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Roadmaps for Research and Research Topics in Digital Culture

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Introduction

In 1996, the G7 pilot project 5: Multimedia Access to World Cultural Heritage had four sections on Access, Archive, Display and Navigate, all related in some sense to access. In the past years, there has been a shift to understand the entire knowledge creation/production life-cycle. In 2003, this includes four basic research topics: Preserve, Access, Create/Produce and Learn. While the most immediate areas for research may lie in the areas of access and creation/production, we need an approach that allows us to approach the whole creation/production life cycle more systematically: i.e. not just studying elements in isolation, but to understand their integration. We suggest that research matrices through Networks of Excellence (NoEs) can help this process.

Preservation

With respect to preservation we have recommendations for action rather than suggestions for further research topics. The DELOS-NSF working group has pointed to a number of important research issues with respect to preservation. Many of these issues are being addressed by conservation departments in museums, libraries and archives. Only in some cases is this specialized knowledge being shared.[1] In France, the Centre de Recherche et Restauration des Musées de France (C2RMF) is working on a national network with respect to conservation departments.

It is important that expert knowledge of those directly involved with conservation and preservation of both physical objects and their digital, electronic versions be shared and that these challenges are not simply relegated to computer scientists without knowledge of the content. This leads to four recommendations:

1) Such a network of conservation specialists should be extended to the whole of Europe and linked with a) the European Commission on Preservation and Access (ECPA); b) the Electronic Resource Preservation and Access Network (ERPANET) and c) an NoE for culture.

2) A sub-network of this conservation/preservation network should be the International Conservators of Contemporary Art (INCCA) EoI[2] with respect to expressions and media, which are born digital.

3) A NoE for culture should explore requirements for a European Mirrored Repository (EMR) or Repositories in the context of a Distributed European Electronic Resource (DEER, see below), to address needs for preservation in cases of man-made or natural disasters.

4) Since preservation is such a vital aspect of our collective memory, it should become built into all future projects re: cultural heritage: i.e. it should become a standard work package in the way that dissemination and management are today.

Access

Verbal Access

Traditional libraries, museums and archives have focussed on access via author, title, and subject catalogues. The past decades have seen increasing attention to the role of classification systems, thesauri, knowledge organization and the promise of semantic (web) methods. The old idea of creating a uniform standard imposed on everyone, is leading to approaches that recognize the need to keep intact the integrity of national, regional and local multilingual and dialect variants. In this context, mappings, bridges, walkthroughs and other means have gained in importance and have inspired a number of activities in the domain.[3]

Visual/Spatial Access

A second approach entails visual access using geography and changing spatial scales such that one can zoom from a map of the earth to a country, a city, a building and finally focus on an object. Here again there have been many activities in the domain.[4]

Research Topics

A fundamental challenge lies in integrating verbal

and visual search methods with respect to cultural objects: how does one link a visual search for cultural objects (via UMTS, GIS, GPS in different scales) and then shift seamlessly to a verbal based, semantic approach? In simple terms: how can one link: 1) multilingual, semantic access and knowledge organisation and 2) spatio-temporal access with historical-cultural dimensions to create a new kinds of virtual reference rooms?

While the importance of linking local, regional, national with European and international dimensions has been clearly recognized (Ruffolo), considerable research is needed how to achieve this in practice both with respect to the metadata and ontologies that make it possible as well as the interfaces which make it comprehensible.

In science, only the latest data and information is relevant. In science one assumes that the latest insights will replace earlier beliefs. Accordingly there is a focus on access to contemporary databanks with attention to recent literature, but no attempt to document the entire history of science. Databanks in culture typically follow this scientific paradigm. While there are many links between science and culture, culture has four characteristics that set it apart:

1) While science strives for universal truth, the richness of culture lies precisely in diverse expressions at national, regional and especially local levels. *Annunciations* in Italy are very different than those in Germany.

2) Paintings of Rembrandt and texts of Shakespeare do not become outdated as in the case of some scientific theories.

3) Lists of how many paintings by Rembrandt and texts by Shakespeare change with time.

4) Secondary literature on great artists and authors is cumulative. Indeed this is one of the ingredients to measure their significance.

Since versions of paintings and texts change in different locales and regions, and since lists of paintings and texts change over time, we need new kinds of access to dynamic knowledge rather than static lists.

Such problems apply equally to geography. All our search engines apply to the map of the world as it is today. Searching for 19th and even early 20th century African countries is almost meaningless with today's search engines. Poland offers another interesting example. Today it is of medium size. In 1000 it was extremely small. In 1400 it was the largest country in Europe. There is a further problem that Poland's maps of itself are not the same as Russia's and Germany's maps of Poland. Research is needed to provide a new kind of dynamic geography, whereby searching for a country becomes a) searches for a country the boundaries of which change over time and b) the boundaries of which may vary depending on the country making the maps. In an expanding Europe which includes not only Poland, but also Turkey and the former Yugoslavia, these challenges acquire new levels of urgency.

Research is needed how we can move from uni-lingual, static access to multi-lingual, dynamic knowledge with cultural and historical dimensions, with methods that integrate verbal and visual approaches to searching.

Creation/Production

It is widely recognized that digital methods are transforming the modes of creation/production of new content. The digital mode is bringing three basic changes:

1) The knowledge production life cycle extends across all media and all senses: e.g. the production of an oral speech, printed book, film, and television are all potentially connected.

2) Creation of content is intimately connected with its context and communication;

3) The large scale production of major publishing houses and film production studios needs to be linked with creation by small teams, groups and individuals.

Research Topics

Thus far there has been considerable attention to effects of shifting from analog to digital within a single medium such as book publishing or film production.[5] Needed is research on cross-media creation/production such that citations from a painting, a book and film can be combined.

From the above emerges also a second nexus of challenges relating to new methods of collaborative creation, work and sharing in virtual environments and workspaces. For instance, how can one extend the principle of blue rooms to transform cultural

objects, monuments, archaeological ruins and their reconstructions (e.g. Pompeii) into online environments, which can be used directly in television production and potentially in new interactive (television) environments which could also transform the teaching of history in schools and universities?

How can such sites reflect a history of interpretations including those introduced by different archaeological schools and even individuals? In other words: how can we build augmented and enhanced reality environments which include cultural variants: either on a national level, in terms of schools or even at a personal level? What methods can be used to distinguish between these?

Needed are environments and tools whereby individuals, small groups, and major production houses can share, add annotations, cross-media citations resulting in new creations/productions.
In simple terms: how can one combine 1) individual and large-scale cross-media production and 2) sharing in virtual environments and workspaces? This challenge is likely to integrate a cluster of topics which have come to the foreground in the last decade including: intelligent heritage, self-aware objects, ambient intelligence and advanced visual interfaces.

Learning

While it is generally recognized that the richness of digital collections has the potential to transform education, little has been done to link digital collections directly with universities and schools. Needed are new tools for both personal use of such resources and their use in collaborative activities with small groups and teams. One way of addressing these challenges is to integrate results of research on access and creation in personal and collaborative classrooms and other dimensions of e-learning.

Major initiatives such as Strategic Targeted Research Projccts (STRPs) or Integrated Projects (IPS) have enormous potentials to provide important contributions qua frameworks and platforms through high-level solutions, which can be used on a pan-European level. Such deductive, top-down solutions typically risk being too abstract, reflecting too little the complexities of national, regional, and local diversity and too little concerned with user needs. History (cf. Lavoisier's advances in chemistry) has shown that some of the most fruitful advances came when deductive (top town) and inductive (bottom up, inductive) methods are combined.

Libraries	DELOS
Museums	NEMO
Archives	EAN
Broadcast Media	DHAN
Unstable Media	Artnouveau
Music	MusicNetwork
Built Environment	CIHV
Conservation	ENCORE
Preservation	ERPANET

Figure 1. Examples of specialised networks in the field of cultural heritage.

Networks of Excellence

Networks of Excellence (NoE) can provide bottom up examples from cultural institutions, research centres in universities and industry. Such NoEs can also create ongoing integration between projects.

In FP4 and FP5, Networks of Excellence[6] (NoEs) were most frequently devoted to specialized topics (figure 1) with respect to content creation, context creation, and communication. Needed is integration of these individual efforts. Needed is understanding of the complete knowledge production life cycle, not possible through specialized networks working in isolation

Research Matrices
Needed are research matrices, which will lead to a portal for existing critical methods, standards, solutions and trends. Such matrices would be more than simple lists of state of the art with respect to a specialized field, problem or application. They should allow us to see more clearly how developments in that field are becoming linked with those in other fields: e.g. how work in digital rights management integrates features such as copyright, watermarking and security.

To achieve this requires work in the direction of a network of networks. In a first instance it requires co-operation between the technological community (e.g. ERCIM/DELOS) and the three main constituencies of the cultural community: cultural organizations, research institutes and industry/ SMEs as found in E-Culture Net. It is recommended that ERCIM/DELOS might co-ordinate these research matrices, for which an NoE for Culture might provide user input.

Since digital creation potentially entails entirely new products and users, it is wise, from a marketing viewpoint, to follow a modular approach whereby incremental examples serve as a reality check.

3

1. Explore European Mirrored Repositories (EMR)
2. Research Matrices to share Methods, Solutions
3. Multi-lingual, Semantic Access
4. Sharing Content in Virtual Agora
5. Content Creation/Production
6. European Masters/Doctorates
7. Dissemination
8. Exploitation

Figure 2. Eight functions as components for a Distributed European Electronic Resource (DEER).

This is a further rationale for a combined inductive-deductive approach. A NoE in culture can provide user input re: infrastructure needs, software requirements and interfaces. To give this focus, teams might address a small number of specific themes: e.g. multilingual technical terms, cultural terms, archaeological objects and sites, and historical cities. If this series of bottom-up examples of secure, multi-lingual, semantic, and spatio-temporal access with verbal and visual search strategies are systematically approached they can serve to measure different levels of online integration (figure 3).

Sharing research results is thus a reason for the NoE. A more significant rationale for the NoE is that such sharing can lead also to a sharing of critical methods and thinking that advances research as a whole. For instance, comparing methods and criteria for reconstructions of historical cities in different countries can lead to insights far beyond the merits of a particular school or nation in isolation.

The NoE can also explore the potentials of sharing content in a virtual agora, explore prototypes of content creation and production using virtual environments in virtual heritage centres; their applications/implications for European Masters and Doctorates in digital culture, their dissemination and exploitation.

E-Culture Net has been exploring how such functions might provide practical steps in the direction of a much larger vision which could in future integrate the challenges to preserve, access, create and learn in a Distributed European Electronic Resource (DEER, figure 2). As such the DEER as a goal offers a longer-term roadmap.

1 Secure
2 Secure, Multi-lingual
3 Secure, Multi-Lingual, Semantic
4 Secure, Multi-Lingual,Semantic,Spatio-Temporal

Figure 3. Levels of online integration.

Conclusions

The research topics concerning preservation identified by the DELOS-NSF working group are important. At least as important is that the enormous amount of research existing in conservation departments with respect to both physical objects and their digital versions is shared through electronic networks. Hence we recommend that the French approach as championed by C2RMF be used as a model for Europe, with links to both specialized networks such as ENCORE and ERPANET and a NoE for culture. We recommend also that preservation become an integral part of future IST projects in the manner that management and dissemination are today.

We have suggested two clusters of research topics. A first cluster focuses on preservation and access to existing cultural heritage and entails integrating verbal and visual search through a combination of multilingual, semantic access and knowledge organisation with spatio-temporal access and historical-cultural dimensions to create new kinds of virtual reference rooms (cf. DELOS priority 2). This will result in a shift from static access to dynamic geography and dynamic knowledge.

A second cluster focusses on creation, preservation and learning with new forms of digital heritage. This integrates cross-media creation/production with sharing in virtual environments and workspaces for collaborative co-creation for both individuals, and large-scale production teams.

By extending the focus in digital cultural heritage beyond preservation (which should become an essential component in all projects), to include access, creation, learning and exploitation in a single, cross-media, cross-sensory knowledge production life cycle, Europe's diverse cultural heritage can become new resources for publishing, film, television production, entertainment, games and interactive experiences, thus strengthening Europe's position in the international economy.

Using NoEs to create research matrices will ensure that we remain aware of emerging possibilities and trends. Using a NoE to develop prototypes for a Distributed European Economic Resource (DEER) can bring profound economic, educational and social benefits. For this allows an expanding European Union that is not simply a melting pot but continues to respect and foster what Ruffolo has aptly called Europe's "unity of diversities." In this paradox lies the secret of Europe's past identities and the hopes for its future evolution.
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Appendix 1: STRPS or Possible IPS leading to a Third

One way to address the above challenges in access and creation/production might be through a series of STRPS or two IPS, which might then be further integrated through an NoE.

1) **DILIGEANT** (Digital Libraries in a GEANT System)

A first integrated project could thus link:
1) multilingual semantic access and knowledge organisation
2) spatio-temporal access with historical-cultural dimensions to create a new kinds of virtual reference rooms.

Such an IP might be based on the SEMKOS and the AMP EoIs (cf. IMASS). One practical way to tackle spatio-temporal access might be begin with a parallel STRP on Augmented Cities and Environments (ACE), which uses cities as a focus.

In a second phase (e.g. call 2), such an IP could evolve to include high-speed broadband capabilities: e.g. Digital Libraries in a GEANT system (DILIGEANT). This phase might add the Digital Libraries Section of the emerging UK E-Science Grid and the German Digital Libraries Initiative (including materials from the DFG, Max Planck, and Göttingen). This phase would provide broadband samples to test the innovations of phase one in a high-speed environment. Adding these large content providers would serve to test challenges of scalability addressed by the DELOS group.

A third phase would explore implications of these innovations for e-learning, communities and citizens

2) **CO-CREATE** (Collaborative Creativity Electronically for cross-media objects, monuments, augmented cities and environments between virtual heritage centres with multimodal interfaces)

Meanwhile, a second IP could combine:

1) Cross Media Production
2) Sharing in Virtual Environments and Workspaces.

With respect to media production it might begin with the excellent work of the PRESTO and USINE EoIs, adding the feature of cross media creation. The virtual environments component

would build on the work of CINECA and RAI with respect archaeological reconstructions in blue rooms for television production. Examples used would include existing work in the history of cities, e.g. NUME and SANTI. This might be linked with a possible STRP on Augmented Cities and Environments (ACE) mentioned above.

In a second phase (e.g. call 2) this IP would add a broadband (i.e. gigabit dimension via GEANT) by exploring Maurizio Forte's (CNR-ITABC) idea of Virtual Heritage Centres in an online context.

A third phase would explore implications for e-learning, communities and citizens. One way of doing so might be introduce in call three an IP called PACE (Personal And Collaborative E-learning), which uses the results of DILIGEANT, CO-CREATE (and a possible ACE STRP) for e-learning.

Notes

1. E.g. in the case of the Bibliothèque Nationale with the Centre Pompidou.
[2] http://eoi.cordis.lu/dsp_details.cfm?ID=33118
[3] Significant examples in this context are:
a) Multilingual ACcess to Subjects (MACS: http://infolab.kub.nl/prj/macs/) being examined by the AMP (Accès Multilingue au Patrimoine: amp@cepam.cnrs.fr) EoI;
b) the notion of Digital Autonomous Cultural Objects (DACOs, Thaller) and particularly
c) semantic and knowledge organization methods of the SEMKOS EoI.
d) the idea of virtual reference rooms as a means of more systematic access to distributed collections (cf. IMASS).
[4] Developments in Universal Mobile Telephony Systems (UMTS), Geo-Positioning Systems (GPS) and Geographical Information Systems (GIS) have introduced new potentials for spatio-temporal access with historical-cultural dimensions. The EPISTAGE EoI outlines where these developments might go in the near future.
[5] For instance, a number of EoIs approach this problem in the context of analog production where the life-cycle was linked with a specific media: e.g. PRESTO with respect to film and television or USINE with respect to publishing.
[6]

http://www.i3net.org/ser_pub/services/esprit_network_url.html