

Open Access: Synergies between Culture and Sciences

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- Transparency: Title (Folie1.gif)

Introduction

Just as it was the case when the Web was created by turning a network of computers into a medium representing a universal hypertext, also its future will depend on requirements and possibilities that are revealed only in the context of innovative usage scenarios. Such usage scenarios will emerge when the Internet is used as a medium of reflection on current global challenges of human civilization such as the destruction of ecological equilibria, social impacts of epidemics and drug addictions, or terrorism and other devastating consequences of oppression and increasing mass impoverishment.

If such innovative usage scenarios do not comprise culture as well as science, we are faced with the danger that the substance of our cultural heritage will be absent from the medium of the future.

We would then be confronted with the danger of a second digital divide in addition to the primary, technical one. This second digital divide, separating scientists from scholars and both from the public at large, would lead to a fragmentation of the Web into interest groups, thus failing to use the unique opportunity offered by the Internet to create a global representation of human knowledge.

It is precisely the few shining examples of culture on the Web that make evident the potential of the bulk of information constituting our cultural memory. What we need is, in my view, a vision exploiting the new technological possibilities for the creation of a public culture of science, a vision that includes the humanities. and thus keeps alive the roots of our techno-scientific world in the cultural heritage of man-kind.

- Transparency: Pre-conditions (Folie2.gif)

Fortunately, there is a growing awareness that a joint effort is needed to prevent this second digital divide and to create open-access to science as well as to culture. As far as science is concerned, it is the combination of public

debate and concrete steps towards implementation that is the hallmark of recent successes of the open access movement, from the Budapest Declaration, via the Berlin Declaration to the final statement of the World Summit on the Information Society 2003.

- Transparency: World Summit Poster (Folie3.gif)

In my talk I try to clarify the role of culture in this process.

- ECHO Homepage: Content graphical overview

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/graphics/timeline.html)

The Role of Culture for the Future of the Web

Is culture at best only a fellow traveller of the Internet revolution? First of all, although we often tend to forget it, science is also part of our culture. It could not exist without a cultural context favorable to it. As this is one of the lessons we can draw from history, it is very useful to keep history present when facing new challenges, creating a public awareness for the intimate relations between science and culture. That awareness has turned out to be useful also within scientific research itself, as it regularly happened, in the course of the history of science, that scientific revolutions involved rethinking seemingly self-evident categories of our daily life such as space and time. I will come back to this connection towards the end of my talk.

But, of course, culture is much more than science. Culture is simply part of our identity as human beings and its appropriation by future generations is not a luxury but the only way to preserve this identity.

I quote from the definition of the World Bank:

“Cultural Heritage encompasses material culture, in the form of objects, structures, sites and landscapes, as well as living (or expressive) culture as evidenced in forms such as music, crafts, performing arts, literature, oral tradition and language. The emphasis is on cultural continuity from the past, through the present and into the future, with the recognition that culture is organic and evolving.”

What you see here is a rather random collection of sources ranging from cuneiform libraries, via archeological and anthropological sources, sources of the history of science, to video documentations of human behavior. They provide a nice illustration that culture is not just the popular and commercially interesting highlights as the Mona Lisa or the Begees. These collections have been brought together by the European Cultural Heritage Online initiative in a first step towards creating an open access infrastructure in which holders of cultural heritage have the opportunity to make their sources available in an environment that allows for their preservation, their interoperability with other aspects of cultural heritage, and their interactive study over the Web. In a word, this infrastructure illustrates, albeit for a small sample what a future Web of Culture and Science could look like.

- ECHO Homepage: Sign languages -> Introduction film

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/sign_languages)

Such samples illustrate, even if only to a modest extent, in which sense culture could represent a challenge for the future development of the Web. Efforts to include culture on the Web together with an appropriate infrastructure will, for instance, lead to new ways of dealing with audio and video data which can only be evaluated if tools for their interactive, web-based annotation are available. Such tools have been developed in the context of the ECHO initiative for the example of the first video repository of European sign languages but are, of course, much more widely applicable.

- ECHO Homepage: Morph analyse

(<http://nausikaa2.mpiwg-berlin.mpg.de/cgi-bin/search/q1>)

In spite of the increasing role of multimedia, due to its origin in the idea of hypertext, the World Wide Web will also in the future be mainly based on texts, carrying the meaning encoded in human language.

It is therefore quintessential to develop efficient tools for searching, editing, and annotating texts in different languages over the Web, exceeding the limited possibilities offered by today's browsers. As humanists are specialists in dealing with texts in different languages, the most efficient tools for dealing with texts have been developed in the context of the humanities. The results of this kind

of work brings us a step closer towards a web in which one can search not only for strings of signs but for meaning.

Let us take an example from the history of science: How can one find out what various authors wrote about the nature of weight? Even assuming their writings are available over the Internet – how would one find out? Ideally, one would look for the occurrence of the concept of the nature of weight – in whatever form this *concept* is being expressed. In this example, we can use the ECHO infrastructure offering automatic morphological analysis for a variety of languages linked to online dictionaries in order to quickly look up among thousands of pages of ancient texts on mechanics in Latin all phrases in which „nature“ and „weight“ appear in whatever grammatical form. This could easily be scaled up to practically all major languages to become an enriched infrastructure of the Web.

The future infrastructure of the Web will, however, not just be enriched, it will be fundamentally changed by replacing the presently dominating client-server architecture by a peer- to peer architecture in which the present browsers will be replaced by future knowledge weavers. Prototypes for such knowledge weavers have also been developed in the context of humanities projects.

- ECHO Homepage: ECHO Tools with Arboreal

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/technology/tools/Arboreal)

With the help of such knowledge weavers future users will work on shared knowledge by constructing new meaning while accessing the existing body of knowledge represented in the Web through meaningful links to texts and text corpora.

The Role of the Web for the Future of Culture and Science

From the examples for possible contributions by the humanities for the future of the Web it has become clear that, in the Internet era, the nature of the humanities will have to change radically. They can no longer hide away in esoteric niches defending their privileged access to the sources of human culture. They rather have to live up to the challenge of activating the potential of the Web represented by this potential or otherwise perish into insignificance.

Actually, even the seemingly most remote and specialized branches of the humanities may assume a new role in the Internet era.

- ECHO Homepage -> Cuneiform

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/cdli)

Take the example of cuneiform writing. It has served to encode the largest part of human written history but the roughly one million tablets covered with cuneiform writing which have been preserved are today accessible only to a handful of specialists. Given an appropriate infrastructure for culture on the Web, these widely dispersed documents can now, for the first time, be again reunited, reconstituting the ancient Babylonian archives and protecting them against the dangers of today's wars and devastations.

By making these tablets available on the Internet entire disciplines dedicated to their study have radically changed since privileged access to a collection of documents can no longer count as a criterium for qualified scholarship. The work of isolated specialists has been replaced by web-based collaborations of interdisciplinary teams studying issues of a wider scope and taking into account thousands of documents at the same time. The place of footnotes in their publications has been taken by links to the original sources, thus transforming the results of scholarship into new navigational devices providing semantic access to these sources. In the future, such novel approaches will be able to make this seemingly remote material widely accessible even beyond the limited number of specialists. They will thus grant access to a large share of human memory, for instance about complex administrative systems but also about the triumphs and failures of imperial ambitions.

- ECHO Homepage: Dogon

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/ethnologycollection/dogon)

A future Web of Culture and Science has the potential of overcoming traditional dividing lines between cultures, nations, and disciplines. It offers, for instance, new ways of restituting the treasures of non-European cultures accumulated by whatever means in European museums, creating at the same time novel ways of studying these treasures.

Take the example of the Dogon, a society living in central Mali, which have captured popular imagination and scholarly interest since they became known to the Western world in the early 20th century. Increasingly the World Wide Web has become a forum for discussion of Dogon culture, albeit with a focus on tourism, art dealership and on what might be termed 'fringe-ethnology' - the majority of Dogon websites is dedicated to the "mysterious" astronomical knowledge of the Dogon and its supposed origins in the visit of Extraterrestrials. It is only within the context of the ECHO initiative that Dogon objects held in collections all over the world are now being made accessible on the Internet together with scholarly information in order to enable serious anthropological research and in order to retribute to this African society their cultural heritage along with their dignity.

- ECHO Homepage: Scientific Voyages

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/scientificvoyages)

Another kind of bridge between cultural heritage and present concerns has been created in cooperation with the ECHO initiative by the government of the Canary Islands. It has supported a project collecting documents on scientific voyages to the Canary Islands now available on the Internet for the use of students who want to appropriate the cultural heritage of their native land and tourists whose respect for what they usually see just as a vacation paradise may increase when they learn that they actually are encountering a long cultural tradition. What you see here is a map of the island Las Palma published by Leopold von Buch in 1836.

As you will have noticed, all images are displayed by a standard image browser allowing not only various ways of image processing such as zooming on the fly, but also a Web based annotation and commentary of these images by marking with reference points whose URL can be used as a reference.

- ECHO Homepage: Intuitive Physics

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/intuitivephysics)

Other bridges which can be created by a Web of Culture and Science are those between disciplines whose separation is favored by traditional media barriers. An

example is provided by the separation of the history of science studying *past* thinking processes mostly on the basis of texts and cognitive psychology studying *present* thinking processes mostly on the basis of documenting human behavior e.g. by video films.

- ECHO Homepage: Chinese Knowledge -> Stevin

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/chineseknowledge

http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/scientific_revolution/stevin)

Bridging different languages with the help of an infrastructure for a Web of Culture and Science is a crucial means for overcoming cultural biases when studying human development, for instance when studying the interaction between Chinese science and European science. Here we see a Chinese text on mechanics from 1627, written jointly by a Chinese and a Western scholar. If you have trouble reading it, you can try to make use of the language technology coupled to it. Each sign is a link leading to an entry of an online dictionary found publicly available on the Web. The Chinese text makes use of contemporary European sources difficult to identify because of the absence of any footnotes. A team of Chinese and Western scholars has tried to identify these sources publishing a commentary on the web comprising links relating passages of the Chinese text to potential European sources such as a mechanics text book by the Dutch scientist Simon Stevin. If your difficulties are not with reading Chinese, but with reading Dutch you can make again use of the language technology available for every text within the ECHO environment.

- Transparency: State of Culture on the Web (Folie4.gif)

State of Culture on the Web

This presentation might be misleading as it suggests that the sources and tools necessary for a Web of Culture and Science are already available. What you have seen are, however, merely a few selected examples that might help to imagine the potential of such a Web of Culture and Science.

As a matter of fact, as far as culture is concerned, the present Web is lacking in content, instruments, interactivity, longevity, transparency, and open-access.

Clearly these deficits of the Web, as far as culture is concerned, are the same as those relevant for science.

- Transparency: Reasons for the Present Problems (Folie5.gif)

Reasons for the Present Problems

The reasons for the present problems are also similar to those that have so far prevented the realization of the vision of an open-access infrastructure for the sciences:

commercial interests, lack of infrastructure, lack of funds for the creation and maintenance of an infrastructure, lack of coordination among existing initiatives, fragmentation of responsibilities among institutions, lack of awareness among scholars and institutions, treasure-house mentality, and legal questions.

- Transparency: Criteria for a Solution (Folie6.gif)

Criteria for a Solution

What are the criteria for a solution of these problems? Such a solution must ensure:

long-term archiving, technical conditions for accessibility, interoperability, interactivity, sustainability, quality control, transparency, open access, and innovation dynamics.

Furthermore, a future open-access platform suitable for science and culture can only be realized in the context of a distributed system, ensuring the interoperability of the contents provided.

- ECHO Homepage: Scientific Revolution

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/scientific_revolution)

Strategy for a Solution

Let me now come to a possible strategy for a solution. Given that both the problems and the criteria for a solution are practically identical in the case of the sciences and in the case of culture, it makes sense to envisage a close cooperation in creating an open-access platform that will become the launching pad for a future web of culture and science.

As a matter of fact, cooperation is the key also in another respect because such a future infrastructure can only be created in close cooperation between those who work on the content and those who develop the technology, a cooperation that is not always easy.

The issue of the history of the scientific revolution, for instance, has traditionally been studied by scholars specialized on Galileo, Newton etc. Actually, however, the scientific revolution involved engineers, scientists, and artists all over Europe whose materials are now preserved by such diverse institutions as the British Library, the Biblioteca Nazionale in Florence, or the State Library of Lower Saxony. Rather than creating isolated digital libraries for each of these major figures, it has turned out to be much more efficient to integrate the relevant sources in a single open access platform.

Here you see a manuscript by Galileo, showing his study of motion along an incline plane. Originally we made this group of manuscripts accessible by a joint project with Italian institutions in a specialized digital library. Now it is available along with manuscripts of Thomas Harriot, Isaac Newton, and Gottfried Wilhelm Leibniz within the ECHO open access platform. It therefore enjoys the added value offered by this advanced infrastructure including language technology and the interoperability with the other collections.

- ECHO Homepage: Agora

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/network)

The open access platform that we envisage, should allow every scientific institution, archive, library, museum, or educational institution to make their resources available online with little effort and in a way that guarantees their interoperability with other representations of human knowledge. Such institutions willing to share their holdings would thus become part of an agora in which they would benefit from a co-development of contents and technology providing the innovation dynamics absent from commercial solutions. In the agora of the ECHO initiative, which has long surpassed the European context and

should rather be interpreted as standing for Essential Cultural Heritage Online, institutions from fourteen countries, from China to the US, have made significant sources of cultural heritage publicly available

In order to make participation in the agora attractive, every potential contributor gains a surplus value when entering the agora by making contents or tools available on the Web. In the future, all possible meaningful links between a newly available corpus of materials and the already existing ones should be enabled; tools developed for particular aspects of culture or science should be transformed into modules of a universal working environment applicable to all pertinent domains of human knowledge.

- ECHO Homepage: History of Architecture

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/florentinecathedral)

In the incipient agora of the ECHO initiative it has been possible to help several institutions overcome the technology threshold separating them from the Web and to make important content available that otherwise might have been lost.

An example is provided by the magnificent holdings of the archives of the Florentine Cathedral which have been brought to the Web with the help of our open access infrastructure. What you see here, is a highly structured electronic representation of the codices representing the administrative acts related to the building of the Cupola of the Florentine Cathedral by Filippo Brunelleschi in the fifteenth century. The codices are transcribed and richly annotated. Single passages can be identified with the help of detailed scholarly metadata related to the personnel, materials, or real estate items mentioned in them.

This infrastructure has made it furthermore possible to associate additional materials such as a photodocumentation of construction details of the Cathedral to the core collection. The photos are accessible with the help of plans of the Cathedral using the same tool that we have encountered earlier in the context of the Dogon collection.

- ECHO Homepage: Technology, workflow future

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/technology/workflow/workflow3)

In the future such an addition of complementary material to an already existing collection should happen more and more in a self-organizing manner - without the assistance of a central project management.

But this requires realizing political and technical framing conditions which make it possible to extent such impressive but isolated examples to true seed collections within a global open access framework.

Such seed collections are constituted by digitized collections of cultural heritage which are sufficiently structured for allowing the cumulative association of further materials and instruments. Such collections will, in particular, offer criteria as well as tools for adding further content, ensuring that all possible meaningful links with the already existing contents will be automatically or interactively implemented.

- ECHO Homepage: Relativity Revolution

(http://echoneu.mpiwg-berlin.mpg.de/echo_nav/echo_pages/content/relativityrevolution)

Let me end with a final remark on synergies between science and culture.

Given that the next year 2005 will be the international year of physics and the Einstein Year, it seems plausible to start with the case of Einstein's revolution in physics in order to create such a seed collection that will receive global visibility both from the Humanities and the Sciences.

Such a seed collection should comprise both historical materials related to Einstein's revolution as, for instance, his notebook documenting the genesis of general relativity and present materials related to the heritage in Einstein's work in the sciences linked within a semantic framework constituted by comments, glossaries, popular texts, illustrations, and other educational material making such a seed collection accessible to scientists, historians, teachers, students as well as the public at large.

It is obvious that this can only come to fruition under the condition of Open Access.