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Developments and Challenges in Digital Culture

Proceedings of the Moscow EVA Conference, Moscow: Russian Ministry of Culture, 2001, pp. 33-39.
Separate publication of same in Russian: *EVA 2001 Moska*, pp. 1-4-1 to 1-4-4.

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1. Introduction

Although the mass media are full of discussions about dot.com failures, economic slunps and recessions there were over 120 million new computer users this past year. That is more than telephony achieved in its first hundred years. In September 2001 the number of Internet users worldwide reached 500 million.

Remarkable technological advances continue. In 2000 IBM, announced that they would make a super-computer of 2000 square feet, capable of 100 trillion instructions per second by the end of 2003. This year those figures were adjusted. By the end of 2003 there will be a supercomputer the size of two refrigerators capable of 1000 trillion instructions or teraflops per second. In 2000, all the top 500 computers of the world combined were capable of 64.3 teraflops. So within 2 years there will be a computer that is about 15 times faster than all 500 of the world's largest computers last year.

The year 2001 has seen an announcement by IBM and Sony that they will bring the power of the Big Blue supercomputer to the desktop; the invention of a new chip capable of 4000 gigabytes per square inch (Keele University); the introduction of Hitachi's mew chip so small that it can fit into a dollar bill and new developments in nano-technology whereby computing at the molecular and atomic level promises to become a reality within the next decades. These developments make feasible Philips' vision of ambient intelligence whereby computers disappear from sight and every object, including every cultural object can potentially have its own computer. A generation ago technology was not capable of dealing with the needs of culture. Today the technological limitations per se are fast disappearing but many problems and challenges remain. Chief among these is that the emerging global network is being built to meet the needs of science and technology and does not include sufficiently the needs of the arts and culture.

For the purposes of this paper we shall focus on four areas: the semantic web, virtual and imaginary museums, virtual reference rooms, reconstructions, augmented culture and multisensory dimensions before turning to networks as a possible means of addressing these issues.

2. Semantic Web

The fathers of modern computing had a vision of separating form from content and meaning. This led Shannon to develop his BInary uniTS (bits). This quest continued with the evolution of Standard Generalized Markup Language (SGML), which strove to separate the text from the styles in which it was expressed. eXtensible Markup Language (XML) continues this tradition, distinguishing between XML for the basic coding of text and eXtensible Style Language (XSL) for different styles.

In 1994, Juri Rubinsky expressed the need for semantic metadata. This was one of the ideas that led to the development of the Dublin Core Metadata Initiative in 1995. By 1998 at the 7th World Wide Web (WWW7) Conference (Brisbane), Tim Berners-Lee was speaking of the need to separate rhyme from reason, the need to separate poetical statements which are not conducive to proof from reason, which has logical claims that are conducive to being submitted to proof. The next year at WWW8 (Toronto) the idea of a global reasoning web had become a vision of a semantic web: a web, which is capable of dealing not just with words but also logic and meaning. The semantic web is now integrated within the vision of the World Wide Web Consortium's quest for a Resource Description Framework. In Europe, the semantic web is linked with the European Commission's plans for the sixth framework programme. In the United States, the semantic web is supported by OCLC's Dublin Core (DC) group and by the Defense Advance Projects Agency (DARPA).

One of its premises of the semantic web in its present form is that meaning is closely linked with logic and thus with things which can be proven. This is a noble goal. It assumes that information/knowledge is universally true and the same everywhere. This is eminently useful in the realms of science and technology. Science is concerned with universally valid laws/rules. Hence we need globally accepted definitions of zinc, chemical formulae and the like if we are to have an international scientific community. This is also the case in medicine. Our definition of a heart needs to be the same if surgeons are to operate successfully around the world.

It is important to recognize, however, that the needs of the cultural sector are different for three fundamental reasons. First, cultural objects/products have local, regional and national variants. To take a prosaic example: beer has certain international standards, which are necessary to assure that the brew is safe and not poisonous. But ultimately what makes beer interesting is that German beer is different from Dutch or Danish beer, and even within a region or locally there are many variants. Hence a semantic web which aims to create databases with only a single definition of beer is not useful. In the case of cultural products/objects we need databases to indicate information/knowledge at the

global, international, national, regional and local levels. And in an increasingly networked world we need evermore links between these levels.

Second, the cultural sector has a historical dimension, which is central to its existence. In the case of science the focus is on the laws/rules which apply now. To be sure there are historians of science who remind us that the history of the subject is useful in understanding how we got to where we are today. In culture, the arts and the humanities the situation is different. The historical commentaries on great authors such as Homer and Shakespeare or on great artists such as Leonardo and Rembrandt are not just of passing interest. They are central to the field, for the depth of culture lies precisely in the cumulative effect of these historical commentaries over the ages. Indeed these commentaries over time give cultural objects such as the text of Shakespeare's Hamlet their full importance. Hence, whereas science deals with laws, rules, formulae which function as if they were a-temporal, cultural objects entail an essential temporal dimension. In science, a database of current formulae and definitions may be sufficient. In the realm of culture we need databases, which include historical definitions, (etymologies) and make visible the cumulative dimension of cultural objects.

Related to this is a third difference. The goal of science is to arrive at truths or at least working hypotheses concerning which there is global acceptance. The greater the acceptance the more scientific a claim becomes. In the cultural sector global agreement is extremely rare as in the case of UNESCO World Heritage sites (although even here there is disagreement). Indeed the richness of the cultural sector lies precisely in the amount of disagreement; in the diversity of interpretations concerning the same object. Hence, whereas science needs databases to record those "facts" on which there is global agreement, culture requires databases to record all the disagreements concerning a given cultural object.

Hence the semantic web as it is emerging reflects admirably the needs of modern science and technology. But it does not yet answer the more complex needs of the cultural sector. Some might argue that this is not essential and merely a luxury. However, since culture is intimately connected with tourism, which has become the most important source of income in all the G7 countries and many other countries of the world, culture is definitely not a luxury. In addition to being, indirectly, one of our most important sources of economic gain, it is also fundamental to our sense of identity. And in an a world where narrow identities of fundamentalist sects are threatening the very fabric of society the need for identities with dimensions of tolerance many become our only hope for long term survival as a civilization. Thus a semantic web, which includes cultural, spatial (local, regional, national, global), historical and interpretative dimensions is one of the major and indeed essential challenges facing us in the near future.

3. Virtual and Imaginary Museums

The WWW virtual library of museums hosted by the International Committee on Museums (ICOM) attests to the extraordinary growth in the realm of virtual and imaginary museums. A decade ago there were only a few sporadic examples of online

museums. Now there are over 8000 in Italy alone. In the year 2000, the Marburg Photo-Archive made a million photographs of its collection available on line. The Canadian Heritage Information Network (CHIN) introduced its Virtual Museum of Canada which integrates for the first time examples of art in distributed collections from all over the country. The Research Laboratory of the Museums of France in the Louvre now has some 26,000 cultural objects for each of which they have 150 images. These are being put in a Linux database and will be made available probably in the coming year. So the good news is that ever more collections worldwide are making at least parts of their collections freely accessible on the web.

The bad news is that this still represents a very small percentage of what is available in the museums themselves where images typically range from 30 Mb to 3 gigabytes. Such sizes are much too large in the case of persons with regular 56k connections. On the other hand, if there were broadband connections at universities and research institutes such materials could be made available for the purposes of research. Making the riches of our memory institutions available for regular education and research thus looms as one of the great challenges of the next decades. We have emerging broadband networks, we have the beginnings of networks for memory institutions, we have the idea of Schoolnet but these need to be integrated.

Software tools such as 3D Studio or specialized tools such as Infobyte's Virtual Exhibitor now enable us to reconstruct very convincing interiors. An example in Uruguay points to some of the problems potentially inherent in these developments. The *Museo Virtual de Artes El Pais (MUVA)*[1] was planned for contemporary artists of the country. Unfortunately the country's political regime considers their art as unacceptable. Hence the physical building was never built. Consequently, the artists created a virtual museum online. Unless we build into our online museums clear indications which parts are real (i.e. have exact counterparts in the physical world) and which parts are virtual, there will in future be no way of knowing which is which.

This problem is becoming more acute through an interesting trend of the past few years, whereby the games industry is increasingly using cultural materials for its purposes. In 1996, the Réunion des Musées Nationaux (Paris) and Canal+ produced Versailles 1685, a game of intrigue at the cCourt of Louis XIV on a CD Rom with "25 hours of gameplay set in history's most beautiful palace." There are now two "whodunit" games, which use the Louvre as their venue. There is a new game, Virtual Reality Notre Dame (VRND), which claims to be the first globally accessible multi-user real time virtual reconstruction.[2] It entails a chat function such that one can potentially even have "conversations" with the hunchback of Notre Dame. Such games are part of a larger trend whereby video games are now becoming movies and/or interactive group games: e.g. *Mortal Combat*, *Lara Croft* and *Final Fantasy*. In the film version of *Lara Croft*, for instance, the great hall from Greenwich is moved to Venice without explanation. From the viewpoint of artistic license this is perfectly permissible. But as we develop increasing realism, unless we have some indication to know what is real (with a physical counterpart) and what is play (with no necessary counterpart in the physical world) there may be no way to distinguish between them in the future. So another challenge is to

develop new criteria by which to recognize cultural objects are real and which are imaginary; which museums are virtual reconstructions and which are imaginary.

4. Virtual Reference Rooms

In the early 1990s, there were numerous plans to digitize objects in museums, libraries (e.g. the DELOS programme) and archives. Within the fifth framework programme of the European Commission efforts were made towards a more integrated approach whereby such institutions were treated as memory institutions. Reference rooms of these memory institutions can be seen as the search engines of the collective memory of mankind. Starting from this premise, a project presently underway in the 5th framework called Information Management ad Interoperability of Content for distributed Systems of high volume data repositories through multi agent systems (IMASS)[3] is exploring how virtual reference rooms could serve as a new access strategy to distributed collections. Here again part of the challenge is develop an approach which distinguishes between local, regional, national and global information/knowledge such that users can gain access to the materials which they wish, rather than simply being provided with generic information without a clear provenance. If we do not introduce such a layering of sources into our databases the global village will ultimately lead only to a McDonaldization of culture in a manner feared by authors such as Barber.

5. Reconstructions

Reconstructions of cultural monuments and archaeological sites began in the early 1990's. In 1995, Maurizio Forte wrote a first important survey of these developments referring to hundreds of examples. The past years have seen literally thousands of examples. Several trends can be identified. First, the size and scope of these projects is increasing enormously. Whereas the earliest examples were typically from 10-100 MB the most advanced examples are now hundreds of gigabytes (e.g. Assisi) or even terabytes. Whereas the earliest examples usually entailed a single building, the most impressive examples now cover entire city centres (Bologna in the NUME project) or even a whole province (Galicia in the SANTI project). Second, what began as reconstructions of isolated objects are now being integrated with satellite photos. This contextualization should be extended to all major reconstructions.

Third, projects such as the NUovo Museo Elettronico (NUME) are creating a reconstruction of the city of Bologna over a thousand year period such that one can trace how buildings have changes in the course of centuries and can also follow the story of how certain objects, which were once in the streets are now in museums. Thus the NUME project offers one of the first serious attempts to create databases, which include historical dimensions. NUME is careful to limit itself to reconstructing aspects concerning which there is little or no disagreement.

A fourth trend has confirmed, however, that there can be serious disagreement with respect to precisely how a site should be reconstructed. In the past decade, for instance there have been no less than five attempts to reconstruct the famous Abbey at Cluny, which was once one of the largest buildings in Christendom and was destroyed at the

time of the French revolution. First, there was a reconstruction by the Institut National de l'Audiovisuel (INA) in conjunction with IBM. This led to a second effort by the Centre d'Enseignement et de Recherche (ENSAM, Cluny) again in conjunction with IBM. A third entailed the Nieder-Österreichische Landesregierung, Abteilung Kultur und Wissenscaft. A fourth entailed the Technische Universität (Darmstadt) and a fifth was produced by Walder und Trüeb Engineering AG.

To date such reconstructions do not provide us with enough information concerning the sources on which they based, or the principles by means of which they were reconstructed. In the case of books there were traditionally footnotes and bibliographies to assure the seriousness and veracity of the publication. In the case of electronic books we also need hardware and software parameters. In the case of electronic reconstructions we need further veracity parameters (e.g. digital watermarks) and clear information about the authors, their assumptions, methods and procedures in reconstructing a monument or site.

While there are hundreds of websites worldwide which provide passing screen shots of the thousands of reconstructions which have been made, students at universities typically have no online access to these complex reconstructions which range from 10 MB to several terabytes. If we cannot even show our students the best that has been done in the past generation, how can we prepare them for the next generation? Moreover, how can we expect them to develop new methodologies for the treatment of these new products if they do not even have access to the best examples? This means that Philippe Busquin's vision of a European Research Area (ERA) for science is equally needed in the realms of culture and the arts. If we need a grid for science, we also need a cultural grid.

6. Augmented Culture

A fifth trend is to integrate these reconstructions within the physical landscape whence they originated. For instance, a European IST project called Archeoguide,[4] explores this possibility using the example of the Temple of Hera in Greece. Augmented reality is used to superimpose a virtual reality reconstruction of the temple onto the physical landscape where the temple originally stood. A project with Ericsson foresees doing the same in the case of the old town of Stockholm using special glasses to superimpose onto the existing buildings images of what was there before.

Methodologically this trend is of great importance for it introduces many possibilities for augmented culture.[5] In future a project such as Archeoguide could offer viewers a history of reconstructions of the Temple of Hera and other sites. Today when a visitor enters a site such as Hagia Sophia (Istanbul) they are confronted by a museum. Previously this was an Islamic mosque and earlier still it was a Christian church. Using glasses and augmented reality a visitor could trace the history of a cultural object, church, monument or other site in the course of the centuries.

This principle can be extended to other domains. Steve Feiner (Columbia University) has demonstrated the potentials of augmented reality in the context of what he terms

architectural anatomy: i.e. using glasses to see the positions of water pipes and electrical wires and other architectural features which are usually hidden under floors, above ceilings or behind walls. IBM has adapted this principle to show that one could superimpose on the heavens the Greco-Roman constellations of the stars such that one can, for instance, see precisely which stars are used in the composition of the Big Bear (*Ursus Maior*) and other figures. Augmented reality can take this principle one step further. The Persians, Indians, Chinese, Mayans, ancient Norsemen and others all produced their own constellations. Thus the same glasses, which allow us to superimpose the Greco-Roman constellations can be used to impose upon the sky all possible constellations. In this way we can literally learn to see the world in different ways, and learning to see through the eyes of different cultures becomes more than a cute metaphor. It can become a new method for appreciating the rich complexity of otherness, which is at the heart of culture rather than forcing us to seek only for the least common denominator of sameness, which lies at the boundaries of different cultures.

That which applies to the history of churches and to constellations in the night sky applies potentially to the whole of culture. Most educated persons can easily recognize a figure of the Buddha. But the moment we enter into the six realms of Buddhist life; the twelve acts of the Buddha; or the myriad symbols that accompany the 33 million emanations of the Buddha all but the most adept easily become lost, all the more so because there are divergent interpretations in the school of the greater vehicle (Mahayana), the lesser vehicle (Hinayana) and again in the Tantric traditions (especially Vajracana), which again vary both spatially (e.g. they are different in India, Nepal, Tibet, China, Japan etc.) and temporally (i.e. they have changed and evolved over the centuries). Although the details are obviously different the same can be said for all of the great world religions. Their symbols and the meanings of their symbols change in different places and in the course of time. Augmented culture can make all these traditions visible and comprehensible to persons within a given culture and even more significantly to persons from different cultures.

7. Multisensory Dimensions beyond Literacy

Ever since the advent of the alphabet there has been a literacy divide. On the one hand those who had regular use of sight and mastered the alphabet could read and thereby gained access to an ever-increasing repertoire of recorded knowledge, which went far beyond the memory limits of an individual brain. On the other hand, those with impaired sight and/or those who were illiterate were largely excluded from this remarkable resource, relying on the help of others to read them passages such that they had oral/aural access to this written repertoire. The advent of printing increased the range of the literate repertoire and increased the chasm between the literate/written and illiterate oral/aural world.

At first sight computers simply continue this tradition of the literacy divide. It is important to recognize, however, that computers potentially introduce whole new dimensions. Computers potentially deal with all five senses. While they began as glorified typewriters (using sight), they soon became the equivalents of record players

and radios (sound) and are gradually extending to include force feedback (touch), smell (e.g.Digiscent) and even taste (e.g. Trisenx).

A distinguishing feature of the new digital medium is that all of these sensory imputs potentially become interchangeable. In other words once something spoken (sound, cf. software such as Via Voice) is digital it can be transformed into handwriting or print (sight) or into any other sense such as Braille (touch). This means that written texts can readily be made available to the blind. It also means that an illiterate person can theoretically offer their knowledge in spoken form; it can be recorded digitally and then made available in written or print form. Conversely the knowledge of memory institutions, once it exists in digital form can be transformed to oral (spoken) form such that even an illiterate person has access to the collective memory of civilization.

In the past, the potentials of computers to bridge the literacy divide were hindered by economic realities, which precluded a majority of the world from having access to technology due to economic barriers and created a digital divide. This is changing. India is producing a Simple Computer (Simputer) without US parts, which costs under $200. The simputer is explicitly concerned with reaching illiterate persons. In the United States there are now laptop computers, which cost $292.[6] John Gage (a chief Scientist at Sun) predicts that such computers will cost as little as $10 and sell for $25 within the next five years.

In the past five years Worldspace has been developing a new vision, which links satellites over Asia, Africa and South America to reach 4 billion persons in the developing world by radio. If this vision is expanded to link the satellites with a small computer which can also function as a radio, then the lack of infrastructure of the third world need not exclude it from the developments which are underway. In short, the economic barriers are disappearing and the only real barriers are the horizons of our own visions. If we expand these properly then the wonders of the technological revolution can extend to include all persons and traditions rather than merely a few dominant modes.

8. Networks

The potentials of networks promise to render universally pervasive the consequences of these extraordinary developments. The idea of networks for culture is not new. In 1989, UNESCO and the Council of Europe established a Network of Networks for Research and Cooperation in Cultural Development (Culture Link). They subsequently established a Cultural Information and Research Centres Liaison in Europe (CIRCLE) and a Cultural Heritage and Development Action Network. From the early 1990s the European Commission has sponsored a number of projects with a view to creating networks for museums and cultural objects (e.g. RAMA, AQUARELLE, MENHIR, VAN EYCK). In June, 2001 the EC organized a concertation event (Vienna) which identified 25 support actions which could contribute towards European Networks.[7] In July, 2001 the French Ministry of External Affairs organized a conference (Avignon) to discuss cultural networks particularly in France, but also worldwide. On 21-22 November 2001 the EC

(DG Education and Culture) is organizing a Forum 2001 dedicated to Cultural Cooperation in Europe.

In 1996, the EC broached the idea of a network of centres of excellence in the context of their Memorandum of Understanding for Multimedia Access to Europe's Cultural Heritage. In the context of the MEDICI Framework the Maastricht McLuhan Institute was asked to develop this idea further. From 1998 to 2000 a series of seven basic goals were identified:

1. Interoperability of Content
2. Identify Quality
3. European Multimedia Education (European Masters, PhD)
4. Fundamental Research
5. Contribute to Reflections Concerning Policy Development
6. Share Existing and Create New Content
7. International dissemination.

In the course of the past two years the methodological challenges introduced by new media have come ever more into the foreground. A number of these challenges are outlined above. Paradoxically, many of those involved with the new media seem intent on reproducing on their screens the limitations of print to which McLuhan drew attention, rather than exploring the potentials which can be unleashed by the new media. And while there are some exciting new projects, such as a German initiative, which aims to make the slide collections of individual professors accessible through an online distributed database, we desperately need to provide students access to the full richness of the materials, which are potentially available today. Only then can we hope to develop new methods for dealing with the ever evolving new technologies.

In 2001, it was decided that a threefold path of development is desireable. First, key institutions should work toward networks within their own countries. In Italy, the Scuola Normale in Pisa has created the FORMA consortium which includes the Accademia della Crusca, the Centro internazionale Andrea Palladio and the Istituto e museo di storia della scienza. In Spain, the Universidad Complutense has identified 11 universities for a network. In the Netherlands, the National Research Organization (NWO) has created a consortium, which includes the National library, national gallery, national archive, national audio-visual institute, the National Academy of Sciences plus a number of universities and key research institutes. Austria is working on a similar network, which will be the subject of a conference from January 13-15, 2002. In France, Germany, and Scandinavia similar national networks are also under discussion.

Second, it was decided that these key institutions at a national level should write letters of intent for co-operation at a European level. The rectors of the universities of Bologna, Madrid, Vienna and the Scuola Normale (Pisa) have written such letters confirming their intent to work with the Maastricht McLuhan Institute. A third step will be to link these national initiatives in working towards a cultural grid, which can contribute to the European Research Area (ERA) according to the vision of Philippe Busquin.

Internet developments are, of course, global and must extend beyond the traditional boundaries of Europe. The networks which are emerging in Russia, Central Asia and the Far East, in North and South America, Australia and elsewhere must become part of this vision. On December 6-9, 2001 the Institut zur Erforschung und Förderung österrechischer und internationaler Literaturprozesse in conjunction with UNESCO is organizig an international conference on Multilinguality, Transnationality and Cultural Sciences. On December 11-13 UNESCO, the National Institute of Informatics, and the National Center of Sciences are organizing a Tokyo Symposium for Digital Silk Roads. In the past there were both silk roads and spice roads, which connected east and west. In the future we need their digital equivalents, which go far beyond the bustle of information highways to create many new paths for understanding. Only with a multilingual, multicultural approach, which includes all traditions can we hope to maintain and develop our cultural diversity, which is as essential to the spirit as is bio-diversity on the bodily plane. The challenges of digital cultural heritage are great: the possibilities are even greater.

Notes

[1] See: http://www3.diarioelpais.com/muva/
[2] See: http://www.vrndproject.com/vrndfr.htm
[3] See: http://www.i-massweb.org/
[4] See: http://archeoguide.intranet.gr/project.htm
[5] This topic was first broached by the author in a paper: "Augmented Knowledge and Culture," *INET'2000*, July 2000 (http://www.isoc.org). Available in abbreviated form at the site of the ORF (http://science.orf.at). The idea is further explored in a book due to appear in the spring of 2003: *Understanding New Media: Augmented Knowledge and Culture.*
[6] See: http://www.wekum2u.com/compaq/compaq.html
[7] See: http://www.cordis.lu/ist/ka3/digicult/en/fp6.html and
http://www.cscaustria.at/events/supportactions3.htm