the decision to support the work.

A complication arises for agendas that are based on interdisciplinary collaboration in that the range of contributing perspectives inevitably reduces the concentration of support. In particular, where an “end-user” element is involved in the decision making processes the perspective of benefits and timescales to address research issues will be different. Thus, the decision to approve a research agenda in terms of developing a new drug or surgical procedure is normally taken by a group with similar professional understanding, weighing different potential developments against each other and prioritising between them.

Decision-making on research in the applications of ICT has only appeared to operate in this way where a perceived commercial return, in terms of product sales, is envisaged. Justification for investment is in terms of capturing a percentage of a potential market, etc. Where research is required to deliver in terms of a social agenda, the picture becomes more complex and the decisions have to be informed by support from the socio-political arena. Securing this support is an integral part of pursuing the research agenda.

The issue of timescales is vitally important here because the research with the highest impact is almost inevitably going to reach maturity when it has had a fundamental impact on the working practices of the very application constituencies whose support is required. Those supporting the research direction therefore have to also become knowledgeable about the implications of the work, and the potential impact on working practices as the research progresses. Indeed, concern over this impact and sensitivity to the implications is likely to be a serious component in determining continued support for the research directions and may well impact on the effective timescales involved. Too rapid a change in itself may lead to resistance to embarking on the direction of travel.

In order to share the definition of a common interdisciplinary research agenda, the perspectives of the contributing disciplines must all be discussed and a common, realistic understanding reached, which is likely to involve compromise. Issues which are likely to be at the top of an application domain’s priorities are also likely to be shorter term considerations than the potential future directions which professionals in the ICT domain might envisage.

The contrast is often classed as “technology push v application pull”, but in truth the gap is wider than that and there tends to be little overlap in the two perspectives. The overlap tends to be in the engineering required to make practical use of the results of research by implementing a set of operational pre-conditions (e.g. agree standards or evaluate/educate business practices) before a genuine take-up can be achieved.

The issue is probably best highlighted in the area of standardisation for interoperability. In the discussions reported in the previous section, virtually every grouping of cultural heritage professional recognised the importance of standardisation in the ways in which our knowledge of the past was archived. This will have a fundamental impact on the ability to design systems which can interoperate, for example, bringing resources together

from a range of collections in order to respond to a need which an individual collection could not meet.

To many technologists the achievement of agreed technical standards is a tedious and time-consuming exercise which can only be undertaken after the research to demonstrate *potential* interoperability has been completed. Actually engineering a solution may be less interesting intellectually to the technological researcher, but is of fundamental importance to the business processes in the application domain, and to achieving market take-up of the research results.

To the application domain, the achievement of agreeing technical standards is a long-term goal and involves significant research on their part to understand the technical implications of the agreements being proposed. This process may well take several years and is normally an evolution as understanding is reached. The situation where, as is frequently quoted, “I like standards because there are so many to choose from” is a reflection of the continuing evolution of the proposed standards, as understanding of the implications of a particular set of agreements is realised in the application domain.

It is likely that the whole debate around the potential implications of take-up of “Dublin-core” (and its derivatives) and/or CIDOC-CRM as an approach to documenting knowledge about museum collections will become a manifestation of evolving understanding, complicated by existing investments and political willpower(s).

These debates also fuel the decision-making processes for research investment and may fundamentally influence the directions taken in the underpinning technological research and the evolving priorities in research there. For example, the assumption that multi-lingual applications will be based on a common standard for the ontology describing a collection might lead to research in one style of search based on embedded semantics. If the choice of common ontology is different, new constraints and search metrics may well need to be developed, and if the technology domain has to operate with multiple standards concurrently, then a profoundly different approach might be needed. None of these individual scenarios is yet a solved research area and each would take a different research program to investigate. The priorities for the technologists must depend upon those of the cultural heritage domain and they in turn can only take the decisions based on the advice on implications from the technologists. The process of evolving the agenda must be truly interdisciplinary in order to be maximally effective.

In the first year of EPOCH the consortium tried to ease these communications difficulties by creating a number of showcases intended to enable a shared understanding of current potential applications and the work that would be required to realise them in a business-like context.

4. Characterisation of communities represented

Each of the meetings referred to in the introduction was convened for particular purposes. Almost all of these motivations included a specific remit to develop a research agenda, and in all others the interdisciplinary nature of the events led to some discussion about the notion of working at the interface of cultural heritage and technology and the implications for future directions. This concentration of events provides a fascinating and unique opportunity to examine a snapshot of the perception and thinking of current state of results and relative importance of future directions, amongst professionals working in a broad range of contributing disciplines.

4.1. *Preparing FP7: Brainstorming meeting on “Digital Libraries and Living Heritage - The user as creator” (Luxembourg, 27th – 28th Feb 2006) [1]*

This event is described in [1] as

“The European Commission, unit 'Learning and Cultural Heritage', organises this workshop as part of a consultation process for the preparation of the first IST programme under FP7. An expert group have been invited to provide input to the definition of future research topics in the domain digital libraries, with an increased emphasis on creativity and on access to cultural resources.”

20 experts were invited to attend the two day event and debated around the research priorities represented in the title of the event. As with all such events the title reflects some expectation of the intended target, as does the selection of the invitees. In this case the balance was probably weighted more towards digital libraries, their services rather than the monuments, sites and museums communities.

There has been no public “final report” published from the exercise, but the discussion focussed around a number of themes including the topics and technologies that should provide the research focuses; the mechanisms that would best address those topics and an assessment of the strategic value to Europe of undertaking them.

A vision of the future was presented by Chris Batts, the CEO of the Museums and Libraries Association. He presented a view of a future where every citizen had a right to be able to get personalised access to information, integrated seamlessly across all available sources and treated as a commodity/basic service (comparable to the electricity or water supply). Topics which tended to dominate the discussion were;

- Various aspects of access to collections – most commonly more traditional collections of documentation objects rather than the diversity of museum and other collections of multi-dimensional, multi-modal and more performance orientated items
- Content creation by “users” most commonly thought of as “the educated amateur” rather than considering the “cultural heritage professional” as a

“user” of professional tools designed to support their work and allowing them to be more productive.

The degree to which these events can have shaped the IST Advisory Group’s draft report [13] on “Shaping Europe’s Future through ICT” is debatable, given the timing of the appearance of the report so soon after the brainstorming session. However, the ISTAG report appears to be consistent with the main interests of the majority in the debate held at the brainstorming session. This raises significant concerns about the suitability of FP7 to continue to support discipline-based ICT developments targeted at supporting the physical cultural heritage of monuments, sites and museums (see conclusions).

4.2. EPOCH WORKSHOP, ICCROM, (Rome, Italy, 5th – 7th March 2006) [18]

This workshop was the latest in a series of activities undertaken under the EPOCH “Stakeholder needs” and “Research agenda” activities. Following the latest meeting convened, a report drawing together the feedback gained in a series of meetings has been brought together [19], summarising the consultations and proposing a resulting structuring of the “common research agenda” being developed in EPOCH under three areas, as follows:

- Capturing technology: recording and documentation
- Interpretation, management and conservation technology
- Presentation and dissemination technology

These proposals arise out of a series of consultation exercises involving a broad representation of interests, ranging from individual cultural heritage professionals to organisations with cultural heritage, technological, political and/or policy focuses. The interests also range from those whose central objectives relate to research, to those involved in more operational roles.

The three areas proposed in the classification map directly onto different areas of what is described in the EPOCH program of work as a “pipeline” of processing cultural heritage data, which spans from collection of data from primary sources, integration, structuring and classification of information into collection documentation, and then analysis, interpretation and presentation to the public or for research purposes by cultural heritage professionals.

An overarching theme in the reactions of the professionals consulted was a scepticism of the degree to which the ICT suppliers had practical understanding of the constraints in both resources, and in operational processes, under which cultural organisations operate. The resulting prioritisation for research also appeared to reinforce this message, in that the aspirations associated with much of the proposed research were closer to reflecting the needs to make known technologies actually operate effectively in the cultural heritage sector, than to create new technologies to solve longer term problems to meeting perceived novel opportunities.

4.3. *New Heritage: Beyond Verisimilitude, a conference on cultural heritage and new media (Hong Kong, 12th - 14th March 2006) [2].*

This event was attended by about 60 delegates drawn primarily from professionals in the interpretation and presentation of cultural heritage. The event was significant in that the work presented was, in the main, targeted at the use of new media in the presentation and interpretation of cultural heritage. This focus highlighted the continuing and, if anything, expanding needs for curatorship skills, since the digital artefacts in themselves constitute cultural artefacts in their own right. These skills need to be enhanced in view of the complications that are introduced by technological obsolescence, the relatively fragile media used for longer term digital storage, and the continuously evolving formats recorded on those media.

This event was not explicitly discussing a research agenda, but the papers presented included many sections on “further work”, largely based around the experience of designing trial prototypes or case studies in the use of technologies by cultural heritage professionals interpreting particular areas of cultural heritage. This has the feel of an area in which the underlying theory of effective communication has yet to evolve, and the work to date has been largely exploratory application of more traditional interpretation principles. It seems likely, therefore, that there remains a stage in which the evolution of new principles and the adoption of new media to their best potential have yet to mature. It remains to be seen whether these new paradigms with their own principles will evolve with time in the same way as the transitions from theatre to cinema and later to television each started by emulation of the old metaphors and evolved into having their own distinctive features.

A final public report of the event has yet to be disseminated, but may well produce additional input from the perspective of the cultural professional into the wider research agenda debate.

4.4. *Grand Challenges in Computer Science Conference (Glasgow, Scotland, 22nd - 24th March 2006) [3, 4, 5].*

This event was a combination of the annual event of the Conference of Professors and Heads of Computing (CPHC) and the UK Computing Research Committee (UKCRC). It was attended by about 130 academics (mainly Professors) of Computer/ Computing Science. The majority were from the UKCRC which targets membership from the most research active in CS research and has a definite Science orientation (as opposed to Engineering).

The Grand Challenge movement has origins in the late 90’s in both the USA and the UK as a way of assuring the relevance of computing to real world problems. The recent Science 2020 report [17] shows that the concerns are still current. This report is the result of a Microsoft activity designed to demonstrate the challenges for Computer Science research up to 2020 and recommends the concept of “Grand Challenges” as a means to re-energise CS in UK universities.

“Computer Science teaching and research is currently at an awkward cross-roads where it needs to decide whether it is something that serves other disciplines, is an engineering exercise, or a real science in its own right. This report makes it clear that it can be a science in its own right. Its concepts and theorems are starting to prove fundamental in explaining natural and physical phenomena. However, clearly, there are significant aspects of computer science that are purely engineering. Both play a role in science. There is probably a good case to be made for calling each side separate disciplines. What is clear is that computer science needs to be re-energised in universities to inject new life into the discipline, and to focus around helping find solutions to grand “challenges”, some of which we outline here, rather than having a tendency to focus on issues that have little connection to the real world seen depressingly too often in computer science teaching and research.” [17]

It is interesting to note that the American Council of Learned Societies’ Commission on Cyberinfrastructure for Humanities and Social Sciences refer to the UK Grand Challenges criteria in their draft report [16].

David Arnold presented a proposal for a new grand challenge entitled “Bringing the past to life for the citizen” [5] which had been developed under the scheme in [3]. Proposals were expected to address a challenge that would not be met in the immediate future, with an expected time horizon of 15 or so years. The proposal is attached as Appendix 2 and includes a concentrated listing of the contributing research domains and progress needed to meet the challenge.

Following the presentation of the proposal at plenary session of the Grand Challenges conference, and following some discussion the concept was agreed for further development. Next stages of this development will be:

- a. A website associated with the Grand Challenge
- b. A workshop to bring together those elements of the CS community in the UK who are interested and wish to contribute effort to define the research agenda, foothill projects etc to take the ideas forward. A foothill project is the term used to describe an identifiable piece of work which is an early objective en route to meeting the overall challenge.
- c. Feed the Research Councils joint agenda expected to be developed under the Preserving Our Past agenda.

It must be emphasised that this agenda only represents some aspects of the cultural heritage interests – it is designed to demonstrate that new Computer Science is needed to deliver the cultural heritage agenda and that this can only happen with the full engagement of the cultural heritage community. Each community needs the other to produce the use-inspired basic CS research that is needed.

4.5. Preserving Our Past workshop (Birmingham, England, 29th March 2006)

The “Preserving Our Past” workshop was called by four of the UK’s research Councils (Arts and Humanities; Natural Environment; Economics and Social Sciences; Engineering and Physical Sciences) with English Heritage. Delegates had to write a 2 page case to be invited to attend and those who were successful met for a discussion on all aspects of the research needed to “Preserve Our Past”. Part of this agenda was of direct relevance to the IST community. A total of 87 attendees debated five themes:

- Integrated Methodologies
- Values
- Engagement and Interpretation
- Impact of Climate Change on the Historic Environment
- Sustainability

The extensive final report is included as Appendix 3 and since the workshop there has been a call for the development of a number of research clusters to investigate the further development of each theme. These proposals are due to be submitted by the end of May 2006 to run for up to 15 months. The results are expected to feed into the programs of work that the Research Councils support, although the Natural Environment research council has since dropped out of the initiative.

4.6. EPOCH Research Agenda Workshop “Research challenges and time horizons” (Florence, Italy, 2nd – 3rd April 2006) [7]

The EPOCH NoE held a series of workshops at the EVA Florence conference in April 2006. Amongst these was a full day working meeting of those working on the EPOCH research agenda, which was followed by a session which brought together a much wider range of representation from the conference delegates.

The full-day session began the process of relating different research agendas and recognising the differing perspectives involved. In particular, considerations of the relationship between the degree of maturity of particular research initiatives as described above were aired and discussed.

This was followed by discussions on the issue of research challenges of varying ambitions and time horizons. We start from the core challenge addressed by EPOCH which focuses on the integration of ICT in the cultural heritage sector with particular emphasis on the needs of monuments, archaeological sites and related museums.

Addressing this challenge is motivated by the needs to:

- Secure long term returns from digitisation by ensuring potential for re-use of digital artefacts

- integrate the currently fragmented efforts in research on ICT applications for the heritage sector by underpinning with a Common Infrastructure of systems and tools which are interoperable, sustainable and affordable.
- Realising potential benefits from novel applications of ICT in scholarly research, preservation and communication of Cultural Heritage.

The absolute imperative of achieving common agreements decreases down this list and the degree of basic research involved increases.

As illustrated in the diagram below, we expect that in some areas the possible achievements of this short- to medium-term research & development work will be limited, at least as much by the needs to achieve agreement on standard data representations and interoperable underpinning technologies as for any reason caused by technological bottlenecks and missing capabilities.

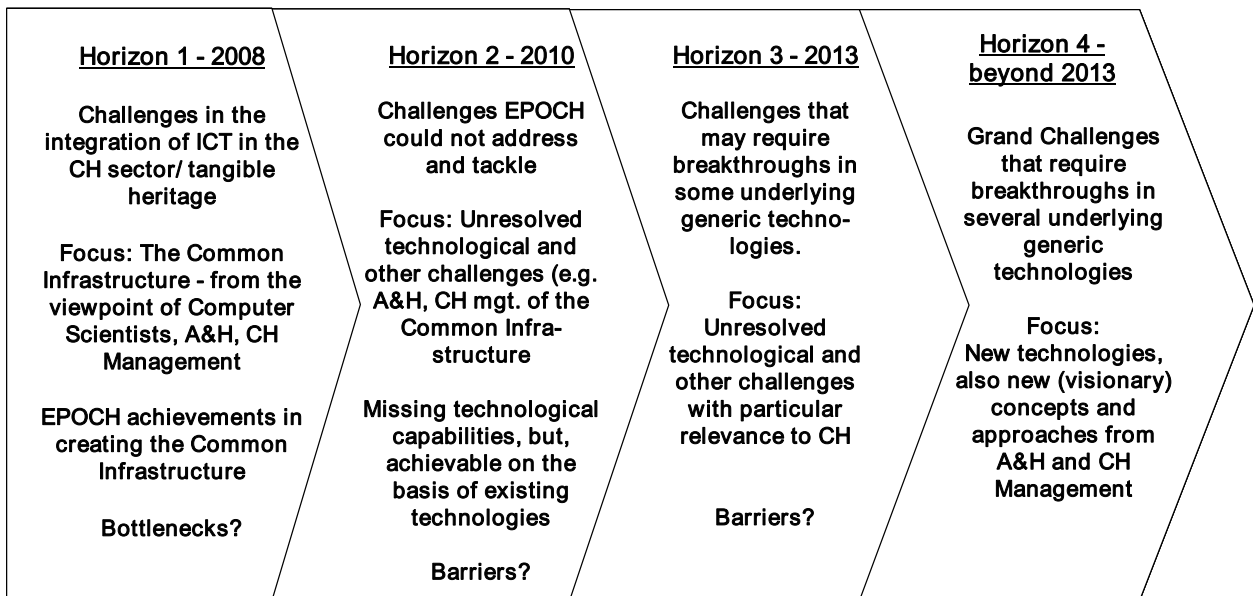


Diagram: Salzburg Research, 2006

Hence, there is a need for a Common Research Agenda that includes challenges and time-scales well beyond EPOCH's aims and project life-cycle. To develop such a longer term Research Agenda will not only provide a broader framework for the ongoing and future work of the Network members and larger research community in cultural heritage ICT. It may also form a valuable contribution to the formulation of respective research priorities under the European Union's 7th Framework Programme and beyond, as well as inform national programmes which will need to be the primary funders of projects in this area of research and development, particularly in areas dealing with their own cultural heritage (e.g. tools targeted at digitization of existing national collections).

4.6.1. From Common Infrastructure to Grand Challenges

As shown in the diagram above, we distinguish between four horizons of research and development.

Horizon 1 – 2008

For the first horizon we use EPOCH's project life-cycle which will end in March 2008. The challenge addressed in this period is the integration of ICT as relevant particularly for the domain of tangible heritage.

This work concentrates on developing a Common Infrastructure that underpins processing of information from data recording (e.g. during excavations), to the analysis and interpretation, through to the scholarly publication of research results or an exhibition for the interested public. For a Common Infrastructure to work, it requires interoperability of tools through common agreed data formats.

This research and development work includes defining the architecture and components of such an infrastructure, evaluating existing and emerging new tools, and identifying or defining required standards for interfaces, data formats and exchange protocols (including both artefact representation and metadata encoding semantic information about the digital artefact).

Actually, the main goal of the Common Infrastructure is to allow for interoperability of the tools which are combined to perform different CH tasks, and enhance the exchange of data between them, including metadata such as semantic annotations which are based on a common ontology (for which the CIDOC-CRM has been proposed, although the relationship to existing results using the Dublin Core as a basis still requires examination).

Horizon 2 – 2010

In the next horizon we place research challenges EPOCH could not tackle due to missing technological capabilities or/and a lack in data standards, exchange protocols and interfaces which are mature enough. Such bottlenecks may be addressed and removed until 2010 based on the existing technologies, or remain barriers due to some unresolved technological problems. Examples in this time frame probably include seamless transition from scanned digitizations to reconstructed objects, including descriptions and semantics.

Horizon 3 – 2013

In the period until 2013 we would expect targeted research and experimentation to achieve breakthroughs in one or more underlying generic technologies to remove the existing barriers. From a perspective in 2006, judging which research issues are likely to remain challenges must be largely speculative and relate more to a perception that the problem is "hard". Multilingual systems capable of semantic analysis in the cultural heritage domain can confidently expect to be one such area.

Horizon 4 – beyond 2013

In the last horizon we place “grand challenges”, visionary goals of research that are not obviously possible, but hold the potential for significant advances in knowledge and technological capabilities. However, incremental progress in research and development would not succeed as breakthroughs in several underlying technologies may be required. Major investments and long-term interdisciplinary collaboration would be needed, in which also new concepts and approaches from the humanities and cultural heritage economics & management may play an important role. The vision of effective and engaging multi-lingual story-telling, which is sensitive to the listener’s and other’s cultural perspectives would be one such challenge.

4.7. *European Workshop on Culture and Technology (Pistoia, Italy, 8th – 9th April 2006) [8]*

This workshop brought together a selected group of 19 senior people interested in the issues involved in improving the use the cultural heritage sector makes of technology, and the research issues that need solving to realise the potential. The results of these deliberations are included in the final report and reproduced in Appendix 5.

4.8. *UK Arts and Humanities Research Council, ICT Research Methods Network Expert Seminar on Virtual History and Archaeology (Sheffield, UK, 20th - 22nd April 2006). [9]*

This expert seminar brought together around 40 researchers, the majority of whom were users of technologies in support of their research in the arts and humanities. A great many of these researchers were working from documentary sources, rather than artefacts, although in some cases the boundaries became blurred. The prime example of this was the presentation by Meg Twycross highlighting the importance of extremely high quality digitisation in assisting reconstruction and analysis of the contents of medieval manuscripts. This included multi-spectral and extremely accurate (12Kdpi) spatial resolution, in order to recover script from damaged manuscripts, whilst analysing aspects varying from timing and nature of edits and the authorship of parts of the text in order to link to the historic context of the authors and their influence, perspective and/or role in the drafting.

Many of the events and initiatives described above are extremely recent and it has not yet been possible to undertake an in depth analysis. However, some trends and characteristics are clear, and the following sections seek to draw out some of these and to suggest ways of putting the various contributions into context.

For these reasons, the next stages of evolving the common research agenda in EPOCH will be to convene discussions bringing together representative experts from the contributors to the various activities outlined above, in order to share some of these perspectives and build an agenda which recognises some of the issues of disciplinary

perspectives and timescales. To have a fruitful debate, it is necessary to have an intellectual framework to assist understanding of the issues and differing perspectives. In this debate, the longer term linkage between fundamental research ideas investigated now and potential applications supported in the future, needs to have more explicit elaboration and recognition.

The next section seeks to distil some definable characteristic groupings which share similar perspectives in order to progress and elaborate a framework for the debate in which such differing perspectives can be discussed.

5. An Analysis of the characteristics of different perspectives

The Common Research Agenda will also need to augment the core perspective on RTD with a view on the requirements, likelihood and time horizon of heritage organisations adopting the future ICT systems and applications that may stem from the ongoing RTD efforts.

Such assessments and respective assessments will be of greater interest to stakeholders from technology companies and the heritage sector, as well as be useful for RTD planners and funding bodies.

Below we describe three perspectives which are important to consider with respect to the further development of market-near prototypes and potential uptake of new applications by cultural heritage institutions.

5.1. *Perspective 1 – Technology companies*

Technology companies develop, vend, implement and service technical systems and tools. With respect to the maturity life-cycle we distinguish between

- (1) companies that are to a certain degree also engaged in technological research & development [RTD] activities, and
- (2) companies that concentrate on marketing, implementing and servicing stable and proven technical solutions.

Both play an important role in the maturity life-cycle.

5.1.1. R&D driven companies

The first type of companies forms an “interface” between RTD, market, and innovation-oriented customers, i.e. the “innovators” and “early adopters” in the diffusion process of new technologies.

Such companies develop prototypic systems and tools into marketable solutions. In any technology field, they are rare examples, particularly if there are no large enterprises that would license or buy and market the solution.

This is the case in the field of cultural heritage ICT, where most of the companies are SMEs, and only little domain specific specialisation has taken place so far (e.g. in the area of collection management systems).

Most companies that engage in RTD activities and, among other target markets, deal with cultural heritage ICT, are spring-offs of university-based research centres. They build on results of some projects funded under various national and European programmes, and most often do not want to lose their foothold in the research community.

A typical example here may be EPOCH partner Imagination (Austria) which offers Virtual Reality services that include consulting, design, production of online interactive 3D applications and VR/AR installations for events, shows, exhibitions or permanent installations. The company is a spin-off of the Institute of Computer Graphics and Algorithms of the Technical University of Vienna. The institute participated in the long-term Austrian Joint Research Program on “Theory and Applications of Digital Image Processing and Pattern Recognition” (1994-2000), funded by the Fund for the Promotion of Scientific Research. After Imagination was formed, it participated in FP5-IST projects such as 3D-MURALE (11/2000-10/2003) and has been one of the industry partners in the K-plus Competency Centre “Virtual Reality and Visualisation (VRVis)”, funded by the Federal Ministry of Transport, Innovation and Technology.

5.1.2. Market driven companies

The second type of companies concentrates on customers who are not in a position or willing to take any risk. Their role includes representing “the face of technology” as mediated to such customers, who - as in any other domain - also in the cultural heritage sector form the large majority of organisations.

The unfavourable business situation of the companies that target customers from the cultural heritage sector is described in the previous Report on the Common Research Agenda (22 April 2005, chapter 5.2: Business Aspects).

They have several major hurdles to take that include the different “business culture” of cultural heritage institutions and professions, small IT-budgets, and lack of technical stuff and background. In practice, this can mean that CH customers sometimes use the companies for free consultancy, tenders may be ill defined, projects have long lead times and decision processes are not transparent. Expensive tendering exercises can lead to the cancellation of an initiative without appointment of a supplier, since it can often show an unrealistic perspective on the amount of investment required.

Consequently, most of the technology companies do not consider the CH domain as their core business. The degree of specialisation is rather low, which leads to the criticised situation that specific needs of the domain are often not met.

Results from a survey conducted in the framework of the EPOCH Sector Watch activity [D.2.1] confirm this overall unfavourable situation.

The EPOCH: D.2. 1: Sector Watch Report, 31 March 2006, section 2.2.2: reports the “Needs of Providers”, p. 13:

“(…) Cultural heritage needs ICT that can be easily implemented, that is sustainable in the long term and that keep the costs low. As most respondents are focussing on the development of prototypes, these technologies are often applied on only one cultural heritage site as a test case. Therefore, these prototypes don’t lead to a marketable product that could be easily integrated in different cultural heritage sites.

Only half of the questioned technology organisations contain staff with a cultural heritage background. In other words, they have a rather poor knowledge of cultural heritage. The stakeholder needs survey expressed clearly the need of a better understanding of the cultural heritage sector.

There is a need for training and better information about technology for the CH community.”

Among the most important observation drawn from activity 2.1 surveys on technology providers are:

- “44% of the respondents are both developing new technologies and base their activities on existing technologies. 38% are focussing only on new technology research, whereas 9% use existing technologies for their activities.
- The respondents reported greater involvement in developing applications for museums (35%) and archaeological sites (37%) and considerably less for monuments.
- About half of the developed applications in CH can be categorised as tools for interpretation and presentation. This is followed by technologies for data collection and processing. Fewer applications are developed by the respondents for conservation, presentation and restoration.

2.4 Miscommunication in conceptualization and implementation

- 45% of the technology organisations employ staff with a cultural heritage background.
- Most organisations concentrate their main technology activities on other research topics than cultural heritage i.e. development of new technologies. Only a small part of the respondents (23%) focus exclusively on cultural heritage applications.
- In 58% of the cases, the choice of technology was done in consultation with the staff of the cultural heritage site. A small number of the respondents indicated that they received a specific order for the technology from the cultural heritage organisation.
- For the question “in which phase of the whole process they were involved” i.e. conceptual phase, further development of the concept and practical realisation, 41% of the respondents indicated all phases. 27 % were involved in the practical realisation, 14% in the conceptual phase. There seemed to be less involvement in the further development of the concept. About 15% of the respondents indicated that this question was not applicable to their specific situation.
- According to about half of the respondents, the involvement in the process was on their own initiative. For 22% of the cases, this initiative was taken by the cultural heritage site (i.e. museum – monument – archaeological site). 11% of the respondents mentioned

other initiators, such as technologists, museum. For 19% this question was not applicable to their specific situation.

- About half of the respondents have given on their own initiative advice for the choice of technology to the cultural heritage site. 16% of the respondents have given advice only on demand of the cultural heritage site itself.
- About one third of the respondents had contact with the curator and/or conservator. About the same percentage indicated that they also had contact with other persons of the cultural heritage institution. 18% answered that they had contact with a committee and/or working group. About one fifth found this question not applicable to their situation.
- Training of the cultural heritage staff about the application is in half of the cases only provided by request (45%). 19% of the respondents indicated that training was not provided and 6% that training is always foreseen. 23% of the respondents didn't answer this question.

2.5. Little attention to assessment

Respondents reported that once the application is finished, technology providers pay less attention to testing it in situ. About one third of the respondents had contact with the curator and/or conservator. About the same percentage indicated that they also had contact with other persons of the cultural heritage institution. 18% answered that they had contact with a committee and/or working group. About one fifth found this question not applicable to their situation.

2.6. Little attention to updating through positive feedback

Only one third of the respondents provide an update of their application from which 70% guarantee an update of the software, 20% of the hardware and 10% of the operating system. The majority of the respondents indicated that this question was not applicable to their situation.”

5.2. *Perspective 2 – Cultural heritage institutions*

When assessing the feasibility of cultural heritage institutions making use of advanced information and communication technology (ICT) their capacity in terms of budget, staff, collections and users must be considered. A study carried out by EPOCH partner Salzburg Research provides estimates of this capacity for small, medium-size and large institutions [40]. The study collected and analysed data from various surveys and other sources. The results are summarised in the following table:

	Small	Medium	Large
Annual operational budget in €	< 100,000	100,000 – 1 million	> 1 million
Staff in full-time equivalents (FTE); professional, support, volunteers not included	< 5 FTE	5-10 FTE	> 10 FTE
Number of collection objects	< 10,000	10,000-100,000	> 100,000
Number of annual visitors: for museums	< 7,000	7,000-30,000	> 30,000

Note: The focus of the study was to provide a better understanding of what distinguishes small from larger size institutions quantitatively. Therefore, the table does not include a category 'very large' or 'major' institutions, which may have an annual operation budget of over € 10 million.

The study points out that most of the smaller and even many of the medium-size institutions, which together make up more than 90 per cent of all organisations, will not find it easy to cover the total cost of ownership (TCO) for certain more advanced ICT applications beyond, for example, a simple web site or a collection management system.

The most pressing factor that hampers heritage institutions in their efforts to leverage their IT environment is the lack of staff. A typical small institution will have fewer than five full-time equivalents, with only a fraction of them being professionals concerned with the institution's core business (e.g. curators, librarians, archivists, pedagogues).

Furthermore, smaller institutions' efforts in following up new technology ventures are limited by lack of financial leeway. A typical small institution will work on an operational budget of no more than €100,000 while a medium-sized institution may have up to €1 million at its disposal.

Needless to say, these budgets leave scarcely any room to finance ICT projects out of the operational financial resources. Consequently, institutions interested in developing and realising technology projects need additional funding.

Yet, a common problem for small institutions is that, while the limited number of professional staff available may be able to ensure that the institution provides its core services, there will be little time to track down the necessary funds that would allow them to finance any ICT venture. And if they identify a suitable funding opportunity, they will find it difficult to prepare an application due to a lack of expertise in drafting a possibly successful bid. (cf. the results of the IMRI studies on the effects of the "bidding culture" on local institutions in the UK, IMRI 2001 and subsequent reports).

Furthermore, experience from many initiatives shows that projects carry the risk of distracting institutions from core business and imposing activities that prove to be unsustainable after the funding period.

Critics also point out that the majority of such projects favour financing the technological infrastructure, that is, the hardware and software equipment, over the development of the

‘wetware’, i.e. the technical skills of the programmers, operators and system administrators. The cost of ownership for the technological infrastructure is usually underestimated or not even considered.

Given the institutions’ ‘trilemma’ of lack of funds, lack of human resources, lack of technical skills, there is little likelihood of small to medium-size institutions being able to participate in research and technological development projects that develop new prototype applications and systems. Even the larger institutions may have difficulty engaging with projects to which they are required to bring their cultural and scientific heritage expertise and knowledge.

5.3. *Perspective 3 – Cultural heritage expertise & service centres*

Given the severe barriers of most cultural heritage institutions, there is a need to create structures that prevent them becoming blind spots in the rapidly developing digital environment. There is enough evidence that this environment of next generation systems and tools evolve much faster than these organisations and smaller cultural networks can adopt and employ (cf. European Commission 2002; Geser 2004; PULMAN 2003).

In fact, for smaller and also medium-size institutions the benefits of most current and future technologies will need to be realised within national and larger regional initiatives.

In such initiatives, a leading role will require to be played by new forms of cultural heritage expertise & service centres. There will, over the coming years, be an increasing demand for supportive digital services centres and ICT training programmes for technical and non-technical staff on how to handle new technologies.

Such funded mechanisms should enable smaller institutions to keep the costs and risks of digital heritage resources and services manageable, while not being excluded from new technological developments.

The establishment of CH expertise & service centres could also lay the groundwork for the required much stronger linkage between research & technological development and CH experts and practitioners, which should be based on true interdisciplinary efforts.

Particularly if such centres are established in conjunction with research centres that specialise in cultural heritage ICT, this may provide for a steady stream of knowledge between researchers and technologists and experts and practitioners from – and clients of – cultural and scientific heritage organisations.

In a much more effective way, curators, arts & humanities scholars, educational programme managers and experts from cultural hotspots, such as historic city centres or larger heritage sites, could be involved in the development of prototypes of new applications, and feedback from professional users and visitors of sites, monuments and museums be collected.

Model examples of cultural heritage expertise & service centres are the Dutch Digital Heritage Association (Vereniging DEN) which supports about 60 member institutions (cf. Van Kasteren 2003), or the smaller EPOCH partner Interactive Institute.

6. An integrating framework

In an earlier section we saw that the progress of research in any particular area may be characterised by a number of phases – investigation of underlying theory (“blue-skies” research); solution of implementation pre-requisites (“underpinning engineering” issues); and effective deployment (“take-up” including business process re-engineering). Although phrased in terms of science and engineering metaphors similar stages of underpinning theory, evaluation/refinement and deployment seem appropriate and identifiable in other research domains.

For the purposes of classifying the research topics, they might be divided by considering them against these degrees of maturity from the perspective of the community for whom the research agenda is being developed. However, as noted before, different communities may in some cases view the same topics as being at different stages of maturation and hence place different priorities on the same topics.

In this framework individual topics would be considered against measures of maturity and potential solution time-frames for each of a number of perspectives.

It is perhaps easiest to conceive of a research agenda as providing a list of unsolved problems and an expected set of resources needed to address the challenge posed, in a particular timescale.

It is less common to try and evaluate the risks associated with NOT solving the problem, but this must colour the prioritisation placed on investing in longer term research directions. We are therefore envisaging the incorporation in the analysis framework some of the terminology of risk management. The costs of not achieving a solution in a particular topic might be considered by analysing the range of applications that would be envisaged for it and the potential that those applications bring.

In the world of ICT research, the structuring of phases takes on a particular significance and the notion of time horizons may need to be viewed as a dual – the notion of time horizons for technologies contributing to visions of future applications, and the degree of maturation of technologies now. A research topic may be viewed as a requirement to solve a current need. It may be approaching a solution as a result of having been worked on for a number of years. It may be that the underlying theory is regarded as solved, but that practical engineering solutions based on the research results are not yet available. Or it may be that prototype solutions have been evolved, but the deployment issues of incorporating systems based on the prototypes have yet to be fully evaluated and solutions found. Finally, even where the solutions exist there may be substantial issues to resolve in terms of uptake in the market, which can have more to do with integrating business process and assisting conservative professionals to adopt, and adapt to, novel methods.

Different topics will progress at different rates so that some may be overtaken by developments elsewhere. However, the notion of target application or applications for a specific topic brings with it the opportunity to assess inter-related risk – as in areas where more than one technology must make progress if the application is to succeed.

The need to view time horizons in the context of changing underlying circumstances is therefore highlighted – a research topic will in some cases be superseded by changing events in other technologies – most notably in ICT, the available processing power and storage and communications solutions. The frequently cited case of the success of VHS tape systems against the Betamax systems, which were widely perceived as technically superior is only one case of the success of a project based on technological R&D never reaching mature market penetration, and hence missing on its potential window of opportunity. Both technologies had progressed a long way down their timelines and in fact were based on similar underpinning theory. This was probably more a case of post-research competition, rather than particular superseded research directions.

Of perhaps more historic interest is the amount of effort put into engineering practical solutions to overcome the shortcomings of storage tube technologies in the 70's only to have new, faster technologies effectively remove the underlying shortcomings and the original need for the research. We note in passing that the new technologies in this case reintroduced issues that had been effectively addressed by earlier technologies, and hence re-invented the need for some research that had previously been thought obsolete, though the original work required re-interpretation in the new context!

7. Conclusions

As noted in the discussion on timescales in the previous sections, Research Agendas come and go and many topics may, predictions of the time horizons for finding solutions to particular challenges do not always follow the hopes of the researchers involved, and hence the timeliness of particular topics may become lost despite the inherent value of the research. In this framework we have tried to separate out the degree of maturation of particular topics from the original expectations of progress and from the political agendas that may drive funding for research. Instead, we have sought to set up a framework to discuss the communities' statements about the degree of maturation of the topics, the potential offered and the remaining challenges.

The next stages of the process will be to facilitate a debate by bringing the wide range of contributing and overlapping debates in the range of communities described in section 4 together, to try and create a more interdisciplinary perspective on the common research agenda. This debate will be seeded with a discussion of the issues which may inhibit agreement on the commonality of the research agenda, and with presentation of the proposed integrating framework for quantifying perspectives. It will seek to draw contributions from the range of communities represented and, by thinking in terms of a risk analysis, seek to put some time horizons and degrees of prioritisation on clusters of topics.

Of course such an exercise takes time and in the meantime other developments will occur. In the Commission's planning for FP7 two important additional events have happened during the course of the current period of discussion.

The recent planning and consultation for the roles of IST in FP7 have led to the publication of a report by IST Advisory Group (ISTAG) [13] on "Shaping Europe's Future through ICT". In this report the only mention of heritage occurs in the context-setting section on "Tomorrow's Society" as follows:

"Embracing Digital Culture

In a globalised world, there is increasing recognition of the social and economic value of culture. Citizens have an awakened interest in their own cultural identity – local, regional, national and European. Preserving this cultural heritage for future generations, while enriching it with contributions from our own time, constitutes one of society's most important tasks. In the European context, this means a particular emphasis on linguistic diversity, which is a key European asset. But digital technologies also offer new means of creative, artistic and social expression and will also drive new industries in the creative, media and tourism sectors. In addition, ICT will play a fundamental role in facilitating inter-lingual comprehension and interactions." [13]

The notable absence of mention of physical cultural heritage in this document does not bode well for the opportunities of specifically targeted FP7 IST funding on research into technologies specifically required for, and sensitive to, the requirements of the cultural heritage sector. There is considerably more attention paid to the "content sector" but again the European world-leading status in physical cultural heritage is not included as a particular strength to be developed. Table 3.1 of the report [13] includes the following assessment in this area:

<i>Segment</i>	<i>EU's Global Position</i>	<i>EU Industry Strengths</i>	<i>EU Industry Weaknesses</i>	<i>Key Market Features</i>
<i>Content and Media</i>	<i>Strong European players in companies such as Vivendi Universal and Bertelsmann, but these lack the global reach of the big US media conglomerates. In addition, Europe has strong creative SMEs</i>	<ul style="list-style-type: none"> • <i>Digital interactive TV</i> • <i>Image processing, representation and coding</i> • <i>Semantics and knowledge management</i> • <i>Computer vision</i> • <i>Virtual and augmented reality</i> • <i>Games, animation, and special effects</i> 	<ul style="list-style-type: none"> • <i>Packaging & delivery of content and services</i> 	<ul style="list-style-type: none"> • <i>Dominance of US media companies in EU markets</i> • <i>Positive knock-on effects for other ICT industry segments (e.g. PCs, digital cameras, telecoms)</i> • <i>Content value chains are increasingly complex</i>

It is in this area of content sharing and seamless integration of access systems that the major challenge for organisations like museums are touched on in relation to the IST agenda

“The manifestations of this digital ecosystem are seen in a number of trends:

...

2) Increasing share of content and services within the overall ICT market: Digital content and services are the main beneficiaries of the convergence revolution. The growth of network infrastructure and access platforms has given rise to a proliferation of content-based products and services for both consumer and business markets. In this new ecosystem all sorts of actors will be able to generate and transact digital content and services over global networks. Content/service providers will be as diverse as small businesses, professional football clubs, local/specialist libraries & museums, writers & artists, and individual hobbyists and enthusiasts”

At the same time the Commission’s “Consultation on Social Sciences and Humanities (SSH) in the 7th Framework Programme (FP7)” found that

“In general, respondents agreed that the future research agenda in SSH should be built on previous research. However, most of the contributions also called for a broadening of the scope of the Research. In this line, we could identify two major inter-related themes which most respondents have referred to in various ways and in different combinations; they are: Economic, social and cultural sustainability as a cross cutting issue; and Europe in a global context. Examples of themes which have not been extensively addressed in previous FP’s, but which are frequently highlighted, are: ageing, and demographic changes; research on business sustainability; and finally research on media, communication and culture.

As far as Humanities are concerned, a number of contributions suggested for EU research to address new areas such as: anthropological studies of European culture and origins; archaeological and historical studies of technological development of societies; European

languages and cultures; History of contemporary changes; history of religions, welfare and values, etc.

In relation to the question on the specific needs of infrastructures for SSH, most contributions refer to the need of further harmonisation and standardisation of datasets, centralised databases, digitalisation of paper-based information, web-based archives, etc., all this in view of promoting comparative research of high quality.” [SSH2006]

The combination of these two reports leads to the conclusion that from a perspective of EC research priorities little priority is placed on the need for domain-embedded intelligent ICT tools in support of the workflows in physical cultural heritage from data discovery to communication to the public. In contrast, the infrastructure to support notions of more intangible, performance-related and participatory cultural heritage may be seen as emerging in both the content and media IST agenda and in the Humanities and infrastructure components of the SSH debate.

It seems that two general lines of thinking are influencing the thinking behind such prioritisation:

- a. That the technologies required to underpin the needs of the Physical Cultural Heritage Sector in Monuments, Sites and Museums are either readily available or have no special, domain-sensitive needs and can be accommodated by generic technologies
- b. That the issues of intangible heritage, cultural sensitivity, contextual interpretation and narrative can be served by research in the humanities supported by an infrastructure of known technologies and some harmonisation and standardisation activities.

It seems difficult to see where, in this milieu, there might be a place for research into the tools and techniques required to embed 3D digital artefacts, with their datatypes and their manipulation and analysis, associated novel ontologies, knowledge representation and management, connection to intangible heritage and the needs for communication of their significance, to quote but a few examples. It may be that the community needs to rephrase the objectives of research to emphasise generality of application with cultural heritage as an exemplar, but this would lose some of the advantages of targeting the interdisciplinary perspectives more explicitly.

The conclusions also seem to conflict with those of the ACLS Commission on Cyberinfrastructure for the Humanities & Social Sciences, whose draft report seems to support the notion that specific novel, domain-specific, tools are needed to appropriately exploit the potential for exploitation of digital technologies in support of the Humanities.

From the point of view of EPOCH’s continuing work on the Common Research Agenda this might be seen as something of a disappointment but in fact it re-emphasises the need for an agenda. This remains an essential component in creating the European Research Area – a fundamental objective of the Network of Excellence. A common research agenda will also provide the basis for influencing national programs as in, for example, the Preserving Our Past development in the UK [6] as well as providing background context for other parts of the EU R&D activities.

7.1. Grand Challenges as stimulus for the next generation of cultural heritage ICT

A Grand Challenge movement has originated amongst the Computer Science community in both the UK and the USA over the last 10 or so years. The principle has been to choose problem areas where it is clear that a multi-disciplinary team will need to work over a number of years (say 15-20) in order to rise to a specific challenge. The two movements were initiated at roughly the same time in the US and UK. These challenges are defined in different ways in the USA and UK and have a number of criteria for being regarded as suitable topics. [3].

In the overview of the time horizons of the Research Agenda we included a horizon that goes beyond 2013. This may seem to be overly ambitious, yet, it is not. Rather, we see the need for challenging the research community to explore new avenues of research that should build on a strong cross-disciplinary fertilisation of ideas. To formulate and foster research on a couple of “grand challenges” may currently well be the right stimulus to within the next ten years remove existing bottlenecks and barriers, and considerably advance towards the next generation of cultural heritage ICT.

7.1.1. Considering the incubation times of IT innovations

Besides this motivational aspect, placing the Research Agenda in a longer term perspective takes into account the incubation times of innovations in the area of information and communication technologies. Detailed studies on such incubation times have been conducted by the Computer Science and Telecommunications Board of the US National Research Council of the National Academy of Sciences. (NRC-CSTB 2003) They show that many of the technologies that represent the basis of the current ICT industries needed 10-15 years from the first basic research to commercial introduction and exploitation. These include, among others, Reduced Instruction Set Computer (RISC) processors, parallel computing, relational and parallel databases, client/server computing, LANs, Internet, portable communication, graphics, and speech recognition. The studies illustrate the complex interplay of university research and industry RTD, some of the concurrent, mutually reinforcing advances in multiple subfields and, most importantly, “the long, unpredictable incubation period – requiring steady work and funding – between initial exploration and commercial deployment”.

However, while the grand challenges considered here will require research teams to watch out for, and incorporate such mutually reinforcing advances in different areas of research and development, they should also put particular emphasis on inter-disciplinary collaborations, that are sensitive to the particular needs in Cultural Heritage.

7.1.2. Inter-disciplinary perspectives of Grand Challenges in cultural heritage ICT

For a snap-shot of the current discussion on the need of such cross-disciplinary perspectives and collaborations in stimulating major advances in cultural heritage ICT, we turn to recent developments in the USA.

In 2003, the so called “Atkins Report” of the US Science Foundation Blue Ribbon Advisory Panel on Cyberinfrastructure has been published, which proposed to establish an Advanced Cyberinfrastructure Program (ACP) [37].

In response to this proposal, the American Council of Learned Societies established the ACLS Commission on Cyberinfrastructure for the Humanities & Social Sciences to explore and discuss the participation of its member institutions in such a program. In the broad discussion that followed, particularly strong arguments for the need of cross-disciplinary perspectives and collaborations have been brought forward by Bernard Frischer.

Frischer is director of the Cultural Virtual Reality Laboratory (CVRLab) at UCLA, which was founded in 1997 with the mission of creating authenticated 3D computer models of cultural heritage sites around the world. Since August 2005 he also directs the Institute for Advanced Technology in the Humanities (IATH) of the University of Virginia. These organizations are often referred to as model institutions, where computer scientists and scholars from the humanities are working together to create innovative digital heritage projects.

Starting from the observation of a convergence of interests of the, currently, often separated communities of technological researchers and engineers and humanities & social sciences scholars, Frischer points to “bridges we need to cross the all-too-obvious chasm separating our two communities”. As such bridges he proposes to conceive of a couple of exciting Grand Challenges, “exciting to us as humanists and social scientists; and equally exciting to the engineers, computer scientists, and other scientists responsible for the Atkins Report”. [39]

As one such challenge or bridge, Frischer suggests “Serving and Archiving Virtual Environments (SAVE)”, a “framework for creating, archiving, and distributing an online real-time visualization of the entire cultural history of humanity”. Elaborating from a presentation of the computer model of the Roman Forum (with GPS coordinates and different building phases), which was developed at the UCLA from 1997-2003, Frischer explains:

“The sliver of space/time you saw in ancient Rome would expand to include other human settlements from prehistoric times to the contemporary world. The visualization would include buildings, artefacts, and human activities. It would simultaneously be the information system that could integrate and take to the next level of computational intensity and conceptual complexity such disparate projects as the Japanese Earth Simulator System, the US National Virtual Observatory, and a range of projects in the area of social science informatics.”

Frischer continues: “Creating SAVE would be a Grand Challenge involving many disciplines. Once built, SAVE would become a powerful omnidisciplinary tool for research and education. It would help us to visualize the development of human culture and to analyze the continuous interaction between humanity and the natural world on various scales from the atomic and cellular to the planetary and galactic.”

Frischer points out that Grand Challenges of this kind would provide the cutting edge research problems to be addressed through an Advanced Cyberinfrastructure Program (ACP), as suggested by the Atkins Report.

The arguments for this include quantitative as well as qualitative aspects. In quantitative terms, Frischer notes that “the scale of SAVE is such that it dwarfs by a factor of more than 100 the computer resources available in a typical research-group or department—and this is exactly the level of computational demand foreseen by the ACP”. [39]

In more detail: “Our crude estimate of a minimal size of SAVE, once completed (itself a debatable concept) would be 88.50 petabytes of data. This estimate is derived from the following piece of hard data (the size of the current Roman Forum model-44.6 gigabytes) and these assumptions: 1) the Roman Forum is one-hundredth the size of the city as a whole in the year 400 A.D.; 2) Rome represents one five-hundredth of all significant settlements on earth in 400 A.D.; 3) at a minimum, we want one model of all significant settlements once every 100 years since the beginning of civilization ca. 4000 years BP.”

Frischer also highlights the fact that cultural heritage simulations raise considerable challenges for computer scientists and engineers, such as the sought for combination of photorealism and high interactivity. “In few areas of simulation is this combination more appropriate to strive for or more difficult to achieve than in models of monumental built environments.”

The Atkins report also foresees the creation of a number of “generic” and “disciplinary” centers for the ACP, of which it is recommended that some may be co-located. Frischer considers the suggested SAVE Center as a good candidate for a disciplinary center which should be co-located with a generic center of advanced computer visualization.

This would ensure that the humanists and social scientists of the SAVE Center could work closely with colleagues from the computer sciences, for which the Cultural Virtual Reality Laboratory (CVRLab) at UCLA and the new Institute for Advanced Technology in the Humanities (IATH) of the University of Virginia might serve as models.

A further consideration may be important to add: Frischer also suggests that the co-located centers should have a jointly-run “visualization theater” for demonstrating results of visualization projects to students and the larger interested public. Historical or archaeological themes could attract a wide audience, such as the Virtual Mummy project at the British Museum, and create “the kind of smashing success that builds support among the public, and this is crucial in ensuring the long-term sustainability of the pure research we want to undertake for many years at the proposed Visualization and SAVE centers”.

The Grand Challenge posed by Frischer has its origins in understanding the potential scope of a visionary application and envisaging some of the tools needed to make it happen. Much of the challenge involved is to cope with the modelling, storage, access and management processes involved in dealing with the anticipated volume of data. In this respect it is not unlike the challenge of the Prestospace project which is seeking to develop tools suitable for rapidly digitising the 100Million hours of audio-visual materials held in European collections.

The Grand Challenge posed by Arnold et al [5] – “Bringing the Past to Life for the Citizen” – would also include the need to handle large scale data, but the real challenge involved is in creating the conversational, cultural sensitive agents and avatars that can respond to visitors in ways that are sensitive to the cultural importance of the artefacts, and the sensitivities of the person(s) using the system.

By formulating a set of topics around specific visions of future achievable applications, an agreed Common Research Agenda would have a long enough perspective to bring the advantages described in the introduction.

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9. Appendices:

- 1 Background document for the EC FP7 Brainstorming meeting “Digital Libraries and Living History” (Luxembourg, 27th -28th Feb 06).
- 2 Bringing the Past to Life for the Citizen: A proposed Grand Challenge presented to the UK Grand Challenges in Computer Science Conference (Glasgow, Scotland, 22-24th March 06).
- 3 Report on the “Preserving Our Past” workshop
- 4 EPOCH Workshops at EVA – Program and description
- 5 Final Report of the European Workshop on Culture and Technology (Pistoia, Italy, 8th – 9th April 2006).
- 6 EPOCH Rome Workshop, ICCROM, March 5-7th 2006
- 7 Program for the UK Arts and Humanities Research Council, ICT Research Methods Expert Seminar on Virtual History and Archaeology (Sheffield, UK, 20th-22nd April 2006).

Appendix 1: Background document for the EC FP7 Brainstorming meeting “Digital Libraries and Living History” (Luxembourg, 27th -28th Feb 06).

**Brainstorming meeting on
Digital Libraries and Living Heritage
“The user as creator”**

Luxembourg, Mon 27 and Tue 28 February 2006

BACKGROUND DOCUMENT

1. Objective

The aim of the meeting is to collect the views of the research communities, discuss recent and potential research applications, assess their impact and identify their relevance to the domain of Digital Libraries and Living Heritage.

The purpose of the workshop is:

1. To review and adapt the main research challenges to be addressed in the FP7 IST work programmes for the period 2007-2013: key objectives and possible breakthroughs, demanding research tasks to focus on, timing and sequence of priorities, etc.
2. To provide guidance on the types of activities that would be required;
3. To align priorities with related regional, national and international activities and policies.

Results of the meeting will be summarised in a report that will be used in preparing the new IST Programme.

2. Participants

The participants have been selected from different stakeholder communities and research expertise regarding: digital asset management; distribution and networking of cultural information and services; semantic web technologies (including multimedia/multilingual search and retrieval); interfacing and representation; online community developments. A list of the participants is attached (annex 2).

3. General background

Participation, creativity and engagement are key objectives and important socio-economic functions of the future digital cultural landscape. Networked digital resources, increasingly made accessible through a “digital libraries” environment can play an important role in this context, facilitating citizens to act as interactive creators and to become participants of living and sustainable communities spanning geographic and cultural boundaries. With time, the creative content contributed by cultural institutions and users at all levels will lead to new business models and services for the production, use and exploitation of Europe’s cultural assets and will pave the way to innovative digital library networks and services.

Given the fact that our living heritage is intrinsically heterogeneous, encompassing many digitised and born-digital documents stored and made available in a wide variety of formats, qualities, languages and systems in many different organisations, research in digital content technologies requires an increasingly applied and multidisciplinary approach.

The meeting will take these issues at the forefront of the discussion on future research. The issue of preservation is dealt with separately in a workshop organised last January.

4. Organisation

The meeting will take place during one and a half days (see Annex 1) structured round plenary sessions and keynote presentations. An external facilitator (Dr. Costis Dallas) will assist in moderating the discussions.

Aim of the first day of the meeting is to anticipate and specify future needs and developments in digital libraries to support and facilitate participation, interaction, and creativity of (especially smaller) online communities. Discussions will be arranged around three questions:

- A. How can we create a critical mass of digital cultural resources? What are the technology and research issues involved?
- B. How will people want to use digital cultural resources and services in the future? What will be the key technology drivers and application areas and markets?
- C. What evolution in user communities can we expect? How will the role of collection holders need to develop?

Result of the first day should be a general sense of the relevant current and emerging socio-economic trends and technologies in the Digital Libraries and Living Heritage

domain, promising and suitable application areas, the added value we can expect of European action, and the topics / problems that should be touched upon.

During the second day the answers to the previous questions will be put in the context of the new FP7 IST research. Key question will be:

- D. By what Community measures can the identified areas be best supported? Which domains exclusively apply for IST research goals?

Result of the second day is to come up with the key IST research objectives until 2013 in the domain of Digital Libraries and Living Heritage. Timing and sequence of priorities will also be important, just as the types of activities that would be required and ways to assure visibility and impact of the research.

5. ANNEX 1: DRAFT AGENDA

DAY 1	27 February 2006
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10h30	Registration
	PLENARY SESSION — EUROCONFERENCE ROOM:
11h00 – 11h30	Opening and objectives of the meeting (Pat Manson, chair)
11h30 – 12h30	Tour de table: presentation and brief explanation on the issues to touch upon by each of the participants
12h30 – 12h45	Digital Libraries & Living Heritage Scenario 2013 (Chris Batt)
12h45 – 14h00	Lunch
	BREAK OUT SESSIONS — ROOMS TO BE ANNOUNCED:
14h00 – 15h30	1. Visibility (host: Jill Cousins) 2. Use and Access (host: Costis Dallas) 3. Online Communities (host: Paul Rutten)
15h30 – 16h00	Break
	PLENARY SESSION — EUROCONFERENCE ROOM:
16h00 – 17h30	Plenary discussion: where and when can we likely identify research crossovers/matches? What are the research domains we need to push forward?

DAY 2	28 February 2006
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	PLENARY SESSION — ROOM 0278:
09h00 – 09h30	Overview and summary of day 1 sessions (Costis Dallas)

09h30 – 10h30	Tour de table: issues for discussion
10h30 – 11h00	Break
	BREAK OUT SESSIONS — ROOMS TO BE ANNOUNCED:
11h00 – 12h30	Break out sessions: - Visibility (host: Jill Cousins) - Use and Access (host: Costis Dallas) - Online Communities (host: Paul Rutten)
12h30 – 13h15	Lunch
	PLENARY SESSION — ROOM 0278:
13h15 – 14h30	Plenary discussion
14h30 – 15h00	Conclusions

ANNEX 2: PARTICIPANTS

NAME	ORGANISATION	COUNTRY
1. Costis DALLAS (Facilitator)	Panteion University Athens Department of Communication, Media and Culture	GR
2. Maristella AGOSTI	University of Padova Department of Information Engineering	IT
3. David ARNOLD	University of Brighton Faculty of Management and Information Sciences	UK
4. Chris BATT	The Museums, Libraries and Archives Council (MLA)	UK
5. Wernher BEHREND	Salzburg Research Forschungsgesellschaft Knowledge Based Information Systems	AT
6. Michael BRÜSTLE	CEO Brüstle Management Consulting	DE
7. Donatella CASTELLI	Istituto di Scienza e Tecnologie della Informazione Pisa	IT
8. Jill COUSINS	The European Library	NL
9. Birte CHRISTENSEN- DALSGAARD	State and University Library Denmark	DK

10. Myriam DIAZ -DIOCARETZ	Maastricht University European Centre for Digital Communication / Infonomics	NL
11. Christian FONNESBECH	Congin – Dramatic Content Engineering, Copenhagen	DK
12. Stefan GRADMANN	Hamburg University Computing Centre	DE
13. Alenka KAVCIC-COLIC	National Library of Slovenia Research and Development Centre	SL
14. Stefanos KOLLIAS	National Technical University of Athens and Director of the Image, Video and Multimedia Systems Lab.	HE
15. Erich NEUHOLD	Fraunhofer Integrated Publication and Information Systems Institute (IPSI)	DE
16. Kia NG	University of Leeds Interdisciplinary Centre for Scientific Research in Music (ICSRiM)	UK
17. Xavier PERROT	Bibliothèque Nationale de France	FR
18. Paul RUTTEN	Leiden University Department of Digital Mediastudies	NL
19. Guus SCHREIBER	Free University Amsterdam Department of Computer Science	NL
20. Gerhard WEIKUM	Max-Planck Institute of Computer Science	DE

Note: This list was subject to the availability of the experts and is not a roll call of the meeting

Appendix 2: Proposed grand challenge: Bringing the past to life for the citizen

**David Arnold,
University of Brighton**

1. Character and Rationale

“The past is all around us. We live our lives, whether consciously or not, against a rich backdrop formed by historic buildings, landscapes and other physical survivals of our past. But the historic environment is more than just a matter of material remains. It is central to how we see ourselves and to our identity as individuals, communities and as a nation. It is a physical record of what our country is, how it came to be, its successes and failures. It is a collective memory, containing an infinity of stories, some ancient, some recent: stories written in stone, brick, wood, glass, steel; stories inscribed in the field patterns, hedgerows, designed landscapes and other features of the countryside.” [1]

Many people have an undeniable fascination with the past. Evidence ranges broadly from the continuing popularity of stories told of the past (manifest in popular film, novel and theatre); to the significance of historic environments in determining tourists' destination choices (evidence in [2]); to the frantic pressure on the recently-mounted online national census data (with the associated wide-spread hobby of tracing family trees); and even the impact of heritage on the value of properties in a district. There are in excess of 10,000 museums and visitor centres in the UK, most dealing with particular aspects of the past and recording vast amounts of data.

Much of the evidence that we have of the past relates to contentious material – most often conflict and religion – about which there are inevitably differing perspectives, affecting perception of the events themselves (and the participants in them) as well as the modern day observers with their own current ethical, philosophical and social contexts. Cultural heritage professionals are often, rightly, loathe to settle on particular interpretations of the significance of events or heritage artefacts, preferring to present a range of interpretations. They are also suspicious of the media trivialising and misrepresenting the past in the interest of a more entertaining and profitable re-interpretation. The emphasis is often on preservation and custodianship.

Computer scientists have become widely involved in attempting to assist cultural heritage professionals in their tasks but, as with any data handling, the computing professionals look for additional worth to be obtained from the existence of digital records. At times these additional uses have appeared to cultural heritage professionals as crass and insensitive, failing to address the real requirements of their disciplines and spreading more confusion than light.

1.1 The vision

The long term vision is that the citizen should be able to witness events of the past replayed interactively, but this is more than just a recreation, allowing the viewer to explore and discover more about the circumstances and motivations of the participants, linking the reconstruction to the modern day evidence if they choose and receiving explanations of the differing socio-political perspectives which are relevant to the events.

1.2 The tasks

This is a truly multi- and inter-disciplinary challenge. There are many intermediate steps to achieving the long-term vision and many technological challenges to meet on route, touching on a widely spread set of computing sub-areas and other disciplines. At the extreme the challenge re-activates the Turing Test.

However computing science has already much to offer to the many interim applications' stages of discovery, recording, analysis, cataloguing, reconstruction, interpretation, story-telling and communication of physical artefacts and records of the past. Currently these offerings are somewhat fragmented with a huge range of intermediate formats, many (mostly local) formats for classifying facts and cataloguing collections and little by way of interchange formats ensuring the persistence of the information specifically targeted at the preservation of the cultural heritage content. Instead there are common formats for general geometric information or GIS content or database/archive structures, but little specifically targeted at the preservation and reuse of the cultural heritage content. There is also a huge body of knowledge already archived in incompatible formats and often where the original data collection cannot be repeated since the original sources have been lost or destroyed, whether by acts of war, terrorism or simply the ravages of time or normal processes of archaeological excavation.

Breaking down some of the component challenges that the complete vision would need to address, the following seem key areas:

- An integrated infrastructure from data capture to deployment in cultural heritage research and scholarship is required. The main challenges here are the definitions of data formats to allow interoperability of tools and long term applicability of the base data. This provides the framework for the rest of the work.
- Whilst the principles of meeting the Grand Challenge may be met without completing digitisation of all historic information, there are significant challenges in extracting and analysing existing non-digital collections information – both artefacts and metadata. There are real challenges in digitising and preserving existing collections – for example, the challenge of digitizing and preserving the estimated 100,000,000 hours of Audio-visual material from the 20th century is a significant production automation and deployment challenge, quite probably involving research into viable automation and preservation techniques. These are not in themselves viewed as part of this Grand Challenge. There is also a parallel set of research challenges in understanding how the content of such resources might be used within the Grand Challenge – data and metadata formats, content analysis, semantic analysis of image and 3D data etc. The principles of using

these data will require exploration to meet the Grand Challenge, without completing the digitisation process.

- Intelligent interactive tools for use by non-IT professionals, which are tailored, so that the cultural heritage professionals can work in their domain of expertise rather than fighting to achieve particular effects using general purpose tools. Such tools would also empower the myriad of voluntary groups (preservation trusts etc) as a by-product.
- Modelling and visualisation systems which differentiate interpretation and evidentially-supported fact, so that viewers are not misled by “pretty” presentations into misconceptions of cultural heritage “knowledge”. These tools need to operate at the interface between recording what remains and reconstructing what is believed to have been there. Enormous progress has been made in some areas of recording – e.g. laser scanning of sites and artefacts, but there are very significant challenges in analysing such data as the basis for interpreting the original state of the sites or objects. Visualisation also involves reconstruction of the environment under which the originals would have been viewed. Such visualisations will include the need to understand historic lighting conditions and sound generation, as well as more obvious retracing (for example uncovering Mayan Pyramids from the subsequent ingress of vegetation)
- Such recreations involve very large data sets, for example viewing whole cities in detail including not only models of the original architectural detail but also the population. Algorithms, data-structures and systems for efficient visualisation of very large, animated, and detailed multimedia datasets are therefore required. Whilst this challenge is shared with other potential applications, one aspect that will improve the results is an understanding of the common characteristics of historic artefacts. Understanding styles of architecture and detailing allows efficient modelling and tailored level of detail operation; knowing underpinning characteristics of fabric and fashion will allow more efficient modelling and rendering.
- There are a range of challenges here under a broader heading of “Natural Language technologies” including systems that:
 - Understand how to make story-telling effective in Virtual Environments so that objective design criteria can be set for delivering engaging experiences to end users and integrating the potential exploration of the underlying data by the viewer.
 - Use Natural Language understanding with thesauri of appropriate terms and standardised ontologies applied to content drawn from heterogeneous digitized collections and catalogues spread over many sites. This sub-area also includes the analysis of historic sources – the descriptions of previously recorded collections - data mining of large, heterogeneous data collections to assist in cultural heritage scholarship and in assembly of interesting virtual collections from disparate sources.
 - Ultimately incorporate cultural and emotional interpretation, and potential historic language constructs, in particular where use of language may have had different cultural or social connotations than similar language now. Imagine the role playing experience that allowed the user to experience

the different interpretations that people of Christian or other religious persuasions might place on events, purely by selecting from a potential set of backgrounds. This is probably the longest time horizon of any of the component challenges listed here, but there are also many interim achievements that would enable in successful projects, short of the full vision. Interim solutions would include parameterised, but pre-scripted interpretations authored by experts in appropriate fields with interactive systems making selections.

- Working with experts from cultural heritage fields to demonstrate value added to traditional methods, in order to show the real value of ICT developments for cultural heritage professionals. This would have to include a better understanding of the long-term implications of digital artefacts varying from the physical media used for storage to data management and version control. Standards similar in objectives to Digital Object Identifiers and attention to issues such as standardised recording of provenance of digital artefacts, as well as addressing legal, copyright and fair-trade agendas so that socio-economic benefits are suitably returned to those whose heritage and artefacts are involved.
- Although the intellectual Grand Challenge may appear to have been solved when there is the first exemplar of an event which is suitably “living” the full challenge specifically includes the phrase “for the citizen”. This aspect will not be solved until there are sustainable business models – when the production of such experiences is achievable economically and hence allows them to be experienced by a reasonable proportion of citizens. It is imperative for technological solutions to be cheap both in initial capital and in operations costs if they were to have a widespread impact on CH operations, although it is admittedly a later stage than proving it is possible technically to produce such solutions at all.

Some of the technological challenges arise in order that the credibility of the objectives of the Grand Challenge is clearly demonstrated to Cultural Heritage Professionals.

1.3 Differences from existing six proposals

The current proposal overlaps marginally with perhaps three of the existing six Grand Challenges, for different reasons.

Probably the closest is “Memories for Life” in that some of the technologies of organising heterogeneous data sources and extracting and interpreting information would have some overlap with the technologies involved in the interrogations of metadata and collections information. The challenge lists topics in “Data and Databases,” “Information Retrieval,” “Artificial Intelligence,” and “Human-Computer Interfaces” all of which overlap to an extent with the lists of sub-topics above. However in all cases the characterisation of the technologies listed above assumes a degree of domain specific knowledge that would be different from the domain-specific knowledge required in Memories for Life. Similarly the Machine Learning component of Memories for Life would probably be distinct from the dialogue management aspects of the Natural Language technologies described above.

The second potential overlaps might be seen as with “In vivo – in silico” although the overlap here is primarily philosophical – the current proposal is to build a Grand Challenge which is targeted at quite specific application domains. The content is however clearly distinct. In some senses the objective of modelling nature is also shared – the environments to be modelled would incorporate flora and fauna as well as communicating virtual humans.

The third potential overlap is with “The Architecture of Brain and Mind” where some of the cognitive processes listed (e.g. “understanding language”; “deciding what to do”) would be part of the more advanced versions of “Bringing the Past to Life for the Citizen”. These challenges are not envisaged as addressed in the context of this proposal until significant progress has been made in the many other aspects. Should the general problem have been addressed by the Architecture of Brain and Mind then this proposal would continue to need to map the generic solutions into those appropriate to recreations of the past. This is expected to be a similar challenge comparable to many of the others above where base-line technologies may have been developed but proper integration into the domain-specific requirements has not yet been achieved. In addition it is not obvious from the current description how GC5 will deal with such factors as “cultural influence,” “belief,” and multi-lingual ambiguity (ie where terms have no correspondence in other languages or where interpretations of closest matches overlap).

Each of these potential overlaps would need discussion during the full definition process for the Grand Challenge.

2 Proposers

During a fairly short gestation period in this form the proposal has been backed in principle by the following:

Professor David Arnold, University of Brighton

Professor Alan Chalmers, University of Bristol

Professor Andrew Day, University of East Anglia

Professor David Duce, Oxford Brookes University

Professor Phil Willis, University of Bath

3 Evidence of a UK community

The following Universities are already engaged in a Network of Excellence (EPOCH – www.epoch-net-org) which addresses some of these issues – Brighton, Bristol, Brunel, Kent, Oxford, Surrey, Sussex, UEA, Warwick, and York, with Southampton and King’s College, London joining. In some cases the participants are not from Computer Science departments, reflecting the multi- and inter-disciplinary make-up of that NoE. This proposal overlaps significantly with the motivation and objectives of that Network, but the proposal also targets radically more ambitious targets over a timescale that extends many years and concentrates on those aspects with a strong computer science element. The NoE concerned is funded by the European Commission until 2008. The current proposal would have the impact of creating a longer term Computing Science agenda for the existing Network and other participants in the Grand Challenge as well as

demonstrating UK commitment and contribution to the developing international agenda. Other UK HEIs are known to be active in relevant fields.

4 Developing the proposal to full status

There is much to do to scope the outline sub-topics listed above and identify teams willing and able to develop the agenda further within the holistic framework offered by the Grand Challenge.

5 Matching the Characteristics of a Grand Challenge

- a. *International scope.*
The proposed GC has a undoubted international dimension at many levels. Every culture has a past and many geographic locations have multiple contributing cultures. The UK as a multi-cultural society ought to be well placed to offer leading contributions to advancing the field and indeed ought to benefit from anything that assists in inter-cultural education and understanding.
- b. *Ambition can be far greater than that of a single research team/grant.*
As is obvious from the list of UK universities involved in the current NoE. The NoE itself has almost 90 partners with significant clusters of computer science research institutions in many European countries
- c. *The grand challenge should be directed towards a revolutionary advance.*
Success in this Grand Challenge would be a revolutionary advance and would have a major impact on the public and on future generation's educational and leisure experiences. Although it might be considered related to industry sectors where there are substantial commercial interests (e.g. computer games or other entertainment sectors) it is very important for the credibility of the research that the technologies developed are firmly embedded in the search for truth about the past (or multiple valid interpretations) which is the goal of historical research. There are too many examples of the commercial interests of the entertainment sector re-interpreting the evidence, which would lead the credibility of the work proposed here were it to be seen as an off-shoot of the entertainment sector ("Don't let the truth get in the way of a good story").
- d. *The topic for a grand challenge should emerge from a consensus of the general scientific community, to serve as a focus for curiosity-driven research or engineering ambition, and to support activities in which they personally wish to engage, independent of funding policy or political considerations.*
The proposed Grand Challenge is grounded in widespread work already being undertaken which would contribute towards the early stages of creating the vision. There are clear political agendas (for example widening Europe) which would be served by the ability to explain the past from the multiple perspectives of different cultures. For example the re-unification of Germany or the issues surrounding the division of Cyprus and its desire to join the EU are very real examples of a past which has been contentious between social groupings who now have a desire (at least at some level) to share a common future. The example of Northern Ireland is perhaps closer to home and very real too. The sensitivity of exploring such

contentious situations means that they should probably remain off the radar for many years and well beyond the establishment of effective technologies to support the story-telling etc. but the presentation techniques that are an inevitable consequence of meeting the interim challenges will remain useful in presenting authored experiences to public audiences. In addition the usability studies that would be necessary to determine effectiveness with public audiences would also provide contained experimental results.

6 Comments on Criteria of Maturity

- (i) *It arises from scientific curiosity about the foundation, the nature or the limits of a scientific discipline.*

As indicated above the proposed GC is peppered with unsolved computing, science problems as well as interactions with many other disciplines.

- (ii) *It gives scope for engineering ambition to build something that has never been seen before.*

Clearly this is the case

- (iii) *It will be obvious how far and when the challenge has been met (or not).*

This area needs scoping, in particular the various stages short of a self-scripting system using fully autonomous agents could be anticipated in much shorter timescales and would be much more likely to find acceptance in the Cultural Heritage community. They would also still be very interesting and challenging. Experimentation with public reactions, learning and understanding in using systems of less capability would be needed to build progressive confidence in the interim results, before attempting more ambitious agendas became acceptable.

- (iv) *It has enthusiastic support from (almost) the entire research community, even those who do not participate and do not benefit from it.*

See above. Further canvassing of opinions can be undertaken as necessary and would be part of any discussion of the proposal at GC06

- (v) *It has international scope: participation would increase the research profile of a nation.*

See above.

- (vi) *It is generally comprehensible, and captures the imagination of the general public, as well as the esteem of scientists in other disciplines.*

In considering the current list of Grand Challenges the current proposal would appear in many ways the easiest to explain to a public audience. The public are thirsty for such content:

“In a recent survey undertaken in England it was found that “More than half (52%) of people in a nationwide poll in 2003 had visited a historic park or garden in the last twelve months, and 46% had visited a historic building. According to the same poll more people had watched a TV programme about history or archaeology over the same period (66%) than had visited the cinema (51%)” [3]

The resulting applications in tourism, education and edutainment would be substantial. (see quotations below)

- (vii) *It was formulated long ago, and still stands.*
 Telling stories of the past is as old as society itself. Many early examples of rock art present pictorial interpretations of the past and the tradition of oral heritage passed from generation to generation is part of the tradition of language. Hand-written and printed histories and novels reflect various levels of interpretation. Theatre, cinema and television represent a progression of media but all have dealt with themes drawn from history and varying levels of accuracy. An understanding of what makes an engaging interactive experience which nevertheless imparts understanding is at best not well understood and quite probably not understood. Evidence of this would be the limited success of books with “goto’s” – take a decision for the character and move to defined page as a result. Even in linear text the number of courses in creative writing and the volume of remaindered and unpublished novels attests to the complexity of the problems.
- (viii) *It promises to go beyond what is initially possible, and requires development of understanding, techniques and tools unknown at the start of the project.*
 See above
- (ix) *It calls for planned co-operation among identified research teams and communities*
 The proposal would require contributions from research teams working in many areas of computing science and in other disciplines related to cultural heritage, including media, museology, archaeology, history, religious studies, art history, etc – the list would go on.
- (x) *It encourages and benefits from competition among individuals and teams, with clear criteria on who is winning, or who has won.*
 Whilst this would inevitably be the case in terms of the individual component technologies as clear theme of the work proposed is that the components should fit together and be developed with proper understanding of the cultural heritage domain. As such inter-disciplinary teams are a virtually inevitable condition for successful contributions and assume a great deal of cooperation.
- (xi) *It decomposes into identified intermediate research goals, whose achievement brings scientific or economic benefit, even if the project as a whole fails.*
 There are many intermediate stages which would bring major benefit socio-economic benefits. Tourism is a huge market sector and historic interest is a major factor in determination of choice of venue. (see quotations below)
- (xii) *It will lead to radical paradigm shift, breaking free from the dead hand of legacy.*
 Then paradigm shift in terms of the traditional dissemination of the evidence of the past would be substantial. Visitor experiences would allow a level of engagement with the contents of, and knowledge about, collections and a step-change in augmenting the educational value of artefacts.
- (xiii) *It is not likely to be met simply from commercially motivated evolutionary advance.*

Generating investment for preservation of the past from commercial sources is usually regarded as an appeal for charitable donations. Politicians are increasingly looking for justifications for investments in cultural heritage in terms of socio-economic impact and investment in pure preservation or conservation is less likely to find favour than investments which promote access to the heritage. Access (tourism, education, etc) is where the economic contribution is most easy to observe, even if hard to measure. Other social effects (such as a decrease in graffiti and vandalism in well-maintained historic environments) have been observed but not widely quantified. The perception is that the heritage sector is populated more by social enterprises where profit is not the lead motivator and hence commercial investment is less likely to flow.

7 Interesting Quotes/Facts

7.1 On Tourism

1) “In 2000 tourism expenditure in the United Kingdom totalled some £75 billion, and the value added by the tourist industry represented around 5% of GDP-larger than the car, steel and coal industries put together. The impact of foot and mouth disease on the tourism industry demonstrated both the importance of the industry to the economy and its interconnectedness with the wider economy.”[1]

2) In a recent study [2] “Historic interest” was cited as the 5th most common reason for the choice of tourist destination (by 32% of those surveyed), behind (1) “Scenery” (49%) (2) “Climate” (45%) (3) “Cost of Travel” (35%) and (4) “Cost of Accommodation” (33%). The citation of scenery may also have a cultural heritage component.

3) In 2002 the World Tourism Organisation [5] were reporting that “Worldwide receipts amounted to US \$462 billion in 2001 Half of all receipts are earned by Europe, The Americas have a share of 26%, East Asia and the Pacific 18%, Africa 2.5%, Middle East 2.4 % and South Asia 1.0 %”. In Europe Tourism represented 12% of GDP in 98-99 [1].

7.2 On Heritage in Education/Social Engagement

4) “The historic environment has immense value as an educational resource, both as a learning experience in its own right and as a tool for other disciplines. Whether at school, in further and higher education or in later life, the fabric of the past constitutes a vast reservoir of knowledge and learning opportunities. This is as true of the oldest archaeological remains as it is of buildings of the last fifty years. The history of buildings and places is also the history of the age in which they originated and of the eras in which they flourished. They can tell us about the individuals and the institutions that created them and occupied them and about the societies and the local communities they served. Nor is the educational significance of the historic environment confined to the teaching of history. It is also relevant to subject areas as diverse as economics, geography, aesthetics, science, technology and design. Buildings and places can also play a role in developing a sense of active citizenship; by learning about their own environment and how they can participate in its evolution, people feel a greater sense of belonging and engagement.” [1]

5) “Policymakers need to regard the historic environment as a unique economic asset, a generator of wealth and jobs in both urban and rural areas. With this recognition there needs to be coupled intelligence and creativity. We must value the fabric of our past for its importance in attracting millions of visitors to this country each year. At the same time we must recognise that effective management strategies are needed to ensure that much-visited fragile sites are not irreparably damaged. A high-quality, sustainable tourist product must be our aim...” [1]

8 Bibliography/References

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- [3] English Heritage “Heritage Counts 2003” – available from <http://www.english-heritage.org.uk/heritagecounts/research.html>
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- [5] World Tourism Organization, News release, Madrid, 18 June, 2002
- [6] Council of Europe “Forward planning: the function of cultural heritage in a changing Europe”, 2002 (see - http://www.coe.int/t/e/cultural_co-operation/heritage/Heritage_and_society/3Planning.asp)

Appendix 3: Preserving Our Past Workshop

The Preserving Our Past workshop was hosted by four UK research Councils (Engineering and Physical Sciences; Economic and Social Sciences; Natural Environment; and Arts and Humanities) with English Heritage. The workshop report was circulated electronically and is reproduced here for information. An associated call for proposals for research clusters to take forward the agenda in a number of area has been issued with a closing date at the end of May.

Preserving Our Past – Workshop Report

Introduction

The Preserving Our Past workshop was held at the Hilton Birmingham Metropole Hotel, NEC, Birmingham on 29th March 2006. The workshop was funded by AHRC, EPSRC, ESRC, NERC and English Heritage as a need was identified to build effective working relationships across discipline barriers in the historic environment research community. In addition, new relationships between academic researchers and those working in the creative, cultural and heritage sectors needed to be developed to meet the needs of the historic environment. Attendees at the event were from a diverse range of disciplines and backgrounds. Ideas were shared and future collaborators identified.

Identification of Cross-Cutting Themes

The main output of the workshop was the identification of five cross-cutting themes that historic environment research should address. The five themes which were agreed upon were:

1. Integrated Methodologies
2. Values
3. Engagement and Interpretation
4. Impact of Climate Change on the Historic Environment
5. Sustainability

It is hoped that a cross-disciplinary Research Cluster can be funded in each of these themes. Only those people who attended the workshop are eligible to apply for Research Cluster funding as the Principal Investigator but participation in any future cluster activities should be open to all.

Content of Report

The main body of the report records the outputs of the afternoon sessions of the workshop. The outputs are split by theme. The group lists give the names of the workshop participants who chose to discuss each theme.

Within each theme participants were asked to identify what grand challenges could benefit from cross-disciplinary research. These challenges were prioritised and a poster produced on each challenge identified as high priority. These posters are transcribed below. Challenges are highlighted in bold and underlined.

An appendix contains a list of all the theme ideas and grand challenges that were suggested on the day. Participants of the workshop may find this information useful.

Theme 1: Integrated Methodologies

Group List

Donald Davidson	Dan Hicks	Clifford Price
Mark Dowsett	John Hughes	Colin Prosser
John Farmer	Adrian Hyde	Armin Schmid
Mary-Cate Garden	Jian Kang	Andy Smith
Peter T Gaskell	Alick Leslie	Heather Viles
Ken Grattan	Eric May	Pete Walker
David Harvey	Angie McClanahan	

Achieving Interdisciplinarity – Integrative Methodologies (2 posters)

Poster 1:

What are the names and expertise of those interested in the challenge?

All subjects necessary to developing understanding of historic environment “continuum” e.g. Archaeologists, Historians, Anthropologists, Geography, Environmental sciences.

What other academics/users would need to be involved?

Any necessary to Ensure dissemination of knowledge

- Relevance + Value Added + Accessible
- Public - Participatory Management
- Education
- Knowledge Transfer

What Research Cluster activities might help identify research ideas to overcome this challenge?

- Education – Workshops - Public/Practitioner
- Focus Groups
- Evaluation/audit of specific information sources

Eric May

Donald Davidson – Stirling University

Alick Leslie

Angie McClanahan

Mary-Cate Garden

Additional Comments

This should consider how we translate blue-skies interdisciplinary activity into user focused outputs! - Joe Howe – Queens

Others who expressed an interest in this challenge

Phil Banfill – Heriot-Watt	Jian Kang	Fiona McLean
Richard Jones	Bernard Smith	Donald Davidson
Damian Murphy – York	Mary-Cate Garden	Lesley McFadyen
Lanfranco Aceti	John Pendlebury	Banu Gunel
Aylin Orbasli	David Arnold	John Carmen
Mags Adams	Jamie Kaminski	Mark Dowsett
Kathryn Hallett		

Poster 2:

Integrative methodologies: Consensus or collisions?

A site-specific approach

What are the major elements of this challenge?

- Juxtaposing different approaches to knowledge construction
- Finding a language to bring people's ideas together
- Identifying one landscape to focus upon – e.g. World Heritage Site
- Involving communities with sites
- Undermining participants' authority

What people would need to be involved?

Scientists	Dan Hicks
Social scientists	John Hughes
Practitioners	David Harvey
Policy maker...	Adrian Hyde
Local communities	Heather Viles
... everybody	

What Research Cluster activities might help identify research ideas to overcome this challenge?

- Site visit (e.g. Saltaire, Avebury) and workshop bringing together to work on one site from a range of perspectives
- Follow up visits / workshops
- Outputs – to leave on site something

Additional Comments

Language? What about English Departments, Poets, Artists.
Good idea to take a specific case.

Others who expressed an interest in this challenge

Bernard Smith – Queen’s University, Belfast
Tony Brown - Exeter

'3M' - Monitoring, Measurement and Management (2 posters)

Poster 1:

What are the names and expertise of those interested in this challenge?

Andy Smith (Central Facilities)

Ken Grattan (City University)

Armin Schmidt (Archaeological Geophysics)

Pete Walker (Department of Architecture and Civil Eng. Bath University)

Colin Prosser (English Nature - Geology and Wildlife)

English Heritage and Scotland/Wales/NI Equivalents

What other academics/users would need to be involved?

Anthropologists/Humanities

Social Scientists

Policy Makers (Local Authorities)

Geographers (Remote and in situ sensing)

Local Heritage Groups

Owners

Surveyors

Data Analysis and Modelling

What Research Cluster activities might help identify ideas to overcome this challenge?

Workshops: users – Inclusive Workshops

Summer Schools

Brainstorming

Case Studies/Site Visits

Pilot Projects: 'Pump Priming' Funding £

Networks

Dissemination on Broad Front – Knowledge Transfer

Additional Comments

John Howe – Queen's

There is a need to engage with main players e.g. DEFRA, ODPM, OST, Scottish Exec.

Others who expressed an interest in this challenge

Bernard Smith - Queen's University, Belfast

Phil Banfill - Materials Scientist

Eric May – Microbiologist

John Hughes – Geologist – University of Paisley

Poster 2:

Integrated scientific and social monitoring and management

What are the names and expertise of those interested in this challenge?

Mark Dowsett – Physics/instrumentation

Jian Kang – Sound Environment

John Farmer – Environmental Chemist

Peter Gaskell – Human Geographer

Clifford Price – Conservation scientist

What other academics/users would need to be involved?

Social scientists

Conservation scientists

Conservators

Curators

Natural Scientists

Artists

Historians

Government Agencies

What Research Cluster activities might help identify ideas to overcome this challenge?

Workshops

Site visits e.g. monuments, museums, facilities, sites,

Shadowing – cross-discipline – experience other institutes / faculties

Additional comments

Literature Searches as an activity?

What does “Integrated scientific and social monitoring and management” mean?

Assumes knowledge of the object of enquiry.

Others who expressed an interest in this challenge

Lanfranco Aceti

David Arnold

Mags Adams

Paul Selman

Theme 2: Values

Group List

Ian Strange	Deyan Sudjic	Nigel Clubb
Peter Borsay	Aylin Orbasli	Martin Cherry
John Pendlebury	Chris Andrew	Noel Fojut
Dana Arnold	John Carman	John Barrett
Mags Adams	Jaime Kaminski	Lesley McFadyen
Steve Shaw	Rob Pickard	Brian Garrod
Peter Brimblecombe	Lisanne Gibson	Charles McKean
Bernard Smith		

Whose Past?

What are the names and expertise of those interested in this challenge?

Nigel Clubb - Archivist/Audience Development
 Ian Strange – Leeds Metropolitan University - Planner/Geographer
 Martin Cherry - Historian/Conservation Policy
 Noel Fojut – Archaeologist/Heritage Manager
 Pete Borsay – Historian
 Lisanne Gibson – policy/history/critical theory
 John Pendlebury – Conservation - planner/social scientist
 Dana Arnold - Architectural Historian

What other academics/users would need to be involved?

Sociologists
 Artists
 Folk-life studies

Local history groups
Museum Curators
Heritage Practitioners
National Trust
Creative Industries/Cultural practitioners
Need to consult citizens/users

What Research Cluster activities might help identify ideas to overcome this challenge?

Workshops
Study Visits

Questions

- Of evidence
 - Survival of 'past'
 - Oral, material, textual, visual
- Change across time and cultures
- Construction of identity

Others who expressed an interest in this challenge

Armin Schmitt – Bradford
Nicki Whitehouse – Cultural values of woodlands

Additional Comments

I think that tourists are an important/effectual group here - tourism specialist needed
National Trust can provide the studies and practical examples – Sarah Staniforth

Regeneration and Planning/Changing values in the historic environment

What are the names and expertise of those interested in this challenge?

Rob Pickard - Financial/Regeneration/Legal

Jaime Kaminski - Business Analyst

Steve Shaw - Planning and Tourism

Mags Adams - Decision Making and Qualitative Methodology

Charles McKean - Architectural and Urban History

What other academics/users would need to be involved?

Generic Users

What Research Cluster activities might help identify ideas to overcome this challenge?

Developing cross-disciplinary methodologies to assess values for the protection, management and regeneration of the historic environment.

Additional Comments

Joe Howe – Queen’s

A user focused output that details the relationship between historic environments and the value to local economies.

Role of tourism in forming/charging/distorting values is important here.

And to understand social consequences of this - Lisanne Gibson.

What are the techniques for facilitating interdisciplinary discourse?

What are the names and expertise of those interested in this challenge?

John Carman – Archaeologist – Heritage Value

Aylin Orbasli – Architecture

Bernie Smith – Geomorphologist

Peter Brimblecombe – Chemist

What other academics/users would need to be involved?

Cross-cutting:

Researchers

Practitioners

Policy Makers

Educators

+ Facilitator (see below)

What Research Cluster activities might help identify ideas to overcome this challenge?

Structured workshop targeted at enabling research.

Others who expressed an interest in this challenge

May Cassar – Language Barriers

Interrogating Authenticity

What are the names and expertise of those interested in this challenge?

Deyan Sudjic - Architectural Historian

Chris Andrew - Psychologist

John Barrett - Archaeologist

Lesley McFadyen - Prehistorian

Brian Garrod - Tourism

What other academics/users would need to be involved?

Public - Market Research

National Trust

Curators

Architects

Designers

Artists

What Research Cluster activities might help identify ideas to overcome this challenge?

A practice based project

Workshops on specific sites

Curating

Other Comments

English Heritage will be publishing "Conservation Principles, Policies and Evidence" in January 2007 which defines values contributing to significance. "Authenticate" is a subject concept in this field. - J Fidler, EH

National Trust can provide case studies – Sarah Staniforth

Others who expressed an interest in this theme

Richard Jones	Jaime Kaminski – Brighton	Deyan Sudjic
Clifford Price	Angela McClanahan	Gill Chitty
Lanfranco Aceti	David Harvey	Mags Adams
Jian Kang	Antony Long – Durham	John Carman
Peter Gaskell	Brian Garrod	Rob Pickard
Anne Bacon	Fiona McLean	John Pendlebury
David Arnold – Brighton	Mary-Cate Garden	John Oxley – City of York
Peter Borsay	Kirsten Holmes	

Theme 3: Engagement and Interpretation

Group list

Damian Murphy – University of York
 Banu Gunel – University of Surrey
 Christian Heath - Kings College London
 Anne Bacon – Northumbria University
 Kathryn Hallett – Historic Royal Palaces
 Fiona McLean – Glasgow Caledonian University
 Kirsten Holmes – University of Surrey
 Mathias Fuchs – University of Salford

Gill Chitty – Council for British Archaeology
 Adrian Olivier – English Heritage
 Richard Jones – University of Cardiff
 Graeme Barker – University of Cambridge
 David Arnold – University of Brighton
 Pat Sterry – University of Salford

Interpreting the past

What are the names and expertise of those interested in this challenge?

Kirsten Holmes – Visitor Research
 Banu Gunel – VR
 Pat Sterry – Capturing/testing interpretation/visual studies/interpretive training
 David Arnold – Computer Graphics/VR/Usability
 Damian Murphy – Virtual audio environments/sound art
 Richard Jones – Archaeologist/landscapes
 Mathias Fuchs – Game design, artist
 Kathryn Hallett – Conservation scientist

What other academics/users would need to be involved?

Natural Language Processing
 Sociologists

Professional Interpreters

The public

Geographers

Planners/Architects

Historians

Information scientists

Educationalists

Exhibition Designers

Conservators

Scientists

What Research Cluster Activities might help identify research ideas to overcome this challenge?

Researching how people interpret historic environment

- GPS/GIS
- Social Science Methods
- Planners
- Historians/Archaeologies

Develop ways of using new technology and mixed media to present multiple narratives in mediated settings

Capturing and testing existing and new forms of interpretation

Additional comments

Studies of perception and language

Others who expressed an interest in this challenge

Lanfranco Aceti

Brian Garrod

Deyan Sudjic

Mags Adams

Steve Shaw

Fiona McLean

Clifford Price

Anne Bacon

Martin Cherry

John Oxley

Andy Howard

Ian Strange

Chris Andrew	John Carman	Kirsten Holmes
Mark Bateman	Alick Leslie	Banu Gunel
Antony Long	Lisanne Gibson	Gill Chitty
Jian Kang	Mark Dowsett	Peter Borsay

Engagement

What are the names and expertise of those interested in this challenge?

Graeme Barker – Archaeology
 Fiona Mclean - Heritage Studies
 Anne Bacon – Paintings Conservation
 Christian Heath – Sociology
 Adrian Olivier – Heritage Manager
 Gill Chitty – Voluntary Sector

What other academics/users would need to be involved

Artists	Designers
Craftspeople	Economists
Conservators	Applied scientists
Archaeologist	Environmental scientists
Historians	Curators
Social Scientists	Managers
Computer Scientists and engineers	Policy Makers
Educationalists	

What Research Cluster Activities might help identify research ideas to overcome this challenge?

Creating new affinities between the formal & informal contexts for engagement

Crossing boundaries (professional, academic, voluntary, community, private)

Connecting sectors e.g. science, technology (old and new) with the humanities and social sciences

2 way link between society and historic environment services

Additional comments

- Studies of perception and language
- The challenge is the translation of high-quality joined up science into user focussed outputs for multiple end-users - Joe Howe – Queen's

Others who expressed an interest in this challenge

David Arnold

Richard Jones

David Harvey

John Pendlebury

Jian Kang

Lisanne Gibson

Damian Murphy

Angela McClanahan

Fiona McLean

Lanfranco Aceti

Jaime Kaminski

Kirsten Holmes

Ian Strange

John Carman

Banu Gunel

Mags Adams

Mary-Cate Garden

Peter Borsay

Brian Garrod

Theme 4: Impact of Climate Change on the Historic Environment

Group List

Mark Bateman – Sheffield University	Phil Banfill – Heriot-Watt University
Paul Baker – Glasgow Caledonian University	Jian Kang – University of Sheffield
Edward Impey – English Heritage	Lanfranco Aceti
Georgina Enfield – University of Nottingham	Daniel Watt
Richard Morris – University of Leeds	Mags Adams
Tony Brown – University of Exeter	Deyan Sudjic – Kingston
Antony Long – Durham University	John Pendlebury – Working on pathfinder
Andy Howard – University of Birmingham	John Oxley – City of York
	Richard Avent – Cadw

Retention and Refurbishment vs. Demolition and Rebuilding?

Toward multidisciplinary decision making driven by climate change and carbon emissions

What are the names and expertise of those interested in this challenge?

Paul Baker
 Phil Banfill
 Edward Impey
 Building Economist
 Building Scientist
 Planner
 Historian
 Sociologist
 Geographer

Life Cycle Assessments

What other academics/users would need to be involved?

Community Groups
Housing Assoc./Social Landlords
Local Authority Planners
Statutory Consultees
Construction Industry
CITB
Architects/Designers
Urban characterisation Specialists

What Research Cluster activities might help identify ideas to overcome this challenge?

Site Visits/Field Trips
Workshop to define scope
Research Tasks
Consultation

Other comments

- There is a need to develop applied methodologies that draw upon different disciplines for practice. e.g. further develop sustainability appraisal - Joe Howe, Queens
- Need to consider also environmental obsolescence
- And how does climate change impact on this?
- Need sensors and telecoms for remote monitoring?
- Embodied Carbon/Whole Life Costing
- ODPM involvement

Others who expressed an interest in this challenge

John Oxley - City of York

Pete Walker - Civil Engineer, University of Bath

Tom Hughes - Geologist / materials

May Cassar

Charles McKean

Kathryn Hallett

Steve Shaw

Occurrence, Nature & Responses to Extreme Weather Events in the Past

What are the names and expertise of those interested in this challenge?

Tony Brown	B.H.S.
Mark Bateman	Historians
Georgina Endfield	Archaeologists
Richard Morris	Geographers
	Social scientists
	Engineers (civil)
	Literature/Poetics
	English Heritage and National Agencies
	Natural England and National Equivalents

What other academics/users would need to be involved

Tyndall Centre/UEA
Environment Agency
Met office (including Archivists)
AHRC – Landscape & Environment
Policy Formulation – DOE, ODPM, DEFRA
Centre for Ecology and Hydrology

What Research Cluster Activities might help identify research ideas to overcome this challenge?

Establishment of a field academy

Facilitated Site/Field visits

Short Course for User Community

Trans-Disciplinary Seminar Series

Living Arts Involvement

Others who expressed an interest in this challenge

Graeme Barker – Cultural impacts of extreme events

Andy Howard - climate and land use in fluvial symptoms

Bernard Smith – Interested in sequences of events – magnitude/frequency interactions

Alick Lesley – aleslie@jgs.ac.uk

Nicki Whitehouse - Societal responses to extreme long term/short term events

Antony Long - Interested in Working on this project, especially storms, tsunami and coastal erosion

Heather Viles - Storms, N.A.O. and the built environment

Additional comments

- Joe Howe – Queens – There is a need to consider past extreme events and impact and then project forward to future extreme events and how we manage them
- Include “historic environment” in title

The Sustainable Preservation of the Historic Environment During Climate Change

What are the names and expertise of those interested in this challenge?

Andy Howard – Quaternary science – Geoarchaeology

Anthony Long – Coastal geomorphologist and sedimentology
Richard Avent – Heritage Management

What other academics/users would need to be involved?

Specialists in climate prediction - Met Office, Hadley Centre
Environment agency, Natural England (and equivalents in devolved administrations)
National historic environment organisations
Specialist University Departments
Government Research Bodies
The building Industry
Local Authorities
Conservation bodies and amenity societies
National Trust
Social scientists and economists
Wind power sector, renewables – energy futures
Materials conservation specialists

What Research Cluster Activities might help identify research ideas to overcome this challenge?

Seminar programme with cross-cutting themes by historic environments

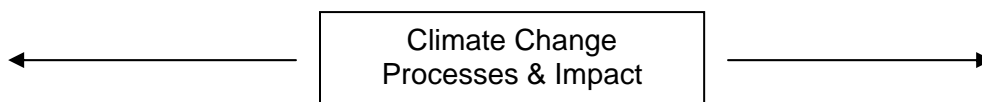
Historical Environments

Uplands

Flood plains/ Wetlands

Urban

Coastal Zone



Themes: Prediction, Modelling, Mitigation, Monitoring

Others who expressed an interest in this challenge

May Cassar

Adrian Hyde – Geotechnical engineering

Phil Banfill – Building materials specialist

Heather Viles – Urban maturing & ultimate change

Mark Pollard, RCAHA, Oxford University

Alick Leslie – aleslie@bgs.ac.uk

Andrew Wareham – ajkcl.ac.uk

John Oxley – York

John Hughes – Geologist/Materials – Paisley University

Nicki Whitehouse - Peatlands/Cultural records

Eric May – Impact of climate change on microbial weathering

Ian Simpson – Soils/Sediments based cultural records

Armin Schmidt – Archaeological Geophysics

Mark Bateman – Quat Science/Geoarchaeology

Tony Brown – Archaeology and earth resources

+

Additional comments

- Building Scientists?
 - Do an OST foresight exercise: Output will be for end-user community - Joe Howe – Queens
 - Historical records of landscape and losses, changes as a result of past climate change - G. Enfield
-

Theme 5: Sustainability

Group list

Martin Jones	David Watt	Nicki Whitehouse
Joe Howe	Andrew Wareham	Lanfranco Aceti
Paul Selman	Simon Glasser	John Fidler
Ian Simpson	Mark Pollard	Peter Robinson
May Cassar	Sarah Staniforth	

How do we Define Acceptable Change?

What are the names and expertise of those interested in the challenge?

Sarah Staniforth, National Trust – Practitioner
 David Watt - Built Fabric and Practitioner
 Lanfranco Aceti, Fine Art – Digital Media, C.S. (V.R.)
 May Cassar, UCL Centre for Sustainable Heritage
 John Oxley, City of York - Practitioner
 Ian Simpson, Stirling - Environmental Assessment
 John Fidler – English Heritage
 Joe Howe, Queen’s – Environmental Planning/Engineering
 Mark Pollard, RLAHA, Oxford

What other academics/users would need to be involved?

Sociologists
 Economists
 End Users – Managers, Policy Makers
 ALGAO, ALGE, IHBC
 RACS, RIBA, RTPi, LI, ICE

ICOMOS, ICCROM

Local Authority community strategies

“Common Ground”/Ground Work

Environment Link

What Research Cluster activities might help identify research ideas to overcome this challenge?

Provision of test sites / case studies / practical experience

Workshop to gather together existing empirical knowledge / research

Practice based projects / empirical knowledge / applications

Dissemination

Facilitate workshops / test sites / archive of previous actions

Site visits / existing practice

Literature reviews on monitoring, performance etc – cross-disciplinary review

Fully integrated knowledge transfer pack on sustainability appraisal for user communities

Additional comments

- Link built, urban, landscape aspects.
- Acceptable change – to communities

Others who expressed an interest in this theme

Heather Viles - University of Oxford

How do we Develop a Single Discourse for Cultural and Natural Systems?

What are the names and expertise of those interested in the challenge?

Martin Jones, Bio-Archaeology

Nicki Whitehouse, Palaeoecology

Sarah Stanforth, National Trust – Practitioner

Lanfranco Aceti, Fine Art, Digital media, C.S. (V.R.)

May Cassar, UCL Centre for Sustainable Heritage

Ian Simpson, Stirling - Cultural, natural records in soil systems

Paul Selman, Landscape Planning

John Oxley, City of York

What other academics/users would need to be involved?

Ecologists

Natural England

Environment agency

Humanities / Historians / Env Historians

Archaeologists

Linguists and Poetics – evolution of vocab

ALGAO / ALGE / IHBC

Systems Modellers

Cultural Geographers

National Commission for UNESCO

National Trust

English Heritage / CADW / Historic Scotland / EHSNI.

Scottish Natural Heritage / CCW

Council for British Archaeology

Environment Link

What Research Cluster activities might help identify research ideas to overcome this challenge?

Workshops

Seminars

Practice Base projects – Empirical Knowledge and Applications

Collaborative Research

Literature Search

Interdisciplinary workshop with “Natural England” + “EH” + “RCS”

Facilitator – 1 year full time ideally!

Field Visits

Case Studies

Scenario Modelling

Additional comments

See also Integrated Methodology Groups

Others who expressed an interest in this challenge

Tony Brown

Jonathan Bake – London

Graeme Barker

Richard Morris

Ian Strange - Leeds Met

How do we Understand the Influence of Timescales on Decision Making?

What are the names and expertise of those interested in this challenge?

Sarah Staniforth, National Trust – Practitioner
 Nicki Whitehouse – Palaeoecology
 Paul Selman – Landscape planning
 Ian Simpson, Stirling – Long-term environmental change
 Joe Howe, Queens – Environmental planning/engineering
 May cassar, UCL centre for Sustainable Heritage
 John Oxley, City of York Practitioner
 Andrew Wareham, CCH, KCL
 Mark Pollard, RLAHA, Oxford University

What other academics/users would need to be involved?

OST, DEFRA, ODPM, RSPB, WWF.
 Politics / Governance / Economists
 Climatocogists
 ENO Users (Managers)
 Ecologist / Palaeoeologists
 GIS Specialist

What Research Cluster Activities might help identify research ideas to overcome this challenge?

Provision of test sites / Case studies / Practical Experience
 Live mapping exercise
 Site Visitors
 Workshop to backcast and forecast case studies
 Single site / Data rich case study - funded
 Demonstration / Pilot project to unpick the research questions associated with this challenge
 OST Foresight Type Project

Appendix

The appendix contains a list of all the theme ideas and grand challenges that were suggested on the day, these are split by theme.

Cards grouped under themes in the morning session were those used in the clustering exercise during which the cross-cutting themes were identified.

What are the Grand Challenges within this theme that could benefit from cross-disciplinary research? – The lists under this heading correspond to the 1 or 2 cards that each participant was asked to complete to answer this question. These cards were used to prioritise which challenges were highest priority and on which posters should be produced.

Participants of the workshop may find this information useful.

Theme 1: Integrated Methodologies

Cards Grouped Under the Integrated Methodologies Theme in the Morning Session

- Multidisciplinary studies of decay processes of construction materials
- Sharing technologies, resources, and approaches creating new affinities between disciplines and approaches
- Monitoring performance in use of construction materials
- Integrated conservation research – The cathedral example
- Training and understanding
- Developing integrating mythologies for achieving/maximising interdisciplinary synthesis.
- Monitoring – From large scale infrastructures to small scale sensors
- The ground as an archive
- Philosophies and methods of conservation decision making (inclusive, collaborative decision making)
- Modelling of physical environment of historic/ancient sites
- Identifying – training skills, development needs, and motivation to work in the

historic environment

- Impact of biology / microbiology on structures, artefacts, landscapes
- Methods of enquiry: Methodologies and practices
- Development of non-invasive / unobtrusive technologies for historic environment (e.g. remote sensing...)
- Historic evaluation - understanding benefits & effects / Social, Cultural, economic environmental
- Tracing evolving relationship between 'cultural' & 'natural' environments - human self-perceptive, trajectories in land use, attitudes to change
- Materials supply & research, social-economic issues
- Understanding buried landscapes e.g. peat, sand, later settlement, submerged/off-shore

What are the grand challenges within this theme that could benefit from cross-disciplinary research?

- Moving beyond the socioeconomic approach to 'value' (i.e. quantitative), and embracing more culturally sensitive methods (i.e. qualitative methods like ethnography.)
- Integrated approaches: to assess buried remains (technology, soils...), to monitor preservation (in situ), to solicit user-ownership. Community engagement to ensure preservation
- Facilitating communication between professionals – e.g. physicists and curators
- Development of methodologies to foster interdisciplinary collaboration. Specific issues – time / space resolution
- Database of methods for heritage research
- Incorporating methods of dealing with people in relation to the historic environment (e.g. ethnography.)
- Democratizing methods – questioning “expert” knowledge and processes of knowledge construction
- Involving 'public' at foundation stage bottom up approach
- Built Heritage: Long term resource provenance & assessment. Including databases, GIS, etc
- Building material: Production and sourcing

- Sustainable materials supply for conservation & understanding life cycle
- Damage potential of micro-organisms for heritage artefacts and buildings
- Maximising the extraction of information from subsurface archaeology
- Monitoring technologies and sensors for: monitoring performance in work, monitoring deterioration, monitoring the effectiveness of treatments
- Evolving cheap sensors for sophisticated monitoring
- Improved in-situ monitoring and sensor systems for quantitative measurement of change
- Building materials: Methodologies for testing and appraising building materials, and repair techniques and structure
- The indicators for monitoring change in the historic environment so far selected are totally inadequate. There is a pressing need to bring historic environment monitoring methodologies and practices to a level of rigour which matches those in place for monitoring the natural environment. Evidence – based policy making requires evidence and we can't provide in at present. We need to develop cost effective quantitative and qualitative techniques
- Ontological foundations of methodological approaches – What is it that we are counting, measuring, describing etc.
- Using technology to provide access to hidden archaeology
- National, regional, JCA level data on the nature, condition and management of the historic environment
- Giving appropriate weight to methods from the arts & humanities: e.g. writing archaeological fieldwork, contemporary art / practice-based research, etc
- Integration of qualitative & quantitative research – Including giving parity to experience & perception
- Creating interdisciplinary – yet cohesive – methodologies to assess elements like cultural value, feelings about heritage, and to gauge people's perceptions of the historic environment
- Integrated inter-disciplinary interpretation of the past
- Site management: assessment, recording, management plans, understanding and interpretation
- Simulate/model acoustic environment – Introduce aural dimension
- Making science & scholarship more relevant to real issues facing our heritage
- Encouraging the development of innovative methods for addressing key practical

issues – an integrative framework?

- Understanding and defining the ‘problems’
 - Consider materials from multiple – disciplinary viewpoint e.g. acoustic features
 - Integrated materials characterisation & testing with decision making
 - Materials analysis: quantification of decay, geochemical analysis – new techniques
 - Nature of materials: composition, origins, change (weathering). Geology – Chemistry – Microbiology – policy & training
 - Multi-disciplinary studies of decay processes in historic materials
-

Theme 2: Values

Cards Grouped Under the Values Theme in the Morning Session

- Value and Significance
- Valuation of the historic resource
- Identities
 - Whose history?
 - Understanding identity construction
 - Sense of place
- Governance
 - Legal frameworks
 - Policy frameworks
- Socio – economic - cultural. Value. Investment. Appraisal
- Whose values? Why? How? In the historic environment
- Tourism versus identity
- Studies of cultural value from physical and sociological/psychological perspectives
- What are we preserving and why?
 - Does context give object meaning?
 - Who is involved in process of giving meaning?
- Inclusion + Access
 - Physical
 - Intellectual
 - Cultural

- Cultural identity and value
- Historic and contemporary perceptions / social constructions / story-telling
- Memory and forgetting
- Understanding and ‘capturing’ identity in the historic landscape + environment
- Recontextualising historic environment. New techniques. New resources. Access
- Changes to the physical historic environment and perceptions of value (social, aesthetic...)
- Preservation or digitisation?
- What value tourism?
 - Regeneration / place
 - Local identity
- What makes us value the past?
- What aspects of the historic environment people most identify with and how this should be used as a tool in evaluation and decision making.
- Future vs contemporary vs past values
- Social, political + economic effects of heritage
- What are we ‘preserving’ and who is involved in this process?
- The ‘politics’ of value. Value into policy and practice. Who defines value? Power? Does ‘science’ objectify value?
- What is the difference between aesthetic and cultural value?
- How might soundscapes be valued + preserved over time (in the way that the visual + material environment is currently)
- Whose identity / value / history?
- Integration of the physical assessment of built heritage with assessment of its cultural value – methodologies for “assessing” cultural value.
- The interpretation of identity
- Plural values in unique assets.

What are the Grand Challenges within this theme that could benefit from cross-disciplinary research?

- Moving beyond economic approaches to value
- How do we measure cultural value? Is there such a thing?
- How to accommodate the multiple interpretations and values of the past in planning

for diverse communities? What does social inclusion mean in a historic environment context?

- Heritage led regeneration. How to widen participation and capture social values of places and spaces.
- Using social + economic values as the basis for increased understanding of the heritage system.
- How do we?
 - Increase the understanding of the social value of heritage
 - Use this information to drive policy
- The way different value systems (commercial, aesthetic, authenticity, academic...) converge upon and make different demands upon heritage resources and the challenge of releasing value to the wider community.
- Reconciling specialist views (“The official narrative”) with popular values (including ‘conflicting values’)
- Enabling public access to heritage resources in a context of preservation and conservation.
- Time, space and value. Changing meaning of ‘value’ across time ‘the past’ and space. How ‘value’ is established historically. Space and value.
- How can we integrate knowledge from different groups (ethnic, gender, age related etc) into decisions about what and how to preserve today?
- How are individual + collective identities constructed + how does this relate to the built / historic environment?
- How do we understand authenticity
- Dealing with the tensions that tourism introduces into the equation e.g. tourism’s use of images vs. community’s perception of place / sense of place
- Relating physical + chemical change to aesthetic change + loss of value.
- What are we creating knowledge of? Different kinds of knowledge and what we do with this difference...
- Defining / delineating value schemes appropriate to different approaches to the historic environment
- Whose past? Whose history?
- Values shift over time. How does this transform the object / environment?
- What should we be preserving – and why?
- Conservation has negative as well as positive social consequences

- Achieving a truly interdisciplinary understanding of the 'value' or 'worth' of the historic environment
 - The role of the past in the future
 - Communicating value? Training professionals working in the historic environment..
How do you communicate value?
 - The language business between disciplines
 - Developing a methodology to measure values through benefits and effects of investing in the historic environment by reference to social, cultural, economic and environmental issues.
-

Theme 3: Engagement and Interpretation

Cards Grouped Under the Engagement and Interpretation Theme in the Morning Session

- Communication and engagement
- Public engagement with the past
- Bringing the past to life
- Access to knowledge base. Digital Achieves formation / maintenance sustainability.
- Perceiving / experiencing the historic environment
- Access and interpretation supported by ICT
- Historic environment and community
- Sensory Experience
 - Practice of making and imagining the past
- Politics + ownership of heritage – community as curators, traditional crafts as conservators, and the role of state institutions
- Participation / engagement, social impact on historic environment
- To identify the processes that act as a catalyst for public / community enthusiasm for historic environment and their relationship to current policies of conservation.
- Broadening experience of H.E.
- Public / community / access / participation

What are the Grand Challenges within this theme that could benefit from cross-disciplinary research?

- Moving away from concept of access (1-way) to participation / inclusion (2-way)
- Finding out what is relevant to all participants
- Exploring the impact of that relevance (socio-economic / emotional impacts) on our perceptions of the historic environment.
- Reshaping the historic environment to encompass these perceptions.
- Learning how to manage this properly.
- Interpretation: Access + conservation 'partnership' not 'take-over'
- Developing tools for access and evaluation of experience
- Accessibility for all groups of society. Achieving experience through VR - audio / video / historians / sociologists. What do we need to enable access for? Relation to values. Achieving a large library of historic environments.
- A consideration of how we present and interpret the historic environment to the public.
 - Cultural heritage management
 - Who for - families? Singletons?
 - Experience different stakeholders
 - Social inclusion
 - Interpretation
 - Story telling
 - Authenticity
 - Design
 - Interactive design
 - Tourism
- Cross disciplinary research can explore historical environments from the viewpoint of a media analysis into forms of representation of the historical objects.
- Use of heritage to raise public engagement in science (House of Lords inquiry, SET committee) (Schools+) + vice versa
- Empowering the social enterprise in cultural heritage; with intelligent ICT tools suitable for non-specialists; coupled with understanding organisational motivations.
- Widening access / interpretation for increased understanding - a broader audience for specialised knowledge leading to increased awareness + 'valuing' - "lost" knowledge existing practitioners
- Enhancing experience through understanding of experience
- Community Participations
- Understanding how people engage with the past outside of formal settings (e.g. where they live)

- Historic environment as text.
 - How do we read the HE?
 - Is there space for multiple readings?
 - Is there opportunity to present these alternatives?
 - How do we challenge top-down interpretations?
 - Can we encourage bottom-up readings?
 - Can we get away from socio-economic and political readings?
 - Can we accommodate personal and cultural readings?
 - How can we make the HE more immediate – tactile / auditory / experienced?
- Community ownership of environment
 - Historic environment and the community
 - Not ‘public’
 - But individual, household, local community
 - Explore their engagement with HE
 - Explore how this informs what we do / present / preserve HE
 - Break down academic – community divide
 - Break down disciplinary approaches and form links with the social sciences
 - At what scale are HE’s relevant and to whom?
 - How does familiarity / novelty affect how the HE is perceived?
 - How and when is it experienced?
 - Through which media?
 - Using which senses?
- Understanding and capturing the needs of those who use + visit the historic environment (end-users, visitors, stakeholders, audiences, conservators, communities). Embrace all aspects – heritage assets. Landscape built / human. Cult attractions / museums / galleries / sites / buildings
- Understanding the visitor experience in formal settings (museums, heritage attractions)
- Using other media – design (Psychology – ICT – Historians)
- Bring the past to life for the citizen
 - interpretation, story telling
 - multi linguistic
 - interactive experiences
 - applications - education – edutainment
- Major driver for public policy for the historic environment is public engagement and participation, citizenship etc (social capital). “Sustainable communities” “double devolution”. BUT we know very little about who, why and how this notional interaction happens. And what the public blue fits are. The methodologies of the actual frameworks for this are in the social sciences and we need to bring this to

bear on these questions.

- The Leicester problem / opportunity
 - Linking technology aspects (new ways of displaying sites, experiencing sites etc) with humanities aspects of value, past and present – what was the past and who owned / owns it, plus social sciences aspects e.g. behaviour, alienation, attraction, audience mix, engagement etc.
 - Developing new methods of accessing the HE based on multi-sensory, interactive, interpretive materials
 - Perception of the HE – Virtual reality?
 - Personal experience of the HE
 - What role does art have to play in innovative interpretation of the HE?
 - Enhancing engagement and participation in historic environments
-

Theme 4: Impact of Climate Change on the Historic Environment

Cards Grouped Under the Climate Change Theme in the Morning Session

- Managing impact of climate change
- Understanding nature of future threat
 - Climate
 - Anthropogenic
- Sustainable sourcing & applications (embedded energy), (Stone / Build materials)
- Sustainable preservation
- The impact of climate change
- Pervasive impact of renewable energy
 - Onshore & Offshore
 - Macro & Micro (e.g. towns)
- Climate change: evidence of past impact, understanding and mitigating current impact on historic environment
- Impacts of 'Global warming' on the historic environment. And Implications – Sustainability values / issues
- Climate Change
- Climate change. Interdisciplinary management of impact (Coasts, water, wetlands).

Technology.

What are the grand challenges within this theme that could benefit from cross-disciplinary research?

- Impact of climate change on the historic fabric of buildings etc. Decay determination
- (IN SITU) Preservation of the historic environment (artefacts, fabric, landscape). Technical Innovation in monitoring, prediction, mitigation. Valuation.
- Preservation issues
 - Risk assessment of climate impact
 - Conservation Practice
 - Monitoring
 - Socio-Economic factors e.g. impact on building use.
- Managing Coastal retreat – The implications of coastal retreat on the HE
- Impacts of climate change on the historic environment. Direct impacts – Landscapes/Buildings
- “Energy”. Upgrading strategies to improve energy efficiency, comfort & amenity in “historic” housing, whilst retaining historic character, etc.
- Appropriate mitigation methods for e.g., CO₂ from historic buildings which are also consistent with principles of conservation
- Energy consumption past and present in the construction & use of buildings: How could we model the true energy consumption, impacts of demolition (loss of energy) also rebuilding (use of energy in construction, reduced loss in use, and integrate the results into strategies for the conservation of the historic environment
- Research into impact of renewable energy including offshore wind farms on HE
- Understanding past changes to... ID, valuing & protecting heritage landscape
- Resilience of natural and social systems to climate change
- Historical development of concepts of environment, nature, climate – climate’s language
- Understanding past climate change to inform future predictions & response
- Conceptualisation of climatic variability in the past (How past societies understood, interpreted, responded)
- Climate change in history - extreme weather events - trends, impacts (Human & Environmental), responses.
- Impacts of climate change on the historic environment. Indirect impacts:

- Hydrol. mitigation
 - Coastal defences
 - Development
 - Sustainable preservation – e.g. in situ building, artefacts
 - What happened when under what conditions (impacts of past changes on...).
Future models/seminars. Management at regional level or landscape component
e.g. coastal, floodplain, limestone
 - Occurrence, nature and the response to extreme weather events in the past
-

Theme 5: Sustainability

Cards Grouped Under the Sustainability Theme in the Morning Session

- Isolation of the preserved past and involving communities
- Dynamism and Temporality
 - Shifting meanings + interpretation
 - Accessibility of archives
 - Constructing + communicating meaning
- Disappearing Human Ecosystems
- Sustainability of historic environment
- Defining sustainability and carrying capacity in historic environment context
- Disappearing Historic Landscapes
- Indicators / impact assessment / sustainability
- Sustainability - What does it mean in context of historic environment?
- Modelling the historic environment as an energy system to enable the management of that system as part of a large 'ecology' and to map net benefits of change.
- Long term futures for the past
- Integrating 'Time-Depth' into development and land use decision-making.
- Digital mapping and applications for historical environment. Integrating community survival, regeneration, technology and design

What are the Grand Challenges within this theme that could benefit from cross-disciplinary research?

- In situ preservation of above and below ground archaeological deposits. Efficacy of strategies. What do we mean by preservation?
- How best to allocate scarce public resources across the sector.
- Carrying capacity of the historic man-made environment - managing the leisure culture and its impact.
- How does knowledge transfer into policy?
- Knowledge integration to policy measures.
- How do we quantify benefits of change / development?
- How do we balance use / access with conservation of historic environment?
 - Tourism
 - Regeneration
 - Agriculture
 - Landscape
- Sustainability in terms of being true to the past while taking advantage of changing technologies. Culture / nature interface
- Interrelation between natural / cultural + policy. Joined up Thinking. Cultural Construct.
- How do we bring about convergence between natural heritage (ecological systems) and historic environment / cultural heritage (human or engineered systems)? – Development of common indicators of change (-ve and +ve)
- Disappearing cultural ecological resources
- Historical ecology – resilience of human ecosystems (socio-ecological systems) over time. “The long durée”
- Understanding the scientific basis of the processes which determine the sustainability of the cultural heritage
- Studies of long term change management strategies.
- The development of the cultural Holocene landscape + its implication for sustainability + conservation (i.e. using the past to inform present future management) (part of that may be conservation of archive)
- Contrasting temporalities. Different timescales
- Sustainability:
 - Long term monitoring and prediction modelling of change management.
 - Studying long term risks to historic assets and devising responses.
- Mainstreaming history / heritage into other policy / planning areas. “Time depth” at

the neighbourhood + landscape scales

- Preserving the past for land use futures
- Developing performance indicators for historic built environment:
 - Life / whole life costing
 - Materials
 - Repairs / maintenance
 - Effective decision making
- Developing sustainable safeguards for the historic environment in the context of urban and rural development / growth.
 - Culture / meaning / values
 - Not missing opportunities or threats
 - Proving / providing sustainability in development context
- Sustainability in terms of maintaining systems once the excitement of “new projects and new investment” has passed

Appendix 4:

Electronic Imaging & the Visual Arts

Programme

Monday 3 April

ROOM A

6. WORKSHOP 1 EPOCH PROJECT

9,30 – 13,00

14,30 – 18,00

1) Standards for Cultural Heritage

Chairman: Franco Niccolucci (EPOCH)

Speakers (preliminary list, participation to be confirmed):

- *Richard Beacham, King's College,*
- *Tyler Bell, Oxford ArchDigital,*
- *Andrea D'Andrea, University of Naples "L'Orientale",*
- *Sven Havemann, University of Graz,*
- *Christian-Emile Ore, University of Oslo,*
- *Nick Ryan, University of Kent,*
- *Mike Vandamme, VARTEC, Gent*
- *Sorin Hermon, PIN, Prato*

EPOCH is fostering the use of international standards as CIDOC-CRM for documenting Cultural Heritage and is carrying on research to map de-facto/local standards and related documentation to the international system. Current activity in this field will be reported and emerging issues discussed. Technical standards for computer graphics will be discussed as well, in order to analyse the needs of the heritage sector and evaluate fitness and possible extensions. Finally, the workshop will consider credibility and reliability issues, a feature of great importance for cultural heritage applications, for which a charter (the "London Charter") is being drafted by a committee based at KCL and chaired by prof. Beacham and Niccolucci.

Interdisciplinary attendance – both from the technology and humanities sectors – is warmly encouraged.

2) Usability for Cultural Applications

Chairman: Franca Garzotto (EPOCH)

Speakers (preliminary list, participation to be confirmed):

- *Davide Bolchini, USI - University of Italian Switzerland, Lugano,*
- *Halina Gottlieb, The Interactive Institute, Stockholm,*
- *Antonella Guidazzoli, CINECA,*
- *Franco Niccolucci, University of Florence,*
- *Laia Pujol, University of the Aegean, Lesvos.*

Making usable cultural applications is a challenge that requires appropriate tools to be managed effectively. Such tools are being experimented in EPOCH. The workshop will deal with usability and accessibility for multimedia applications, and will report on the survey performed in EPOCH by PLIMI and USI on this subject. Moreover, psychological aspects of 3D visualization and virtual reality applications will be considered, and related activity at CINECA with psychologists and communication experts will be presented and compared with ongoing research at Aegean University. It is anticipated that psychology and communication experts will intervene as well.

Heritage professionals are particularly welcome.

3) Setting the Research Agenda

Chairman: Daniel Pletinckx (EPOCH)

Speakers (preliminary list, participation to be confirmed):

- *David Arnold, University of Brighton, EPOCH Coordinator,*
- *Paolo Cignoni, ISTI-CNR, Pisa,*
- *Halina Gottlieb, The Interactive Institute, Stockholm*
- *Franco Niccolucci, University of Florence,*
- *Nick Ryan, University of Kent,*
- *Tullio Salmon Cinotti, University of Bologna,*
- *Luc Van Gool, University of Leuven and ETH Zurich.*

Like every new domain, the IT based CH domain has been mainly technology driven. To become a mature domain, it needs to become user driven, where the technological developments fit the requirements of the users, and yield sustainable systems. EPOCH is establishing a community wide Research Agenda that supports this transition, and clearly indicates where the development priorities of the community are.

Having a Common Research Agenda should yield an important impact on the overall research of integration IT in CH and improve efficient use of funds. The workshop will present the preliminary conclusions of EPOCH internal work, which are already the outcomes of partners' discussion and examination by an enlarged group forming the Network's Review College, and will discuss them with the wider scientific community.

All people involved with research in this field, both with a technological or heritage perspective, are welcome to participate.

Participation to EPOCH Workshops is open and free. However, for logistic reasons and to guarantee the availability of a sufficient number of copies of the relevant documentation, non-EPOCH partners willing to attend a Workshop are kindly invited to contact Franco Niccolucci (niccolucci@unifi.it) in advance, to confirm their presence.

4) Networking workshop

Chairman: David Arnold (EPOCH)

Presenters (preliminary list, participation to be confirmed):

- *C2RMF, Paris*
- *CINECA, Bologna*
- *King's College, London*
- *PIN, Prato*
- *Visual Dimension, Belgium*
- *and possibly many more...*

In this informal session, EPOCH partners and other institutions will present "hot" research issue. They will have 10' minutes for introducing the problem and then it is expected that other participants offer contribution to solutions. Possibly, they will continue the discussion afterwards and establish joint research activities. The goal of the session is to facilitate the meeting of people with similar, or complementary, research interests and to promote the creation of new teams.

Discussing new research threads and related problems, instead of solutions, is something that usually happens in the corridors of conferences. This workshops tries to insert such discussions in the program, while maintaining their informal character.

All people involved with research in this field, both with a technological or heritage perspective, are welcome to participate.

Appendix 5: EUROPEAN WORKSHOP ON CULTURE & TECHNOLOGY

Fattoria di Celle, Pistoia, Italy

Report on the Workshop held on 8 & 9 April 2006

Participants:

David Arnold	England
Dario Avallone	Italy
Jean Barda	France
Benedetto Benedetti	Italy
Anna Maria Bonacchi	Italy
David Burton	Wales
Rossella Caffo	Italy
Vito Cappellini	Italy
Andrea De Polo	Italy
James Hemsley	England
Toshiro Kamiuchi	Japan
Romana Krizova	Czech Republic
Francis Lilley	England
Miranda MacPhail	Italy
Franco Niccolucci	Italy
Claude Poliart	Belgium
Seamus Ross	Ireland
Mike Spearman	Scotland
Friso Visser	The Netherlands

The workshop, sponsored and supported by the FONDAZIONE CASSA DI RISPARMIO DI PISTOIA E PESCIA, was held in the beautiful Fattoria di Celle, Open Air Museum in Pistoia. Opening and welcome were delivered by Dr. Giuliano Gori, owner of the Fattoria di Celle.

The Workshop consisted of a mix of participants from academia, industry, governmental and cultural institutions presenting their own opinion.

The introduction by Vito Cappellini addressed the fact that the need for better access to digital repositories is evident. Effective use of material requires different approaches with 3D and visual access. As well as access the question of longevity is of great importance and digital preservation remains an issue to be addressed. The Workshop would concentrate on all the issues surrounding this topic.

The discussing was wide ranging, and many related issues came up. Finally six major areas were identified. These are discussed below.

Visual

So far access to digital materials has been text based for most part. However modern society has a predominant focus on audio-visual materials and therefore, logically, would

require a more visually orientted approach to access. Materials such systems would have to deal with include; 2-D, 3-D, moving images, sound and animations. A visual approach should include facilitating users to laterally explore content rather than being simply led down “well trodden” paths towards a single result. The present ways of and means for accessing digital repositories is dominated by a “single path” “single result” type of outcome. Integrating and analysing multidimensional multi-media data will require provision of intelligent tools allowing cultural heritage professionals to operate in their own professional domains and not as amateur computer scientists.

Quality

There is a tendency to underpin the need to digitise as much material as possible. This is however a questionable approach. It would be preferable to produce materials that are of a rich nature, contextualised and with a sustainable environment, rather than to produce a mass of insignificance. This means a curatorial approach to digitisation as well as a ”standardised” way of handling the digitisation process¹. In other words, the careful selection of materials while digitising and embedding these with a view to their place in many environments (meaning the possible referral to other resources/repositories/materials) is essential. A different approach to digitisation where quality rather than quantity and selectiveness rather than completeness are prevailing, will support a better access for all citizens².

Access

Access in support of the multicultural, multilingual society of Europe is paramount. Different views and multiple ways for accessing culture should support and express the multitude of languages. Access based on a multilingual approach has, by far, not been realised to an extent that is required to support the current status and future changes. Also, as the multicultural nature of European Society becomes more obvious by the day, any digital access should enable different views on the cultural heritage as well as current culture, supporting mutual understanding and acceptance among different groups in society, including design for equal gender access. In a sense this underpins the needs for putting access supporting (formal) education up front. Access until now has been approached more in a sense of “giving” access based on technical abilities and technical support than on the needs of society. This has to change diametrically.

Preservation

With all activities, a recurring issue is that of how to preserve digital materials. Although there is some attention given to questions of how to tackle problems in this area, it would be better to implement solutions that handle the problem upfront. This should be coupled to the issue of how (and why) to digitise materials. In particular digital formats and physical supports should be in line with standards, reviewed and updated whenever major modifications occur. To ensure persistency of the preservation process, a continuous watch on evolution of standards should become a routine activity for leading institutions. The group were pleased to receive reports about those major activities funded under Call

¹ Re MINERVA guidelines

² e.g. as mentioned in the Dynamic Action Plan

5 of FP6. The group agree that these activities would contribute to addressing some of the preservation challenges, but we believe the problem is so large that it will require far more investment and effort.

User consultation

The push and pull of technology, with development of solutions concerning access to and representation of digital materials, has so far not resulted in a clear view of real needs. Meaning that those who are providing access should have a vision of what users require and what use can be made of the content they provide. Involving both providers and users, in dialogue with research and development teams, should come to the mentioned vision. This should take into account new ways of giving access (re. the audio-visual approach), rather than to continue on the current basis.

Future Actions

Two further issues were also discussed. First, to take in consideration the vast amount of work already done in establishing the ERA (European Research Area) within many projects funded by the European Commission such as Michael, Minerva, Minerva Plus, Delos, Bricks, Prestospace, Epoch. Second, to take into consideration the Dynamic Action Plan set up in the framework of the “NRG” (National Representatives Group). The Dynamic Action Plan substitutes and updates the Lund Principles and represents a kind of roadmap for supporting in the next years the creation and the access to the digital cultural content for all citizens according to i2010, in the light of FP7 and the EU member states’ initiatives on Digital Libraries.

The group considered the need to diversify funding for digital access to Europe’s multicultural heritage. The positive role in support of the arts and cultural heritage in some countries of banks, lotteries and multinational corporations was noted. The adoption and coordination of similar opportunities for these organisations to provide sustained funding of cultural projects is encouraged.

The Participants state their willingness to cooperate to further the research agenda related to the above topics in the near future.

Appendix 6: AHRC ICT Methods Network Expert Seminar on History and Archaeology

VIRTUAL HISTORY AND ARCHAEOLOGY

Humanities Research Institute, University of Sheffield, 19 – 21 April 2006.

PROGRAMME

The Expert Seminar has three subjects on the programme. Each subject aims to bring specialists in the application of ICT to the historical and archaeological domains together. Subject specialists will present their overview in pre-circulated papers, presented orally in no more than 30 minutes. There will be a panel Rapporteur who will orientate the discussion with a presentation of no more than 15 minutes. Each subject specialist will be invited to nominate particular ICT applications that 'exemplify' the questions and problems they are tackling. These will be available for inspection where possible before and after the seminars so that discussion of the issues can flow through from one session to the next. There will also be some time for blue-sky discussion so that we can pick up on issues and themes that have not been raised or given adequate coverage up to that point. The aim is to lay the groundwork for a publication in the Methods Network series *Advanced ICT Methods in Arts and Humanities Research* (working title). We shall have our work cut out to reflect the breadth and potential of the subject in our three days' discussions.

SUBJECT 1 - THE PAST AND THE VIRTUAL REPRESENTATION OF PLACE AND TIME (19 APRIL)

This subject will examine questions of the representation of spatial and temporal analysis in historical and archaeological data. Both are crucial to the disciplines in question, although they are understood in different ways. The representation of time ('chronological'; 'epochal'; etc) is problematic in both disciplines. Senses of time have varied significantly in the past and their representation in historical documentation is therefore important. Historical and archaeological representations of space are also flexible. This subject is the one in which we shall touch on the extensive use of GIS and VR techniques developed by archaeologists and historians. In both areas, the disciplines probably have a good deal to learn from other social science disciplines (geography; sociology; urban planning, etc) as well as from each other. We shall conclude by questioning whether ICT tools can be developed and applied which adequately recover the ways in which senses of time and space are historically and archaeologically understood that cannot be effectively presented through traditional media.

SUBJECT 2 - THE PAST AND THE VIRTUAL REPRESENTATION OF TEXTS (19-20 APRIL)

This subject concentrates on assessing critically the degree to which ICT enables historians and archaeologists to interpret text in ways that have not conventionally been possible. Throughout the subject, we shall include images representing textual artefacts as part of our overall consideration. Our first session starts with a relatively practical issue: the application of advanced mark-up in historical and archaeological environments. This will involve the use of specific mark-up for particular historical and archaeological domains, whilst ensuring that our disciplines are applying the interesting techniques developed in other, especially literary, humanities environments. We shall want to take stock as we go of where latest developments have taken us, and where we have not made as much progress in applying techniques and applications available elsewhere. Our next two sessions involve questions of developing environments where text can be 'searched' and 'mined' in distributed environments, including environments where textual artefacts are stored in image forms. In the first, we shall concentrate on the experience (limited) and potential (great) for data-mining in historical and archaeological environments, and the challenge in building the appropriate ontologies. The third session focuses on data-linkage and, in particular, the development of appropriate common environments for archaeological field reports and linking archive/library records to historical text-based materials, including digital images of archival materials. In a final session, we hope to link up by Access Grid with some delegates at the Computer Applications in Archaeology Conference, Utah to take stock of the ICT tools that are currently available which most effectively assist archaeologists to undertake data analysis in ways that were not available in the past. We may want also to consider what a working environment in ICT for these disciplines would look like in the future.

SUBJECT 3. THE PAST AND THE VIRTUAL REPRESENTATION OF OBJECTS AND EVENTS (21 APRIL)

This subject addresses the question of the virtual representation of historical objects, how best to record the various assumptions and circumstances that go into any virtual representation (e.g. the reconstruction of an object or the recreation of a historical event). These have recently been termed 'paradata'. In our first seminar, we shall investigate how ontologies of 'paradata' can help historians and archaeologists develop a reliable scholarly environment for virtual representation. The second seminar takes as its theme an even broader question – virtual representation and the historical and archaeological agenda. The objective of this seminar is to take a reality check on whether virtual representation is really helping us to answer major historical and archaeological questions. On the one hand, we may (ought) to be sceptical about the research conclusions reached through virtual representation to date. On the other hand, the benefits of being able to

study certain kinds of objects, surviving in scattered locations, closely, bringing a variety of skills to bear on them, are clearly potentially very large. Beyond that, there are issues of funding and audience. So this seminar is also about present and future scholarly cost-benefit from research via these technologies. AHRC ICT Methods Network www.methodsnetwork.ac.uk AHRC ICT Methods Network, Centre for Computing in the Humanities, Kay House, 7 Arundel Street, London, WC2R 3DX.

19 APRIL 2006	SUBJECT 1 - THE PAST AND THE VIRTUAL REPRESENTATION OF PLACE AND TIME
09.30	Introduction (to conference and subject 1)
09.45	Using GIS to Study Long-Term Population Change <i>Ian Gregory, Queens University Belfast, Northern Ireland.</i>
10.15	Which; What; When? <i>Manfred Thaller, University of Cologne, Germany.</i>
10.45	<i>tea/coffee</i>
11.15	Visualisation: Pretty pictures or enabling technologies <i>Vince Gaffney, University of Birmingham, UK.</i>
11.45	Spatial Technologies in Archaeology in the Twenty-First Century <i>Paul Cripps, University of Southampton, UK.</i>
12.15	Discussion (to include 15 minute Rapporteur presentation by Kate Devlin, <i>University of Bristol, UK.</i>)
13.00	<i>buffet lunch</i>
19 APRIL 2006	SUBJECT 2 - THE PAST AND THE VIRTUAL REPRESENTATION OF TEXTS
SESSION ONE	
14.15	Introduction (to subject 2)
14.30	Imaging of Historical Documents <i>Andrew Prescott, University of Sheffield, UK.</i>
15.00	Data, Structure and Analysis: XML mark-up and its application to historical data <i>Donald Spaeth, University of Glasgow, Scotland.</i>
15.30	<i>tea/coffee</i>
16.00	Historical Documents and Encoding <i>Harold Short, King's College, London, UK.</i>
16.30	Discussion (to include 15 minute Rapporteur presentation)
17.30	Close
20 APRIL 2006	SESSION TWO
09.30	Finding Needles in Haystacks: Data-mining in distributed historical data-sets <i>Mark Greengrass and Fabio Ciravegna, University of Sheffield, UK.</i>
10.00	Digital Searching and the Problem of the Ventriloquist's Dummy <i>Tim Hitchcock, University of Hertfordshire, UK.</i>
10.30	<i>tea/coffee</i>
11.00	Using Computer-Assisted Qualitative Data Analysis Software (CAQDAS) in Historical Research: Some methodological issues from the experience of the 'Health of the Cecils' Project <i>Caroline Bowden, Royal Holloway, University of London, UK.</i>
11.30	Discussion (to include 15 minute Rapporteur presentation)
13.00	<i>Lunch</i>
SESSION THREE [in ICoSS Access Grid Suite – to link with AAC conference]	
14.30	Shared Spaces: Library and archive metadata, encoded documents and research needs <i>Susan Hockey, University College, London, UK.</i>
15.00	Attempts to Construct a Common Platform for Archaeological Reports <i>Julian D Richards, University of York, UK.</i>
15.30	Crossing an 'Information Divide': The OASIS project and its use of XML schema <i>Catherine Hardman, University of York, UK.</i>
16.00	Discussion (to include 15 minute Rapporteur presentation)

AHRC ICT Methods Network www.methodsnetwork.ac.uk AHRC ICT Methods Network, Centre for Computing in the Humanities, Kay House, 7 Arundel Street, London, WC2R 3DX.

17.00 - 17.30	<i>tea/coffee [in HRI]</i>
17.30	Close
19.00	Dinner for participants
21 APRIL 2006	SUBJECT 3. THE PAST AND THE VIRTUAL REPRESENTATION OF OBJECTS AND EVENTS
09.30	Introduction (to subject 3)
10.00	Digital Artefacts: Possibilities and purpose <i>David Arnold, University of Brighton, UK.</i>
10.30	Oh, to make boards to speak! There is a task!" Towards a Poetics of Paradata <i>Richard Beacham, King's College, London, UK</i>
11.00	<i>tea/coffee</i>
11.15	Constructing a Corpus of Material Objects: The case of the <i>Corpus of Romanesque Sculpture in Britain and Ireland</i> <i>Anna Bentkowska-Kafel, Courtauld Institute of Art, London, UK.</i>
11.45	Virtual Restoration and Manuscript Archaeology: A case study <i>Meg Twycross, University of Lancaster, UK.</i>
12.15	Discussion (to include 15 minute Rapporteur presentation by Matthew Woollard, <i>AHDS Data Archive, UK</i>) and Close of Expert Seminar
13.15	<i>Lunch and depart</i>

Appendix 7: Details on the DigiCULT Forum's roadmapping work "The Future Digital Heritage Space"

From March 2002 to December 2004 the DigiCULT Forum (FP5-IST supportive measure) monitored, discussed and analysed existing and emerging technologies likely to benefit the cultural and scientific sector in Europe and beyond.

In December 2004, the DigiCULT Forum project in their series of thematic issues published a research and technological development (RTD) roadmap *The Future Digital Heritage Space* with the aim to depict the possible future of digital cultural and scientific heritage in the next 10-15 years. (Geser / Pereira, eds., 2004)

The research work for this thematic issue was conducted over a period of seven months (May - November 2004), and took into account the broad user community of the project's result, researchers, technologists and cultural heritage IT consultants as well as boards and directors of heritage organisations, IT project managers, and curators of digital collections, virtual exhibitions and environments.

The product should provide them with an overview of innovative information and communication technologies (ICT), systems and applications that may be achieved in the next ten years or so. It addressed the enabling technologies that will be used, the breakthroughs that may occur and the possible impacts that may shape and re-shape the digital landscape in which cultural heritage institutions reside.

Thematic areas

The roadmap covers a broad range of RTD fields, which address challenges relevant for systems and applications that may be used in the cultural and scientific heritage sector.

Partly overlapping, these RTD fields are defined and briefly described as follows (note that the thematic issue provides more detailed descriptions):

Intelligent heritage

New approaches in making heritage resources self-describing, retrievable and presentable based on conceptual models (e.g. semantic frameworks, ontologies, controlled vocabulary) and/or content features (e.g. content-based analysis, clustering and retrieval).

Contextual cultural information

New approaches and applications for "anywhere, anytime" seamless use of heritage resources, involving context-aware provision of information in terms of location as well as tasks and social and physical situations.

Natural and enjoyable interaction

New approaches and applications for accessing, navigating, and making use of digital heritage resources and environments in personalised, multimodal ways, also including collaborative and community activities.

Create/recreate - 3D/VR/AR

Systems and tools for the digital creation, and re-creation in digital form, of heritage structures (e.g. historic buildings, cultural sites), objects and characters for interactive exploration and use in 3D, augmented and virtual reality environments.

Large-scale & distributed systems

New generations of large-scale, distributed digital libraries and archives of heterogeneous heritage resources, containing increasingly complex and dynamic objects

Persistent and perpetual access to digital heritage resources

Novel concepts, methodologies and techniques that allow for making digital heritage resources and environments persistent, and perpetually accessible and understandable over long periods of time.

Online consultation

The Future Digital Heritage Space to a large extent builds on the results of an online consultation in which 64 researchers, experts and professionals in cultural heritage ICT participated.

In the online forum, for each of the themes presented above the same set of four questions was used:

Q1: What do you envisage could be achieved in this RTD area over the next 10-15 years?

Q2: What are currently the main RTD limitations or gaps that prevent us achieving this vision?

Q3: Considering these issues, what are the major steps or breakthroughs in RTD needed to achieve the vision? – How should these be addressed?

Q4: For each of the major steps or breakthroughs, please indicate the time period in which it is likely to be achieved (e.g. B1 in 20XX, B3 beyond 20XX).

The participants answered the online questionnaire for at least one theme, and many of them gave their opinions on more than one or even all themes.

The contributions to the online consultation amounted to a document of about 200 pages.

They were split into two groups, one concentrating on ‘hard’ RTD issues, which includes research and development extending into a transition phase from RTD results (e.g. prototype applications, specifications, testbeds, pilot projects, etc.) to robust near-market solutions. The other group of contributions concentrated on issues that may affect the uptake of new systems and applications by heritage organisations in favourable or unfavourable ways.