PRESERVING EUROPE'S CULTURAL HERITAGE IN THE DIGITAL WORLD

Claudia Loebbecke, University of Cologne, Pohligstr. 1, 50969 Koeln, Germany, claudia.loebbecke@uni-koeln.de, Tel. +49-221-470 5364, Fax -5300, www.mm.uni-koeln.de

Manfred Thaller, University of Cologne, Albertus-Magnus-Platz, 50923 Koeln, Germany, manfred.thaller@uni-koeln.de, Tel. +49-221-470 3022, Fax -7737, www.hki.uni-koeln.de

Abstract

This paper examines the potential for preserving Europe's cultural heritage in a digital world. After an extensive literature review on the economics of museums and the digitization of cultural heritage, it highlights national and international political initiatives to create cooperative cultural heritage systems. As a mean of achieving global integration while simultaneously keeping institutional independence, this work proposes 'Digital Autonomous Cultural Objects (DACOs)' as reference architecture. This paper illustrates the contribution of DACOs with two real-life projects serving as proof-of-concept. Finally, the paper offers some 'Lessons Learned' and an outlook to wider preservation of Europe's cultural heritage in the digital world.

Keywords: Cultural heritage, broadband connection, digital world, digital libraries, digital archive, digital museum, information society, media goods.

1 INTRODUCTION

Under the term 'cultural heritage object' we subsume all objects that are represented in libraries, archives and museums and that are of cultural or historical value. This definition covers tangible goods like writs, pictures or statues as well as music or films. A Cultural Heritage System consists of several digitized cultural heritage objects about a special topic which are represented with their contexts to a public audience. Digital Cultural Heritage Systems aim at preserving cultural heritage objects for the future and providing access to them via networks. Overall, the creation of Cultural Heritage Systems and digitized cultural heritage raises the question whether they will be an add-on to traditional museums or even replace them.

Until recently, the visual reproduction of objects was more expensive than publishing a description of these objects. Therefore, important objects were 'edited' in the digital world; the most important ones were 'scanned' with the remainder being left untreated. Due to new digitization technologies and cheaper storage, this 'rest' of objects has become increasingly smaller. Hence, further successful digitization could lead to some hundred of millions of easily and freely combinable digital objects of cultural heritage, which may or may not replace traditional museums, archives and libraries (e.g., Loebbecke 2004; Thaller 2004a).

In this context, we aim at developing concepts for the preservation of Cultural Heritage in the digital world which will have to fulfill three main objectives:

(1) Provide accessible source material at least one order of magnitude larger than traditional forms of publication,

(2) Allow for cataloguing by access information,

(3) Offer digital representations going beyond print possibilities.

As contribution of this paper to introduce conceptual components addressing the above objectives, we propose the concept of Digital Autonomous Cultural Objects (DACOs).

The remainder of the paper is structured as follows: In the next section we offer a literature review on three relevant bodies of literature. We then introduce national and international political initiatives in Europe, all aiming at the preservation of Europe's cultural heritage. After a short section to prototyping as research method in the field of system development, we then introduce the concept of Digital Autonomous Cultural Objects (DACOs) as technical proposition. We introduce two real-life DACO applications and conclude with 'Lessons Learned' and a brief outlook.

2 LITERATURE REVIEW

Out of three bodies of literature, (1) Cultural economics or museum economics, (2) Organizational approaches for Europe-wide access to digitized cultural heritage, and (3) Information Systems and Computer Science, we introduce major themes relevant for this work.

2.1 Cultural Economics or Museum Economics

One relevant body of literature on the digitization of cultural heritage stems from the field Cultural Economics, which can be traced back to the work of Baumol and Bowen (1966). More recently, Hutter and Rizzo (1997) present an introduction to the field; Throsby (1994) and Blaug (2001) offer literature surveys on the field of cultural economics.

Shortly after Baumol and Bowen (1966) had introduced Cultural Economics, Peacock (1969), Montias (1973), and Peacock and Godfrey (1974) dealt with Museums Economics. More generally oriented monographs on Museum Economics (e.g., Frey & Pommerehne 1989; Heilbrun & Gray 2001; Throsby 2001; Weil 2002) were complemented with more specific works. For instance, Robbins (1994) and Johnson and Thomas (1998) concentrate on political issues in the context of museum

economics and develop suggestions for economic research. Other authors (e.g., Robbins 1971; Frey 1994, O'Hagan 1995, Steiner 1997; Bailey & Falconer 1998) mainly discuss entrance fees for public museums in particular. Schuster (1998) focuses on hybrid forms between public and private museums, while Meier and Frey (2003) recently have examined the case of private art museums.

Museum Economics are to be distinguished from sociological approaches (e.g., Williams 1982), anthropological approaches (e.g., Keesing 1958) or art historic approaches (e.g., Fowler 2003) of studying cultural heritage. Illustrations of the struggles between the three disciplines can be found in Feldstein (1991), Grampp (1989), and Grampp (1996).

2.2 Organizational Approaches for Europe-Wide Access to Digitized Cultural Heritage

A second body of literature turns to organizational options for developing and managing an infrastructure that offers Europe-wide access and data maintenance and allows initiating precautions concerning long-term material access. Relevant organizational issues covered in the literature specifically refer to (1) who selects which cultural heritage objects to be digitized, (2) who digitizes, and (3) who controls the access.

Due to market failures and some public-good characteristic in cultural heritage objects (e.g., Baumol & Bowen 1965, Baumol & Bowen 1966; Poor & Smith 2004), the provision of cultural heritage objects could be below the social optimum. Hence, for the selection of cultural heritage objects, the value of individual cultural heritage objects has to be determined. In this context, literature (e.g., De La Torre 2002) distinguishes between cultural and the economic value.

While the cultural value - extensively discussed for instance by Connor (1992) - is difficult to operationalize (Throsby 2003), the economic value is expressed numerically, usually in financial terms. Several scholars deal with different economic techniques and approaches accessing the individuals' satisfaction deriving from cultural property in its non digitized version (e.g., Frey 1997; Navrud & Ready 2002; Poor & Smith 2004). These methods include the (1) concepts of willingness-to-pay, (2) impact studies, and (3) Contingent Valuation.

To assess the willingness-to-pay for cultural heritage objects, most studies use either the travel cost approach (e.g., Huszar & Seckler 1974; Martin 1994; Forrest 2000; Ward & Beal 2000) or the hedonic market approach (e.g., Rosen 1974). The travel cost approach measures the effort people are willing to spend to visit a cultural heritage object. It assumes that the cultural heritage object is the only reason for the journey. However, this approach has several limitations (e.g., Throsby 2001), for instance, it does not cover all non market values of the cultural heritage object (Smith 1993). The hedonic market approach measures the value of a cultural heritage object by looking at private markets which indirectly reflect the utility persons enjoy. It does not reflect upon all social values of the cultural heritage object either. Furthermore, its reliability highly depends on the ceteris paribus assumption.

Impact studies (e.g., Rogers 1995) measure the revenue derived from a cultural heritage object. The revenues stem from, for example, transportation fees, entrance fees, meals in the restaurant, gifts, and any kind of other income that can be ascribed to the cultural heritage object. Unfortunately, revenue per cultural heritage object does not reflect the social value of the object and thus is inadequate.

The most common evaluation method is Contingent Valuation (e.g., Throsby & Withers 1985). It uses sample surveys to elicit the willingness-to-pay for cultural heritage objects. The questionnaire involves a hypothetical situation; the term 'contingent' refers to the constructed or simulated market presented in the survey. For example, Martin (1994) and Santagata and Signorello (2000) use Contingent Valuation to measure the willingness-to-pay for a museum. For specific applications of Contingent Valuation to culture see e.g., Navrud and Ready (2002) or Noonan (2003). Its limits are highlighted by Throsby (2003).

After having decided on who selects cultural heritage goods for digitization and having chosen the cultural heritage goods to be digitized, the next question is who digitizes them. This question has been for instance addressed by Waetzold (1971) who states that such work cannot be delegated to graduate

assistants or trainees as it includes important decision for example concerning color reproduction and by Hanappi-Egger (2001) who illustrates the importance of the stakeholder approach in this context.

Concerning the questions who shall control the access to the digital cultural heritage based on which approach, two bodies of literature are available. The first one, mainly stemming from the political and social sciences (Dempsy 2000; Hanappi-Egger 2001) leads us back to the systems theory work as put forward by Luhmann (1987). The computer science literature on access control (e.g., Barkley 1995; Ferraiolo & Kuhn 1992; Giuri & Iglio 1996; Sandhu et al. 1996; Neumann & Nusser 1997) suggests Role-Based Access Control (RBAC) as introduced in 1992 by Ferraiolo and Kuhn (Ferraiolo & Kuhn 1992). RBAC (also called role based security) has become the predominant model for advanced access control because it reduces the complexity and cost of security administration in large networked applications and thus alleviates the administration of users and resources. With RBAC, each user role has a set of privileges for operating on some resources. Access permissions are only associated with roles rather than with individual users; hence, the administrative complexity is greatly reduced (e.g., Ferraiolo & Kuhn & Chandramouli 2003). More specifically, the literature (e.g., Lin 1999; Moffett & Sloman 1994) suggests Policy-Driven RBAC (PDRBAC) for controlling the access in our context where the Internet in general and the proposed infrastructure in particular support large numbers of both users and resources and the mapping of users to resources can change dynamically.

2.3 Information Systems and Computer Science

Thirdly, in the field of technically oriented information systems and computer science research, the creation of digital collections has become fashionable during the last years. As the digital collections are supposed to fulfill the functions of traditional ones - such as collection, conservation, study, interpretation, and exhibition (Noble 1970) or using Weil's (1990) terminology, preservation, research, and communication. Such functions of traditional collections serve as anchor point for developing basic requirements for digital collections or 'virtual heritage' (Addison 2001).

Frequent information systems and computer science conferences investigate technical solutions for translating the fulfillment of these traditional functions into the digital world. Regular conferences in the field, all with numerous scientific contributions, are the Conferences of the International Committee for Documentation of the International Council of Museums (ICOM-CIDOC) (www.cidoc.icom.org/conf1.htm), the International Conference on Hypermedia and Interactivity in Museums (www.archimuse.com/conferences/ichim.html), Electronic Imaging & the Visual Arts (www.vasari.co.uk/), Museum Computer Network Conferences (www.mcn.edu/conferences/), and Museums and the Web (www.archimuse.com/conferences/mw.html).

3 POLITICAL INITIATIVES CONCERNING THE DIGITIZATION OF CULTURAL HERITAGE

In recent years, the creation of Cultural Heritage Systems and the digitization of cultural heritage were supported by politics on a national and international (EU) level.

3.1 National Initiatives

Many European countries started initiatives to make significant parts of their national treasures accessible on the Internet in digitized form. In doing so, the particular digitization projects reflect the different national styles to approach the nations' culture.

In the United Kingdom, a national digitization policy was proclaimed and termed mandatory for every institution. Nevertheless, there is still no single national portal. France, with the 'Gallica' of the 'Bibliothèque Nationale' (gallica.bnf.fr/) has opted for a massive centralized national effort at creating a digital library.

German digitization projects reflect the country's federal system. Many digitization projects have been conducted independently on state level. Recently, efforts have been started to bundle them into a small number of national portals (see Table 1 in the appendix for an overview of the single library digitization projects funded by the German National Research Council).

Considering the different national digitization initiatives, European policy should aim at establishing an infrastructure that guarantees the interoperability of the national cultural policies. Europe's diversity does not allow for favoring one of these policies over another. For example, it would be neither possible nor desirable to describe Spanish's past by German conceptual categories. Rather, a European policy should try to preserve national traditions and spirits by handling the respective traditions subsidiary.

For example, in all European countries manuscripts are identified uniquely by traditional, national referencing systems. They follow their own principles and models for digitization. However, a unified European Digital Manuscript Library will only be feasible if all libraries make their digitized manuscripts accessible as objects that can be accessed via an approved protocol.

3.2 European Commission Initiatives

Part III, Title III, Chapter V, Section 3, Article III-181 of the EU draft constitution (e.g., www.budobs.org/eu-const-culture.htm) explicitly states that the "conservation and safeguarding of cultural heritage" is of "European significance".

In the EU, European research activities are structured around consecutive four-year 'Framework Programs (FPs)'. Already in the 'Fifth Framework Program of the European Community for Research, Technological Development and Demonstration Activities' (1998-2002) (europa.eu.int/comm/research/fp5/fp5-intro_en.html) the 'Information Society Technologies Program (IST)' was established as one of seven priorities. The IST is divided into four actions which comprise interaction of information and knowledge. The third key activity, which deals with the interaction of knowledge and information, also assesses cultural heritage or 'Cultural Heritage Systems (CHS)' as a key activity. The IST project has been continued in 'The 6th EU Framework Program for Research and Technological Development (FP6)' (europa.eu.int/comm/research/fp6/) which intends to improve the integration and co-ordination of the largely fragmented European research within the European Research Area (ERA).

Concerning the digitization of cultural heritage, European Commission activities include, for example, the project 'Digital Heritage and Cultural Content (DigiCULT)' (www.cordis.lu/ist/directorate_e/digicult/index.htm) which aims at developing advanced digital library services through standards, infrastructures, and networks. DigiCULT encompasses several sub-projects, some of which have been continued beyond the funding through DigiCULT. Such projects include 'ECHO - European Cultural Heritage Online' (hecho.mpiwg-berlin.mpg.de/home) and 'E-Culture Net' (www.eculturenet.org/). 'E-Culture Net' particularly aimed at developing the European Research Area (ERA) for digital cultural heritage. It included the 'Distributed European Electronic Resource (DEER)' that later developed into 'Distributed European Electronic Dynamic (DEED)'.

Major examples of ongoing development initiatives are the EU projects, EPOCH and BRICKS, both funded in the FP6. The overall objective of the EPOCH network (www.epoch-net.org) is "to (…) increase(e) the effectiveness of work at the interface between technology and the cultural heritage of human experience represented in monuments, sites and museums". BRICKS (www.brickscommunity.org) "aims at integrating the existing digital resources into a common and shared Digital Library", while respecting the European cultural diversity. Its 'bottom-up' approach is "based on the interoperability of a dynamic community of local systems" as to "maximise (…) the use of existing resources and know-how, and, therefore, national investments".

Overall, European cultural heritage programs have so far concentrated on investigating technical standards or on testing modes of co-operations between institutions.

4 DIGITAL AUTONOMOUS CULTURAL OBJECTS (DACOS) AS REFERENCE ARCHITECTURE

The provision of digital cultural heritage objects for access by research or the interested public is frequently seen as a sub-field of the research on digital libraries (e.g., http://www.delos.info/). As far as not specimen of the monolithic concept of a digital library (Goncalves 2004), cultural heritage servers can usually be subsumed under one or the other of the distributed concepts. Within production systems relatively conservative ones, like harvesting mechanisms, still predominate (e.g., the projects initiated by the Open Archives Initiative (OAI) (www.openarchives.org/). Systematically, the approach described hereafter could be summarized under 'preparation of web services for the provision of cultural heritage material'. We avoid this term however, as in the cultural heritage domain the most prominent technical advisory body, The Office for Library and Information Networking (UKOLN) (www.ukoln.ac.uk/interop-focus/gpg/) quite consistently uses the precise technical term (as for instance implied by the World Wide Web Consortium (W3C) Web Services Description Language Standard www.w3.org/TR/wsdl) 'web services' in a loose and almost colloquial meaning.

4.1 Research Approach: Developing a Reference Architecture

As we "build and evaluate" (March & Smith 1995, p. 254), our research aims at establishing a reference architecture derived from an analysis of existing academic prototypes and few existing commercial products. The viability of the reference architecture is validated using a proof-of-concept approach with two prototypical implementations which are shown below. Following March & Smith (1995, p. 254), we strive to "create models, methods, and implementations that are innovative and valuable".

Further, we also expect this design effort to foster theory building (e.g., Walls & Widmeyer & El Sawy 1992) in the field of system design. To serve this ambition, with additional implementations coming up, we continue to apply and test the reference architecture.

4.2 The DACO Concept[1]

DACOs represent cultural heritage objects digitally such that they can be easily integrated into other web services.

To allow for such integration, two main requirements have to be fulfilled: (1) Functional completeness allowing extended navigation, and (2) 'unobtrusiveness' meaning that DACOs integrate into overarching constructions like frames, but do not take over the website linking to them.

The presentation of each cultural object commonly account for about 90% for the representation of the cultural heritage object. Approximately 10% are needed for several navigation elements and an idiosyncratic emblem of the providing (and sometimes even the sponsoring) institution. DACOs can also be applied for three-dimensional objects: In a co-operation between the British Museum in London, UK, and the Acropolis at Athens, Greece, the British Museum could provide access to the digital versions of its repository of European artefacts from many national traditions. These artefacts (e.g., the Elgin Marbles) could then be used to reconstruct the Acropolis as a 3D model in virtual space.

DACOs are characterized by a common behavioral code that provides for informing about cultural objects on request. The code involves the object wrapping itself in mark-up language. It also provides a persistent addressing scheme allowing for control of the individual institution holding the good as well as a mapping scheme. Thus, even if the technology (e.g., HTML, XML, SGML, VRML objects, Flash movies, SVG constructions) can be chosen by the individual institution, the structure of basic

1 The DACO concept goes back to Thaller (2004a).

elements integrated into a DACO is predetermined. A single DACO may be saved on the server of the holding institutions.

Cultural heritage brokers, connected to all servers, integrate many DACOs of different institutions (DACO providers) into specialized interfaces, thus serving the interests of laymen and researchers. The communication between the servers takes place via the DACO protocol consisting of several XML-codes transmitted via Hyper Text transfer Protocol (HTTP). When addressed by a broker, the DACO server describes itself through providing a list of supported 'access venues' (e.g., titles, authors, years, etc).[2] The access venues can be used by the broker to develop a search mask.

Users access this data via a broker. They see an index of all available DACOs and after, appropriate specification, a HTML-Site containing all relevant DACOs to the special task is displayed. Users select a single DACO represented in the page of the broker as the broker receives the URL of exactly that object as well as information about which kind of DACO will be received (e.g., XML, HTML or Flash).

5 DACOS IN PRACTICE: TWO CASE STUDIES

5.1 Cologne Diocesan- and Cathedral-Library

An example DACO application implies digitizing the complete holdings of medieval manuscripts of the Cologne Diocesan- and Cathedral-Library (www.ceec.uni-koeln.de). The project idea was to test whether complete holdings - instead of individual objects - could be digitized and then replace the 'default medium of scholarship'. The purpose of this project was not to reproduce what could be done in print, but to open material for study not accessible by traditional technology. Therefore, the aim was to provide the complete library content of incunabula online in a sufficient quality for all types of research.

A Digital Cultural Heritage System was built consisting of about half a million freely addressable DACOs. During the years 2001 to 2004 about 420 codices comprising 130,000 pages were digitized in different resolutions. The common resolution of the scanned codices' pages is up to roughly 4,000 by 3,000 pixels, allowing for extensive paleographic research (e.g., exploring the writing direction of the writing element). An average manuscript page consists of 35MB to 48 MB of data, large format codices even of 120 MB. All codices together require storage of approximately 3.5 TB to 4.5 TB, equaling approximately 6,000-8,000 CD-ROMs.

With steadily decreasing prices for storage capacity and good project management, the costs for digitizing a single page in the aforementioned quality is down to about one Euro per page.

Further, additional tools are provided allowing for browsing through the manuscripts like in traditional libraries. A native 'dynamic' XML database administers all codicological manuscript descriptions since the 18th century. For some codices those descriptions amount to the equivalent of fifty printed pages.

'Dynamic' means that links are automatically generated for the references of the descriptions to individual manuscript pages. Thus, even if a multi-page description looks like a direct transcript of the traditional writing, it is a result of a database query that represents a specific intellectual view of a specific research tradition. For example, if one codicological study claims that only the time of a manuscript's origin but not the place of origin is known, but another study gives time and place of the origin, the place of origin will be presented to the user on the screen in all cases. The user can specify

2 An example of this kind of description terms is the CIDOC Conceptual Reference Model (CRM) to be found under cidoc.ics.forth.gr. The primary author of the CRM, Martin Doerr (2003) strongly emphasises the character of the CRM as an intellectual way of describing cultural heritage data. If one looks at truly native XML data bases capabilities, however, it becomes possible to use the CRM not only as abstract, but indeed as concrete data model for an information system. Regarding the understanding of the relationship between XML data bases and other abstract constructs expressible in XML, which is required by that, see Thaller (2004b).

a preference order (or use a pre-specified system wide preference order assigned to the individual study) no matter whether the time of origin is presented from the first or the second study or even from all previous researchers. Several search tools are then designed on such descriptions.

Furthermore, the users can download several tools which measure the performance of typical types of codiological / palaeographic work (e.g., measurement of single characters). As far as available without copyright restrictions, the main scientific literature to work with the codices is also made available in digital form.

Using the concept of DACOs, one URL of the library dissolves into about 600,000 URLs of individual references to a specific cultural heritage object that can be referenced directly from any other cultural heritage resource. This is due to the various views of the metadata and different resolutions.

Most of the traditional references to the codex under discussion are linked to its actual pages. In order to allow authors from any external server setting such links, a worldwide standard has to be created for addressing a specific manuscript. In this context, the system 'Permanent Universal Resource Identifiers' used for identifying single items of cultural heritage would have to be transformed into a 'Permanent Universal Resource Locator'.

In the case of the Cologne Diocesan- and Cathedral-Library, a quotation is linked to the address of 'kn28-0124_25v%22'. The tag can be explained as follows: 'kn-' is the siglum of the library in the German library system, '0124_' the number of the codex and '25v' the folio reference. Therefore, the traditional quotation would be 'Folio 25v of Codex 124 of the Cologne Diocesan- and Cathedral-Library. Together with the additional wrap up (could be easily supplied by a lookup mechanism), the complete address is 'www.ceec.uni-koeln.de/ceec-cgi/kleioc/0010KlCEEC/exec/pagemed/%22|kn28-0124_25v%22'. When accessing this address from another DACO, the complete virtual CEEC library could be explored as proper navigation tools have been installed on the same site.

Concerning the 'user acceptance' of this DACO approach, we expect positive feedback especially from the academic community even if user satisfaction for this DACO application digitized Cologne Diocesan- and Cathedral-Library is hard to measure properly: The majority of pages contain the discussion of canonistic laws in Latin or medieval handwriting, being useful mainly for academic researchers. However, there are also many visits from curious laypersons, which make it difficult to properly assess the intensity of manuscripts uses.

5.2 Distributed Digital Incunabula Library

The 'Distributed Digital Incunabula Library' (inkunabeln.ub.uni-koeln.de/vdib/) is developed as a prototype for the digitization of all German incunabula. Incunabula, Latin for cradle, are books printed between 1454 and 1500. Worldwide, approximately 550,000 incunabula (approximately 27,000 writings) have been preserved. The Distributed Digital Incunabula Library project, organized as a joined project between two libraries, the 'Koelner Universitaets- und Stadtbibliothek' and the 'Herzog August Bibliothek Wolfenbüttel', has demonstrated that the necessary DACO servers can be build fast and at reasonable price. Within the Distributed Digital Incunabula Library, as described in the previous section, a broker directs users to the library holding the digital copy of the cultural heritage objects.

The two libraries involved hold together approximately 5,800 copies incunabula (including duplicates). Out of these, 350,000 pages (ca. 2,000 - 3,000 titles) have been selected for the current pilot project, of which ca. 40 % have been digitized in the first ten months of a two year project. When completed, the 350,000 pages could represent as much as six percent of the titles of incunabula preserved world wide.

Obviously, beyond tackling the technical challenges, cost plays a major role in pushing such a digitization effort forward. The most important cost factors have been (1) content and subject classification, (2) workflow/data importation, (3) raw digitization, (4) storage capacity, and (5) development and maintenance of the WWW server. The content and subject classification is based on the already existing Incunabula Short Title Catalogue (ISTC) which has been in development at the

British Library since 1980.[3] The raw digitization of the single pages was conducted using a Nikon DXM 1200. A book cradle allows for photos in an angle of 45 degrees (see Figure 1) to treat the incunabula carefully while simultaneously saving time and money. The pages are scanned in a 24 bit color scheme using a resolution of 3800x3072 pixel (i.e. about 300 dpi for DIN A3) leading to a (uncompressed) data file size of 34 MB. With such a digitization procedure more than 80% of existing incunabula can be digitized leading to about 12 TB raw data volume (or 24 TB with a complete backup at an additional storage place). Considering all cost components, the costs for one page amount roughly 0.75 € (plus metadata and work environment).

Figure 1. Book cradle for 45 degrees photos (Source: www.image-engineering.de).

6 LESSONS LEARNED AND OUTLOOK

In earlier times, the description of cultural heritage objects has been cheaper than their visual reproduction. However, with the advent of modern digital technology, reproducing visual appearance of text has become cheaper than its description. What has been published by highly developed technologies of the last decades is already available as digital objects. Therefore, following the experiences of the prototypes discussed above, scientists should turn new technologies to those types and amounts of material that could not have been publicly available until ten years ago. Consequently, in the near future, many institutions will present their cultural heritage objects as online content; DACOs could contribute to achieve and maintain independent, individual and unrestricted cultural heritage institutions as well as a global comprehensive Cultural Heritage System.

Overall, the digitization of cultural heritage objects can be seen from two points of view: On the one hand, one may interpret digital cultural heritage objects as equivalent to their non digitized counterparts, as digital facsimiles, just being 'more beautiful' and after intensive development (e.g., word-based linking) able to imitate the possibilities of printed objects on the screen. On the other hand, one may consider digital cultural heritage objects as something substantially new, which make the largest possible amount of sources available through digital corpora with flat access tools. Such digital corpora hold significant new technical potential beyond print offerings. From both viewpoints,

3 See inkunabeln.ub.uni-koeln.de/vdib/dokumentation/introistc1.html for an introduction to the ISTC. The project specific Illustrated ISTC dynamically creates links between the newly digitized DACOs and the catalogue entries at the moment a new DACO is uploaded onto the server. The search tools based on the Illustrated ISTC can be integrated in all common German On-line Public Access Catalogue (OPAC). After digitization, a Table of Contents (ToC) Editor checks the new DACOs for quality and assigns the ISTC numbers to the single objects.

the digitization of cultural heritage should be a quest of every researcher and layperson and be emphasized and fostered by politics on a national and international level.

In any case, following up on the European draft constitution, political support needs to go beyond the development of technical solutions: Several activities seem necessary to make progress towards a European infrastructure and a Europe-wide strategy for digitizing European Cultural Heritage: At least, all European institutions holding digital cultural heritage should be able to integrate their objects into a large scale Cultural Heritage System regardless of their individual political and technical solutions. Therefore, it will have to be defined - beyond current prototypes described in this work and first pilot projects, how a Cultural Heritage Server has to react when asked for access by foreign institution. While the actual definition is a technically oriented design issue, its acceptance and implementation will need political and public support throughout the European Union. Such support should start with some initial encouragement for additional pilot systems showing the possibility of integrating resources drawn from different servers in various cities and countries.

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