Kim H. Veltman
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Abstract

The vision of access the whole of knowledge has a tradition that goes back at least to the Library of Alexandria. The 20th century added two new ideas: 1) that networked access to knowledge and culture would lead to a World Brain and 2) that collaborative sharing of such knowledge could lead to new research design and creativity. This essay reviews these and related trends that led to a Memorandum of Understanding (MOU), the MEDICI Framework and the vision of networks of excellence in culture. Although successful, the framework did not receive official support as expected. An assessment of recent European developments offers five possible reasons.

These two ideas were initially related and have since evolved in parallel. In Europe, for instance, there is now a curious dichotomy. One part of the Commission is pursuing networked access to knowledge (idea 1) and striving for an information society with the European Digital Library as a flagship project. Other parts of the Commission are pursuing networked collaboration (idea 2) in the form of grids, an European Research Area and speak of Knowledge Europe. Needed is a reintegration of these two ideas, a) to align our information systems with knowledge systems; b) to integrate enduring knowledge of memory institutions with emergent knowledge of our research councils, institutions of learning, design and creativity; and c) to develop systems that allow multiple ways of knowing, which Francis Bacon called "knowledges". This integration of the two ideas could become one of the key challenges for the 21st century (idea 3). In retrospect, while the original visions of a MOU, MEDICI Framework and networks of excellence in culture need revision and expansion in scope, the need for them remains.

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1. Introduction

The vision of access the whole of knowledge has a long tradition that goes back at least to the Library of Alexandria. The 20th century added two new ideas: 1) networked access to knowledge and culture through a World Brain and 2) the idea that collaborative sharing of such knowledge could lead to new research, design and creativity. This essay focusses on the first of these ideas and turns to the second idea in section 8, in order to suggest that a new

approach for the 21st century may lie in integrating these two ideas into a strategy, whereby we use systematic access to enduring knowledge from the past in a forum with collaborative workspaces of the present to design and create new knowledge for the future. Put simply, this requires adding historical and cultural knowledge to Engelbart's vision of Augmented Knowledge. In practical terms, this means that the Research Directorate's quest for a) an European Research Space and the Information Society and Media Directorate F's concern with b) e-infrastructures and grids for collaborative work need to be aligned with the Information Society and Media Directorate E's efforts toward c) universal access to knowledge through an European Digital Library.

1.1 Networked Access

The history of computers, in the sense of calculating devices, goes back to the 1630s. The 20th century transformed computers from simple calculators of numbers to devices that could be programmed to deal with text, images and eventually with multi-media, inter-media, multi-sensory and potentially sensory transduction.[1] In the past decades, there has been growing awareness of the role of networks. The intellectual framework for these developments began a century ago,[2] with the notion of a World Brain (*Gehirn der Welt*),[3] which entailed a vision of systematic access to all knowledge. By 1935, Paul Otlet, founder of the Mundaneum and Union Internationale des Associations outlined a prophetic vision of the future World Wide Web:

> a technology will be created acting at a distance and combining radio, X-rays, cinema and microscopic photography. Everything in the universe, and everything of man, would be registered at a distance as it was produced. In this way a moving image of the world will be established, a true mirror of his memory. From a distance, everyone will be able to read text, enlarged and limited to the desired subject, projected on an individual screen. In this way, everyone from his armchair will be able to contemplate creation, as a whole or in certain of its parts.[4]

A decade later Vannevar Bush published his well publicized vision.[5] The technology to enable these visions evolved slowly. The 1930s and 1940s saw military efforts towards programmable computers.[6] These moved to the public sphere in 1948 (Manchester). The 1960s saw initial experiments in text and images. In 1964, David Sarnoff, who led the Radio Corporation of America (RCA), foresaw the implications:

> The computer will become the hub of a vast network of remote data stations and information banks feeding into the machine at a transmission rate of a billion or more bits of information a second. Laser channels will vastly increase both data capacity and the speeds with which it will be transmitted. Eventually, a global communications network handling voice, data and facsimile will instantly link man to machine--or machine to machine--by land, air, underwater, and space circuits. [The computer] will affect man's ways of thinking, his means of education, his relationship to his physical and social environment, and it will alter his ways of living... [Before the end of this century, these forces] will coalesce into what unquestionably will become the greatest adventure of the human mind.[7]

Things went more slowly than predicted. In Europe, the Internet began formally in Great Britain in 1968 through the work of John Davies. In the United States, the Internet began in 1969 with DARPA. In its first twenty years, it grew to 100,000 users. In 1990, another

impetus from Europe (CERN in Geneva), transformed the horizons of networked information through the World Wide Web (WWW). Within a decade the web grew from 1 million to 200 million. Slowly the possibility loomed that the visions of Paul Otlet, Vannevar Bush and David Sarnoff could come to fruition.

1.1.2. Cultural Networks

Long before the Internet, pioneering work towards systematic access to culture was done by the Inventaire général (1780),[8] the Réunion des musées nationaux (Rmf, 1895)[9] and the Marburg Archive[10] (1911). The idea of networks for culture was implicit in the UNESCO constitution (1947): "That the wide diffusion of culture, and the education of humanity for justice and liberty and peace are indispensable to the dignity of man and constitute a sacred duty which all the nations must fulfil in a spirit of mutual assistance and concern."[11] In 1971, UNESCO published the *UNISIST: Study Report on the feasibility of a World Science Information System*. In 1972, the UNESCO Convention on Cultural Heritage[12] provided a particular impetus for electronic treatment in the cultural domain, as has the recent UNESCO Charter on the Preservation of the Digital Heritage (2006).[13]

In 1967, Jack Heller and a consortium of fifteen museums in New York "formed the Museum Computer Network (MCN) to create a prototype system for a shared museum data-bank."[14] In name, this was the first official museum network, but it entailed only a mainframe computer two years before the American Internet and its scope was limited to a single city. The MCN has continued to do important work, but has not created even a national network. Meanwhile, in 1972, the year of the UNESCO Convention, Peter Homulus, founded the Canadian Heritage Information Network (CHIN). This became the first network for memory institutions with a national vision. CHIN was pioneering in the creation of some of the earliest national databases that built on controlled vocabularies and envisioned an integration of materials from memory institutions: libraries, museums and archives. Its Virtual Museum of Canada (VMC) now entails over 450,000 images, more than 150 interactive games and "hosts over 500 Virtual Exhibits and Community Memories Exhibits ."[15]

Early efforts by visionary individuals were gradually institutionalized. In Italy, the ICCD (Istituto Centrale per il Catalogo e la Documentazione), began in 1975).[16] In Germany, the Foundation of Prussian Cultural Heritage (Stiftung Preussischer Kulturbesitz) founded the Institute for Museum Studies (1979). The Scuola Normale (Pisa) organized the first international conferences on computers in the realm of culture (1978, 1984). In North America, The Visual Resources Association (VRA) became an official organization in 1982.[17] The advent of the Getty Trust (1984), with a special Art History Information Program (AHIP), raised expectations. The 1970s and 1980s also saw early efforts in libraries, museums and archives towards electronic catalogues and collections. The Consortium for the Interchange of Museum Information (CIMI), which began as a committee in 1990,[18] introduced one of the first groups for museum professionals to share their experiences and work together towards common standards.

These efforts among professionals sparked experiments to provide the general public with electronic access to cultural heritage. In 1986, the new Musée d'Orsay introduced computer monitors in their exhibition hall. In 1991, the National Gallery of London introduced its Micro Gallery,[19] and thus became the first major museum to provide public access to its entire collection in electronic form. The Remote Access to Museum Archives (RAMA, 1989-1991) project, aimed at an online access to museum materials. The third and fourth framework

programmes of the European Commission saw an increasing number of projects, often in parallel, and sometimes without co-ordination, in the realms of museums, libraries, archives, language technologies and education. A need for further co-ordination was recognized as a new term was coined: Information and Communications Technologies (ICT).[20]

2. Into the Political Agenda

For most of the 20th century, visions of networked knowledge were the domains of researchers and scientists. Although politicians typically used buzzwords like global village, new economy, they were often empty phrases. This changed in 1986 when George Schultz, Secretary of State of the United States, outlined a shift from an industrial age to an information age, although, significantly, he emphasized computers, robots and direct broadcast satellites, rather than the Internet.[21] These ideas were largely shared by Al Gore, who made the term Information Superhighway® the registered trademark of his vision of the Internet. In 1991, as Senator, he passed the High Performance Computing and Communication Act, which claimed that "Advances in computer science and technology are vital to the Nation's prosperity, national and economic security, and scientific advancement."[22] Europe took notice. A *White Paper* (1993) saw a) information networks, and b) energy and transport networks as development themes.[23] The Council of Europe asked Martin Bangemann to head a High Level Committee on the Information Society that included Romano Prodi. The *Bangemann Report* (1994)[24] claimed that there were ten areas where Europe lagged behind the United States with Teleworking, Distance Learning and a Network for Universities and Research Centres at the top of the list.

2.1 G7 Conference

Meanwhile, the World Wide Web grew to nearly 50 million users within five years. This growth, the Bangemann Report, plus the enthusiasm of Al Gore when he became Vice President in the Clinton administration, helped inspire a first G7 Conference and Exhibition on the Information Society, held in Brussels in February 1995. The exhibition offered a first global view of major projects around the world. It also brought into focus significant differences between the American emphasis on an information highway; Europe's quest for an information society and Japan's vision of a knowledge society. One outcome of the conference was a decision to create eleven G7 pilot projects, which would serve as beacons for the new, networked technologies. These included projects on education; a universal library and Multimedia Access to World Cultural Heritage (Pilot Project 5) [25].

2.2 Memorandum of Understanding (MOU)

The Advanced Communications and Technologies Services (ACTS) section of the European Commission (then DG XIII) felt a need for Europe to "get its own act together" and to develop its own coherent vision, strategies and policies before entering seriously onto the world scene in this domain. Accordingly, they launched a Memorandum of Understanding (MOU) for Multimedia Access to Europe's Cultural Heritage with a preliminary lecture (Brussels, December 1995); initial meeting in February 1996 and a formal signing of key partners in June 1996 (Florence).

The MOU initially inspired over 600 signatories, led to general and specialized meetings and produced useful reports on the state of the art in the cultural domain. As this progressed three key ideas came into focus. First, there was clearly a need to develop the economic potentials

of digitized culture heritage in a networked environment. To achieve this, initial competence centres were required. An European project, Museums Over States And Virtual Culture (MOSAIC),[26] was intended to answer this need. Second, a framework was needed for greater interplay and transfer of knowledge between/among the academic community (especially polytechnical, and technical universities, and institutes) and leading industrial players, especially Small and Medium Enterprises (SMEs). This would lead to a better dissemination of technical innovations, practical applications, and new training for the next generation.[27] This was one vision behind the MEDICI (Multimedia EDucation and employment through Integrated Cultural Initiatives) Framework,[28] which was launched formally in October 1998 (Vienna).

Third, it was recognized that the new Information and Communication Technologies (ICT) entailed waves of convergence, which would radically alter existing paradigms. This required new research into methodological, philosophical, social, policy and other dimensions. To this end, an European Network of Centres of Excellence in Culture was planned. The Maastricht McLuhan Institute (MMI) was launched in parallel with the MEDICI Framework with an explicit goal to prepare the ground for this research dimension. This led a) to an informal consortium of seven institutions including Bologna, Pisa, Madrid, Cologne, London and Vienna and b) to the establishment of E-Culture Net.[29]

The MOU, MOSAIC, the MEDICI Framework and the idea of a Network of Excellence in Digital Culture (E-Culture Net) theoretically constituted an underlying vision for the sixth framework programme and beyond. In practice, things went very differently. MOSAIC was partly funded but not as expected. MEDICI was successful and soon acquired over 1,000 signatories. It organized a series of useful conferences and meetings. It developed working groups that provided an excellent census of the state of the art in new technologies, received only nominal funding and continued nonetheless. E-Culture Net[30] was funded for one year and was then dropped. By way of explanation for this change of plans, five reasons can be offered. First, there was a shift within the European Commission. Second, and linked with this, there were delicate issues of cultural policy. Third, there was a new vision of European education. Fourth, there were very dramatic developments in new technologies and fifth, unexpected developments qua Digital Libraries and E-Content.

3. Shifts in European Commission

During the 1990s, the European Commission had 25 Directorates General (DGs) including a Directorate on Culture (DG X), ACTS (DG XIII)[31] and Education (DG XXII). ACTS had serious funding for technological innovations and had a section for technology in the cultural domain. ACTS and DG X sponsored the MOU. When Romano Prodi became head of the Commission, the number of DGs was drastically reduced.[32] DG X and XXII were merged into DG Education and Culture. ACTS was absorbed into what became Information Society and Media, which included Directorate E: Digital Content and Cognitive Systems, which has a sub-section: E.3: Cultural Heritage and Technology Enhanced Learning.[33] Directorate E moved from Brussels to Luxembourg with new personnel.

In the 6th Framework Programme, the new staff in Luxembourg funded two networks of Excellence. One was EPOCH, "a network of about a hundred European cultural institutions joining their efforts to improve the quality and effectiveness of the use of Information and Communication Technology for Cultural Heritage,"[34] This focussed on tools and practical challenges in 3-D environments, especially in virtual archaeology rather than on

methodological problems. Sadly there is a discrepancy between the number of tools promised on the Commission's site for the project and the number of tools presently available on the EPOCH site. A second network of excellence is Kaleidoscope, which aims at "Building a European Research Area in the field technology-enhanced learning."[35]

Some in the Commission have said that the new staff had their own agenda and were not interested in following through with a vision that had been developed earlier in Brussels. As we shall show, it would be simplistic to pretend that this was the only reason.[36]

4. Cultural Policy

One very delicate problem has been the word: Culture. The Maastricht Treaty of the European Union explicitly mentioned "desiring to deepen the solidarity between their peoples while respecting their history, their culture and their traditions."[37] A problem remains that culture is a typically a national matter and in some countries a regional matter. Some felt that the European Union's projects should not deal with culture except peripherally. Others, such as European Parliament member, Giorgio Ruffolo, are convinced that more systematic treatment of culture is a key to fostering Europe's diversity. Ruffolo's report outlined his vision and documented cultural initiatives in the European Union.[38] Ruffolo was not alone. When the Norwegians shifted the Stockholm Challenge into the Baltic Challenge they explicitly included Culture as one of the categories.[39]

While ACTS was promoting the MOU and MEDICI, there were repeated attempts to insert culture as a formal term within the Lisbon Strategy (March 2000). These efforts failed. On the positive side, the Lisbon Agenda agreed on a goal of making the EU "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion".[40] This marked a crucial step because it confirmed Europe's commitment to knowledge rather than mere information. There followed a Lund Action Plan[41] and then MINERVA (Ministerial NEtwoRk for valorising Activties in digitisation),[42] a project sponsored by the Luxembourg unit.

MINERVA was a very important step forward[43] and the thrust of its efforts needs to be fostered . Unfortunately, its rhetoric was not always matched by actions. MINERVA favoured a few members of the Union more than others. It promoted MICHAEL (Multilingual Inventory of Cultural Heritage in Europe) project in the context of e-TEN,[44] which ignored the important work of the French Ministry of Culture's project, AMP (Accès Multilingue au Patrimoine.).[45] To date, MICHAEL deals with only three of the Union's languages, although more are planned. Spanish, which is now the third language of the Internet, is still absent.

The profound challenges in developing cultural policies and activities such as networks within the European Union cannot be solved by short term projects of 3-5 years. It typically takes at least that long simply to establish them. Networks of excellence, if they focus on sharing knowledge and experience, cannot be money-making propositions. Their product is not an object to be sold for profit, but rather the development of human capital, which will one day be a central dimension of a knowledge based society and economy. Needed are long-term structures for co-operation and mobility. Ultimately, we need at least three kinds of networks: one governmental along the lines of MINERVA, and fully representative of all the member states; another that focuses on technical dimensions as MEDICI set out to do and as EPOCH aims to achieve in the specific area of virtual heritage and a third, that addresses problems of method, philosophical, social and other dimensions in the manner foreseen by E-Culture Net.

5. European Education

While one part of the Commission was developing the MOU and MEDICI, other parts of the Commission were working quietly on a new vision for European Education. In 1997, for instance, there was a convention (Lisbon), recognising higher education qualifications in the academic field within Europe.[46] This led to the Sorbonne Declaration (1998), which stated that: "Europe is not only that of the Euro, of the banks and the economy: it must be a Europe of knowledge as well. We must strengthen and build upon the intellectual, cultural, social and technical dimensions of our continent."[47] This was followed by the Bologna Declaration (1999),[48] which effectively paved the way for the Lisbon Agenda (2000). These declarations outlined a vision, whereby students will in future be able to move easily between universities in different countries much as they did in the Middle Ages when universities began in Europe. Lisbon was careful and reticent in its formulations, but Lisbon eventually managed a signing of the European constitution where earlier bravura had failed.

In the short term, the Lisbon-Sorbonne-Bologna connection helps to explain the rise in importance of the Technology Enhanced Learning section,[49] and the funding of networks such as Kaleidoscope and Unfold in Luxembourg. In the longer term, this new approach to European Education means that although the word culture was officially absent from the Lisbon Agenda, it is implicitly destined to become an essential dimension in Europe's quest for a union, which fosters cultural diversity rather than sameness.[50] Future versions of a MEDICI Framework and networks in digital culture will need to reflect these changes in Europe's vision of Education. At present, the Marie Curie Programme favours the sciences. In future, we need equivalent long-term initiatives for the humanities and social sciences. These might have three tracks: one for the training of specific techniques; second for sharing established research methods and a third, to explore new methods. In the case of the third track, perhaps it would be useful to link this directly with the Commission's existing institutes of the JRC,[51] such that these become combinations of Institutes for Advanced Study and think-tanks.

6. New Technologies

Understanding developments in technology remains a great challenge. At the turn of the new millennium there was considerable media coverage of a so-called dot.com bust. Some pessimists predicted that the Internet phenomenon had peaked. Quite the opposite happened. It took a century to achieve 1 billion users of the telephone. In the past seven years, there have been 1 billion new users of the Internet. Mobile technology took 20 years to reach its first billion (1985-2005). In the past, two years this has grown to 3 billion users. In 2006, 59% of users lived in developing countries.[52] For the first tine in history, the developing world is acquiring more of a new technology than the developed world. Our categories of first and third worlds are obsolete. For the next six years, sales of 1 billion new mobile phones are predicted. This will lead to figures larger than the entire world population. As these phones become Internet enabled, the visions of Otlet, Sarnoff and others could become a reality.

Since 2000, there have been further trends towards convergence variously called Bio-Systemics Synthesis in Canada, and Nanotechnology, Biotechnology, Information Technology and Cognitive Science (NBIC) in the United States. It took Europe two years to offer a first glimpse of its own views in a report on Converging Technologies for the European Knowledge Society (CTEK).[53] All these sudden developments are dimensions for

which no-one was prepared in the early 1990s. Even the most optimistic enthusiasts foresaw one billion cell phones not 3-7 billion and no-one in the cultural domain foresaw that the bio- and nano- dimensions would advance so quickly. Curiously, such developments make all the more pressing a need for networks to analyse, understand and explore the implications of what has been called the shift from ICT towards UCT (Universal Convergence Technologies). Without such networks an European Research Area in a deeper sense is not possible.

7. Digital Libraries

During the 1990s, the European Commission avoided projects which entailed scanning in content. The Lisbon Agenda implicitly made e-content an important issue and led to a first programme from 2001-2004,[54] which has now been followed by a second phase from 2005-2008. On the surface all this has evolved quietly.

Meanwhile, a series of developments transformed the original picture. In the 1980s, Bruce R. Schatz, then at Bellcore and Bell Labs, explored both of the key 20th century ideas mentioned earlier: 1) networked access to knowledge using electronic versions of books etc. and 2) networked collaboration to manipulate the knowledge of a community. Schatz was connected with the development of the MOSAIC browser and went on to become the head of a NSF/DARPA/NASA Digital Libraries Initiative (DLI) project (1994-1998).[55] From another quarter, *Bibliotheca Universalis* became one of the eleven pilot projects of the G7. Hereby, Digital Libraries became a strategic topic in the scholarly, political and even the military sphere.

In the second half of the 20th century, projects to scan the full texts of books and documents grew steadily from isolated examples to hundreds of thousands of books. In 2000, this trend had a quantum shift with Proquest's plans to scan 1 million books. In December 2004, Google announced its Google Print Library Project to cover 10 million books, a figure that was subsequently expanded to 20 million, probably to counter India's vision for a similar amount. Today, there are at least six major projects outside of Europe, which foresee scanning the full-text of over 55 million books and documents by 2020.[56]

In the 1990s, European libraries worked together on GABRIEL (Gateway to European National Libraries),[57] and the European Commission had an active Telematics for Libraries program that aimed to create a European Library Space.[58] This led to projects such as The European Library (TEL) and TEL-ME-MOR.[59] The announcements of Google prompted the head of the Bibliothèque Nationale de France, to write to colleagues; then to the President of France, who in turn wrote to the European Commission. In the short term, this transformed the TEL project, such that it integrated earlier efforts of Bibliotheca Universalis, and GABRIEL, and became a new vision of a European (Digital) Library,[60] under the auspices of the Conference of European National Librarians (CENL).[61] It took two years for the European Parliament to confirm the plans.[62] Within the Commission, responsibility for Digital Libraries was shifted very quietly from Information Society and Media DG, Unit E.3 to Unit E.4 - Digital Libraries and Public Sector Information[63]

In the medium term, the Commission committed itself to make TEL a flagship project. "By 2008 it will include 2 million books, films, photographs, manuscripts, and other cultural Works. By 2010, it will provide access to more than 6 million resources from every library, archive and museum in Europe."[64] Some representatives of these projects still speak of records. Others speak of full-text. In any case, these plans are now dwarfed by other

initiatives around the world. Horst Forster, head of the Directorate on Content, has estimated that there are 2.5 billion books in the EU25. He has also estimated that 2% of cultural heritage is presently accessible.[65] There is much talk of a European Research Area accessible at the click of a mouse. But there are no clear plans as to how or when the Commission hopes to achieve full access to these resources. In a world where private companies such as Google speak openly of having a 300 year plan,[66] it may be necessary for the European Commission to develop some very long-term visions, policies, and strategies.[67] For instance, the very name of The European Digital Library does not reflect a need to include all memory institutions: archives and museums as well as libraries.[68] A Distributed European Electronic Repository[69] might be more appropriate. More importantly, its scope remains too limited for at least four reasons.

First, there is a need to integrate access to a) enduring knowledge with access to b) new knowledge and work in process. Traditionally, memory institutions and especially libraries have focussed on enduring knowledge created in the past. Meanwhile, new knowledge has been the domain of research councils (usually at the national level) such as the CNR in Italy, CNRS, INRIA in France, and DFG, Max Planck in Germany. Systematic access to this research remains difficult. Projects such as MORESS (Mapping of European Social Sciences and Humanities)[70] have pointed the way to a more systematic approach. In the past two decades, there has also been a trend towards e-preprints such as arXiv.org. Visions of an European Digital Library, need to integrate these two tasks. We need simultaneous access to both enduring knowledge of the past from memory institutions and ongoing research from research councils in the present, to create new knowledge in the future. In short, access to knowledge needs to reflect ongoing research as well as historical scholarship.

Second, there is a need to develop online, electronic versions of Reference Rooms. The great libraries of the world typically require between one month and two years before users can find things efficiently. In the 1970s, the old reading room of the British Library had over 300,000 reference books, which served as orientation to the actual collection of over 11 million books. Electronic collections introduce a new scale in size of collections. Today, the TEL provides some access to 150 million records. The Karlsruher Virtual catalog gives access to 500 million books. A simple screen for typing in author and title may be seductive but is effectively useless for serious access to the complexities of collections of hundreds of millions of books. Virtual Reference Rooms with hundreds of thousands of standard reference works will need to become a new generation of finding aids that complement the virtual repositories of an European Digital Library.

A further dimension of such digital reference rooms entails a challenge of translations. In today's plans for digital libraries there is often a tacit assumption of: scan and it will be done. Scanning and preservation are necessary starting points. Taken alone these assume that a) users will know the many languages and b) they can read complex scripts, especially in the case of manuscripts. Hardly anyone reads all 25 of the EU languages, let alone the 6500 languages of the world. Very few persons are trained in palaeography. Today the EU translates its key documents into the languages of its member states. We cannot hope to translate everything into all 6,500 languages. With international co-operation, it is possible to foresee systematic translation into a core group of world languages. 75 years ago, UNESCO began an *Index Translationum*. The scope of this initiative needs to be expanded and made part of a future European Digital Library.

Third, universal access to knowledge and information needs to be integrated with the quest for networked collaboration (§ 8). Fourth, collections of knowledge and information need to include different ways of knowing, for which Francis Bacon coined the term: knowledges (§ 9 below).

8.. Workspaces for Augmented Knowledge and Creativity

As noted in the introduction, the 20th century introduced two profound ideas which were related: 1) networked access to past knowledge and 2) networked collaboration to create new knowledge. In the 1930s and 1940s, forerunners of the internet such as Vannevar Bush were fascinated how these two ideas could lead to new forms of scientific work. Douglas Engelbart, inventor of the mouse went further. He predicted new forms of collaborative work, outlined a *Conceptual Framework for the Augmentation of Man's Intellect* (1963), wrote on *Augmented Knowledge* and developed the Bootstrap Institute. Engelbart was a pioneer of what became Computer Supported Collaborative Work (CSCW), Computer Supported Collaborative Learning (CSCL). In his vision, persons in large companies could work together fruitfully in designing and creating new airplanes, cars or other complex machines. Prophetically, this is precisely what has happened in the past decades through the online use of software such as CATIA in designing new automobiles, the Eurofighter, and other large scale industrial projects.

In the 1980s, the work of Bruce Schatz, mentioned earlier, also pursued both ideas. He called the first idea Digital Libraries and called the second idea: Telesophy, a "system for manipulating the knowledge of the community."[71] In the 1990s, the shift from an Internet to the World Wide Web (WWW) was much more than a change of name. The Internet was largely about e-mail, sending electronic letters that could be answered asynchronously. The WWW introduced new levels of sharing corpora of knowledge; databases, preprints and collaborative projects. Especially in the physics and astronomy communities, the focus of attention shifted from enduring knowledge towards access to research in progress and to pre-prints.[72] On the positive side, this had led to a vision of e-science.

Within the Commission this has led in Information Society and Media Directorate F to an EU Research Infrastructures Programme, and the creation of grids for Science and Business "connecting the finest minds, sharing the best scientific resources, building global virtual communities."[73] The current grids are focussed on three topics: weather forecast, biomedics, astrophysics. The good news is that they are focussed topics. Even so their scope is a long way off from the vision of Mediaeval universities to understand the universe of studies (*universitas studiorum*). To achieve an European Research Space, where all knowledge is accessible at the click of a mouse (for those who do not require assistive technologies), we need a strategy and plans that include the full scope of learning.

Hence, within the scientific community, there has been a trend to shift attention from networked access to past knowledge (idea 1), and to focus almost exclusively on networked collaboration (idea 2). Within the European Commission, what began as two inter-connected ideas, are now being dealt with in isolation. We are building an European Digital Library for networked access to knowledge of our collective memory (idea 1). We are also building grids and e-infrastructures for networked collaboration (idea 2). Europe's distinctive feature is the richness of its cultural diversity and its memory institutions. If we integrate these resources, then we can combine past knowledge with present research to achieve new knowledge and creativity (idea 3). A half century ago, Doug Engelbart launched a vision of Augmented

Knowledge. If we add to that vision, historical and cultural dimensions we can, for example, build new architecture and design new products, that reflect regional and local traditions.
Very simply, an European Digital Library, also needs a Forum for Collaborative Work and Creativity, beyond the present efforts of grid infrastructures. The quest for access to past knowledge can then stimulate new Thinkspaces and Workspaces for Augmented Knowledge and Creativity.

9. Information, Knowledge and Knowledges

The Bangemann Report (1994) called on Europe to catch up with the United States in the field of new technologies. The EC's Framework Programmes set out to achieve this and they have been crowned with considerable success. For instance, the GEANT network based in Europe, is now one of the best in the world. These efforts have also had two unexpected consequences.

First, they have brought to light differences between the US and European approaches to information and knowledge. In North America, there has been a greater emphasis on the network than on the content. When the national telephone line was completed in Canada in 1932 it was called a copper highway.[74] Harold Innis stressed the importance of these networks in *Empire and Communications* (1950). McLuhan went further with his provocative phrase: "The Medium is the Message". The computer company, Sun, went even further when it chose as its slogan: "the network is the computer". While very clever qua marketing and sales, this focuses attention on the medium, rather than the messages it can convey through content. In North America, this has led to metaphors of an electronic highway, information highway, and Information Superhighway.

Already at the G7 Conference (1995), Europe distanced itself from these metaphors by insisting on an Information Society rather than an Information (Super-)Highway. At one level this is simply a contrast between a new continent and an old continent. America focuses on getting somewhere, Europe is interested in what happens when one arrives and how it will affect our daily lives. But there is a deeper divide. Europe can distinguish carefully between information and knowledge. In the US, the terms information and knowledge are typically used interchangeably. Often, the US focuses only on Information to the exclusion of knowledge as a term. For instance, in the Library of Congress the subject heading, "Knowledge" yields 12 titles, of which four are published in Europe, and six are on nursing and health. By contrast, the German Common Union Catalogue (GVK) lists 11,880 titles. In the US, the notion of knowledge as information that has been verified or proven (cf. the senses of *Wissenschaft* or *connaissance* or Popper's notion of objective knowledge) are almost entirely lacking.[75] In the absence of clear criteria for knowledge, there is a far greater concern for trusted repositories and screening out, filtering or even censoring uncertain and untrusted information.

Second, these efforts are revealing unresolved trends within the Commission itself qua approaches to information and knowledge. For instance, there is an *Information Society and Media Directorate* to create an *European Information Space* and European Digital Library. This uses the term "Information" as if it were interchangeable with "Knowledge". Similarly the eEurope Action Plan is subtitled: *An Information Society for all*. The Europa site, which introduces Europe in 12 lessons has as lesson *8: Towards a Knowledge Based Society.*[76] Meanwhile, the Employmant and Social Affairs Directorate has a heading on the *Knowledge Society*.[77] The Research Directorate, has a quest for an *European Research Area*, while the

European Commissioner for Science and Research explicitly writes on *EU Research - Building Knowledge Europe.*[78]

What precisely will the new European Digital Library and other e-infrastructures do? Will they merely provide access to information in the sense of words and titles? In the longer term will the European Digital Library be aimed at all knowledge, while the grids of the European Research area are focussed only on e-science as is the case at present? Will the quests for networked access and networked collaboration enable us to distinguish clearly between information and knowledge? Will they provide access only to certified and proven knowledge? While some members of the Commission and representatives of projects suggest that these are pedantic and superfluous questions, the implications of such problems remain profound, Indeed, since they are central themes of FP7, these problems constitute a 50 billion euro set of questions.

There are also more elusive challenges. Early users of the Internet assumed that they could create a net, containing only true knowledge and information. This became an assumption of the champions of a semantic web, who want to deal uniquely with cases with logical proof and truth. This noble ideal is inspiring networked collaboration through grids for an European Research area. In the case of networked access to enduring knowledge through an European Digital Library, the situation is much more complex. Of course, there are some true facts, e.g. the documented date of birth or death of a major figure. In most cases, however, such certainty is lacking. Trusted repositories are a pragmatic stop gap measure but not enough. To address this dilemma there are specialized disciplines of hermeneutics, interpretation and criticism. In a larger sense, the very idea of scholarship is integrally linked with developing methods, whereby any claim must be supported by footnotes and references back to the original source(s).

In a digital context, we need new systems to extend these traditions of footnotes and references via links back to original objects or at least to surviving documents in order to re-examine, verify and possibly re-interpret these original sources. Technological aspects of this challenge entail cameras, new generations of RFID chips or their equivalents. In practical terms, this means that, in the humanities and social sciences, visions of a born digital equivalent to an isolated cloud of truth, are naïve. Any digital web needs to be linked back to the physical world, a challenge that the ITU has described as a trend towards an internet of things. In some cases, such a digital web needs to be linked back to documented alternative worlds, e.g. religious, or literary worlds.

Lurking are more subtle problems. The notion of absolute truth is itself a cultural and historical phenomenon. Some would say it was a notion that came in the 19th and all but disappeared again in the 20th.century. To take a simple example: In science we assume that laws are true. Similarly, in the genealogy of physical human beings, a son needs one father in order to be legitimate, Here untruth leads to scandal and to court cases. By contrast, in the genealogy of Greek gods, there are very different notions of ordering knowledge. The Greeks saw no contradiction in saying that Dionysius was the son of Zeus and Semele on one occasion and that he was the son of Zeus and Demeter on another occasion. In Hinduism, this tendency is even more dramatic. Scholars link four Buddhas with the four points of the compass and also accept that other combinations are possible. In both Greece and India, we find that several explanations can be offered, and yet the combinations are not arbitrary. There may be poly-semantic links, but they are limited. So in some cases there is one truth. In other domains there are multiple truths.

In the 17th century, Francis Bacon became aware of related problems and coined the term "knowledges". As we create a European knowledge space and work towards visions of World Digital Libraries, we need more than catalogues of names, variants and titles. We need tools to sift through these different kinds of knowledges, cases where one truth is the standard and cases where multiple truths are accepted. Some have insisted that these problems are readily solved if we distinguish clearly between fact and fiction. But things are not always that easy. For instance, John Lightfoot (1602-1675), was Vice-Chancellor of Cambridge University. In today's jargon he was a trusted source. He focussed his research on chronology in the *Bible*, for a Christian, the most trusted written source. After long years of research, Lightfoot concluded that Adam in the *Old Testament* "was created on October 23, 4004 B.C., at nine o'clock in the morning"[79] Not all Christians today would accept the details of Lightfoot's claim, while non-Christians may well view the *Bible* as myth rather than as a "true" document. Should Lightfoot's claim therefore be excluded because it may not be true? If so what are the precise rules for inclusion? Should we eliminate all early attempts at history, where the veracity of sources cannot be proven? Should we insist on including only cases where there is complete certainty? If so why is the weather, which is famously uncertain, the first in the list of grid topics in e-infrastructures?

If we strive to create a web that has only documents, which are true in the very limited sense of scientific laws, then we need to exclude all poetry, all literature, all religious texts, the whole of the humanities and the social sciences and most of human language which, through the complex vagaries of etymology, is seldom limited to a single meaning. Stated dramatically if we strive for a semantic web[80] with only single truths, we are obliged to deny our cultures, our diversity, our histories and all our expressions as human beings. If we do so, then the quest to create networked access to European knowledge through an European Digital Library is ultimately itself a lie.

An alternative is to go beyond vague quests for an information space, or knowledge area and to explore ways of understanding the history of our ways of knowing,[81] different knowledges, some of which are logically valid, some of which are intuitively true; some of which are uncertain. Indeed, some dimensions such as superstitions and myth, may be patently untrue in the logical sense and still deserve study, even if mainly as a reminder of whence we came: e.g. early descriptions of a world egg at the time of creation, or images of dragons and phoenixes in the heavens, which helped inspire early efforts towards astronomy. To distinguish between these, we need to integrate hierarchies of claims and levels of certainty into our systems.[82]

In the longer term, it will be useful to distinguish between levels of reality (metaphysical, mental, physical, man-made and social worlds), and also to distinguish between those images of knowledge, which emphasize touch, e.g. knowing in the Biblical sense; others which focus on taste (e.g. *sapienza* and *savoir*); others which emphasize the visual (insight, enlightenment) and others, which are abstract. Some cultures have written down their truths. Others, such as the 27 nomadic peoples that are still active to this day, insist that they convey their knowledge and experience in oral form. In practical terms this means, that a quest for an European Digital Library, also requires new research on knowledge organization ,which integrates historical classifications of knowledge and explores new methods. The idea of universal access is easy. To achieve it is very elusive.

10. Conclusions

Visions of access to all knowledge are as old as the Library of Alexandria. Visions of networked access to all knowledge emerged in the 20th century. One was the image of a World Brain (*Gehirn der Welt*), which led to visions of networked access to knowledge and culture. This became a first great vision of the 20th century (idea 1). In North America, the new technologies led to metaphors of a copper highway, an electronic highway and an information highway. Connected with these was a second great vision, networked collaboration (idea 2). Here, America led initially, although Europe's more careful approach led to more enduring results (e.g. CATIA).

Throughout the first two decades of the Internet (1968-1988) both these visions remained impractical. With the advent of the World Wide Web, a new era loomed. The G7 proposed pilot projects. The Commission developed an MOU, a MEDICI Framework and envisaged extending the notion of Networks of Excellence to the realm of Digital Culture. Now a decade later much of that vision remains unfulfilled. By way of explanation five reasons have been offered. Firstly, there was a change in approach within sections of the European Commission. Second, there were delicate questions of cultural policy and jurisdiction in various states. Third, there was a shift in Europe's approach to Education. Fourth, has been a remarkable growth in the use of technologies and the emergence of new technologies. Fifth, there have been dramatic developments with respect to digital libraries. These reasons meant that considerable efforts were required on other fronts.

Standing back we see that the European Commission is working hard to realize both of the great ideas of the 20th century. Sections of the Information Society and Media Directorate have focussed on the quest for networked access through a European Digital Library (idea 1). The scope of these plans for a Distributed European Electronic Repository need to be complemented by four further initiatives: i) an integration of access to ongoing research in research councils with enduring scholarship of memory institutions; ii) a Digital Reference Room for orientation to navigate through hundreds of millions of sources; iii) linked with a Forum for Collaborative Work and Creativity, that takes the present efforts of grid infrastructures a quantum leap further and iv) a new research institute on knowledge organization to integrate historical classifications of knowledge and multiple ways of knowing.

Meanwhile, Directorate F of the Information Society has focussed on the quest for networked collaboration though grids and e-infrastructures (idea 2), while the Research Directorate is aiming at an European Research Area and the Employment, Social Affairs and Equal Opportunities Directorate aims at a Knowledge Society. In our view, careful distinctions between information and knowledge need to be built into the new e-infrastructures. To achieve this even more co-ordination is required among the various Directorates General. Moreover, the aims of ideas 1 and 2 can be integrated to create a new vision for the 21st century: traditional, enduring knowledge of memory institutions, coupled with the augmented knowledge of collaborative networks to achieve new knowledge and creativity (idea 3). Ultimately the computer revolution is about new access to and collaborative sharing of past content and expressions to design and create new content and expressions. In the United States, Schatz called this telesophy. In Europe, Aristotle, if were living today, would simply have called this on-line philosophy in the deeper sense. Over two thousand years experience since Aristotle have confirmed that philosophy cannot be a simple product. It must be integrated into our daily lives, our visions and our dreams.

Great ideas evolve slowly. The vision of a World Brain (*Gehirn der Welt*) formulated a century ago (1907) has not yet happened. Information Networks recommended by the White Paper (1993) or the Network for Universities and Research Centres recommended by the Bangemann Report (1994) have yet to be built. The visions of the MOU, MEDICI Framework and networks of excellence in culture still need to be achieved. Even so, in the past century, we have connected a) over 1.2 billion persons through a fixed Internet and WWW and b) over 3 billion persons through mobile devices. For the first time in history, we have new media that can potentially help all human beings. The need to continue efforts towards networked access and networked collaboration remains greater than ever.

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Notes

[1] For a survey of these developments see the author's *Augmented Knowledge and Culture*, Calgary: University of Calgary Press, 2006 and the online version of the book and CDROM : http://sumscorp.com/kavai/newmedia/ and http://www.sumscorp.com/kavai/newmedia_cd/

[2] At the national level the Réunion des musées nationaux (Rmn: http://www.rmn.fr/index-gb.html), which began in 1895 with 4 museums and grew to 35 institutions was one of the first attempts at systematic integration.

[3] Friedrich Naumann , „Das Gehirn der Welt", *Süddeutsche Monatshefte*, 4, 1907, 759-764 The notion of World Brain (*Gehirn der Welt*) has since been explored in a series of variant names: e.g. Global Brain, Global Intelligence, Global Mind, Global SuperBrain, Global Superorganism ,Hive-Mind ,Mémoire mondiale, Noospheric Brain (organ of collective human reflection), Planetary Brain, Social Brain, Super Brain, Super Minds, Collective Intelligence.

[4] Paul Otlet*, Monde: essaie d'universalisme -- connaissance du monde; sentiment du monde; action organisée et plan du monde,* Brussels, Editions du Mundaneum, 1935 : http://www.laetusinpraesens.org/docs/otlethyp.php

[5] Vannevar Bush, "As We May Think", *Atlantic Monthy,* July 1945: http://www.theatlantic.com/doc/194507/bush

[6] Specifically in Berlin, Bletchley Park, Yale and MIT. By 1948, Manchester produced one of the first civil programmable computers and a new age of commercial computing began to evolve.

[7] Eugene Lyons, *David Sarnoff, a Biography,* New York: Harper & Row, 1966.. http://earlyradiohistory.us/

[8] *Inventaire général de tous ses biens fait par notaires à Paris, à sa requête et à celle de son beau-frère, Gabriel Guibert*, *Marquis de Bouville* , 1780. cf. http://www.culture.gouv.fr/culture/inventai/extranetIGPC/index.html

[9] Their Joconde database, begun in 1975, now has 347,000 online items freely available Joconde: http://www.culture.gouv.fr/documentation/joconde/fr/apropos/presentation-joconde.htm. Also important has been the Centre de Recherche et Restauration des Musées de

France (C2RMF) which has produced important databases available only to a select group of museum professionals.

[10] Beginning in 1977, through a series of projects funded by the Volkswagen Foundation, the Marburg Archive of photographs was reproduced first on microfiche and then online in electronic form.[10] Today, this collection of 1.9 million freely accessible images remains one of the most important free online resources in the realms of art and architecture.
Marburg Archive: http://www.bildindex.de/rx/apsisa.dll/init?sid={80c3ab13-aca8-4c42-8243-80947b1f298f}&cnt=327712&%3Asysprotocol=http%3A&%3Asysbrowser=ie6&%3Alang=de&

[11] UNESCO Constitution: http://www.icomos.org/unesco/unesco_constitution.html

[12] UNESCO: Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)
http://whc.unesco.org/en/conventiontext/. UNESCO has recently published a Charter on the Preservation of the Digital Heritage: http://portal.unesco.org/ci/en/ev.php-URL_ID=13366&URL_DO=DO_TOPIC&URL_SECTION=201.html . Cf. Documents on cultural heritage protection: http://www2.rgu.ac.uk/schools/mcrg/stdoc.htm

[13] UNESCO, Charter: http://portal.unesco.org/ci/en/ev.php-URL_ID=13366&URL_DO=DO_TOPIC&URL_SECTION=201.html

[14] MCN: http://www.mcn.edu/about/index.asp?subkey=1942

[15] VMC: http://www.virtualmuseum.ca/English/About/index.html

[16] The Institute for Museum Research (IfM) is a public institution. It was established in 1979, annexed to the State Museums of Berlin - Prussian Heritage
http://www.smb.spk-berlin.de/ifm/index.php?ls=10&topic=Home&lang=en&te=ja&tf=ja

[17] VRA: http://www.vraweb.org/about/index.html

[18] Margaretta Sander, "Creating Access and Interchange", *CSA Newsletter*, Bryn Mawr, Volume VIII, no. 3,:http://www.csanet.org/newsletter/nov95/nl119503.html

[19] Micro Gallery: http://www.cogapp.com/home/whatWeDidmicro-gallery.html

[20] For a more detailed survey of these early efforts see:
http://www.eculturenet.org/data/previous.htm

[21] George P. Schultz, "The shape, scope, and consequences of the age of information - George P. Shultz's address before Stanford Univ. Alumni Assoc – transcript", *US Department of State Bulletin*, Washington, May, 1986 (Address before the Stanford University Alumni Association's first International Conference in Paris on March 21, 1986):
http://www.state.gov/e/eb/rls/othr/2005/41256.htm:

> "While the industrial age found its proper symbol in the factory, the symbol of the information age might be the computer, which can hold all the information contained in the Library of Congress in a machine the size of a refrigerator. Or its proper symbol may be a robot, a machine capable of supplementing age-old manual labor and liberating human beings from the most arduous and repetitive of tasks. Or perhaps its symbol is the direct broadcast satellite, which can send television programs directly into homes around the globe."

[22] Gore Bill: http://www.sklar.com/texts/gore-bill

[23] White Paper on growth, competitiveness, and employment. The challenges and ways forward into the 21st century:
http://ec.europa.eu/archives/ISPO/docs/htmlgenerated/i_COM(93)700final.html

[24] Bangemann: www.regiony.nck.pl/download.php?id=73. Cf.
http://www.spatial.baltic.net/projects/_downloads/psf3/WORKSHOP_Presentations/Project_presentation_Baltic_Challenge_WS_2.ppt#288,5,Areas in the Bangemann Report

[25] For a more detailed discussion see the author's . "World Access to Cultural Heritage: An Integrating Strategy", Acts of Congress: *Beni Culturali. Reti Multimedialità*, Milan: Politecnico di Milano, 1999, pp. 69-80.
[26] MOSAIC: http://www.arenotech.org/mosaic98_ingles/MOSAIC_ingles_998.htm
[27] In the meantime, some of the initial goals of MEDICI such as monitoring new technologies were taken up by an ICT Standards Board (ICTSB). ICTSB: http://www.ictsb.org/
[28] MEDICI: http://www.medicif.org.
[29] E Culture Net: http://www.eculturenet.org/
[30] Ibid.
[31] ACTS : http://cordis.europa.eu/infowin/acts/home.html
[32] EC DGs: http://ec.europa.eu/dgs_en.htm
[33] Directorate E: http://ec.europa.eu/dgs/information_society/directory/index_en.htm
[34] EPOCH: http://www.epoch-net.org/index.php?option=com_content&task=view&id=53&Itemid=95; http://cordis.europa.eu/ist/digicult/epoch.htm
[35]Kaleidoscope: http://www.noe-kaleidoscope.org/pub/
[36]Some have also noted a tendency of the Luxembourg section on cultural heritage to work in isolation from existing national efforts and other arms of the Commission in Brussels, the Joint Research Centres (JRC), the Commission's Observatories e.g.
European Science and Technology Observatory (ESTO)
European Information Technology Observatory (EITO)
European Audiovisual Observatory (EAO)
European Observatory for Digital Literacy (EODL)
European Observatory on IL Policies and Research (ENIL)
More co-ordination is always desirable. On the other hand it must be emphasized that considerable progress has been made in the past decade.
[37] Maastricht Treaty:: http://www.eurotreaties.com/maastrichteu.pdf
[38] Giorgio Ruffolo, *The Unity of Diversities: Cultural Cooperation in the European Union*, Brussels: European Parliament; Florence: Pontecorbolo, 2000: http://www.labforculture.org/en/resources/research_in_focus/no_3_european_cultural_cooperation/the_unity_of_diversities_cultural_cooperation_in_the_european_union
[39] Baltic Challenge: http://www.spatial.baltic.net/projects/_downloads/psf3/WORKSHOP_Presentations/Project_presentation_Baltic_Challenge_WS_2.ppt#289,9,From the Stockholm Challenge to the Baltic Challenge
[40] Lisbon Strategy: http://www.euractiv.com/en/future-eu/lisbon-agenda/article-117510
[41] Lund Action Plan: http://cordis.europa.eu/ist/digicult/lund-principles.htm
[42] MINERVA : http://www.minervaeurope.org/
[43] MINERVA made an important contribution by including Russia, which was then dropped in a second phase. Although Russia represents only some 2% of the world's population, its enormous size and rich history has traditionally made it a bridge between East and West, a dimension destined to become more vital in a global knowledge society.
[44] MICHAEL: http://www.michael-culture.eu/.
[45] Cf.
AMP Newsletter 1: http://www.culture.gouv.fr/mrt/numerisation/fr/actualit/documents/amp-newsletter1-fr.rtf
AMP Newsletter 2: http://www.culture.gouv.fr/mrt/numerisation/fr/actualit/documents/amp-newsletter2-fr.rtf

AMP Newsletter 3: formerly at:
http://www.culture.gouv.fr/culture/mrt/numerisation/fr/f_01.htm
[46] Lisbon Convention : http://www.bologna-berlin2003.de/pdf/Lisbon_convention.pdf
[47] Sorbonne Joint Declaration. Joint declaration on harmonisation of the architecture of the European higher education system, Paris, 1998:
http://64.233.183.104/search?q=cache:SugGcwAKdRYJ:www.bologna-berlin2003.de/pdf/Sorbonne_declaration.pdf+Sorbonne+Declaration+(1998&hl=en&ct=clnk&cd=1
[48] Bologna Declaration: http://ec.europa.eu/education/policies/educ/bologna/bologna.pdf
[49]The University of Toronto had a Technology for Enhancing Learning Centre in the early 1990s. For the TEL Centre at York University:
http://blogs.senecac.on.ca/senwiki/en/Seneca@York/TEL
[50] Cf. The EC's Culture in the Digital Age:
http://ec.europa.eu/information_society/soccul/cult/index_en.htm. See also the author's Diversity or Sameness:
http://www.sumscorp.com/articles/pdf/2007_American_Visions_of_Convergence_Apendix_2.pdf
[51] JRC: http://ec.europa.eu/dgs/jrc/index.cfm
[52] Mobile Herald, 2006 : http://www.revivaltimes.com/cellphonestats.html
[53] Alfed Nordmann , *Converging Technologies for the European Knowledge Society (CTEKs)*, Brussels, 2004 http://www.ntnu.no/2020/final_report_en.pdf
[54] E-Content: http://cordis.europa.eu/econtent/
[55] DLI: http://dli.grainger.uiuc.edu/default_old.htm
[56]

Universal Digital Library - Japan	8+
China Digital Library	2+
Universal Digital Library - US-India	20
Google	20
Open Content Alliance	1
CBC (Canadian Broadcasting Co.)	4

	55+

Plans to Scan in the Full Text of Millions of Books.
For a more detailed discussion see the author's: From Recorded World to Recording Worlds (Text):
http://www.langzeitarchivierung.de/eu2007/modules.php?op=modload&name=PagEd&file=index&page_id=48
[57] GABRIEL: http://www.lib.helsinki.fi/tietolinja/0199/gabriel.html
[58] Telematics for Libraries: http://cordis.europa.eu/libraries/en/intro.html
[59] TEL:
http://www.theeuropeanlibrary.org/portal/organisation/cooperation/archive_en.html#telmemor
[60] EDL:
http://ec.europa.eu/information_society/activities/econtentplus/projects/cult/edl/index_en.htm
[61] CENL:
http://www.eblida.org/uploads/A%20Vilks_European%20Digital%20Library_EBLIDA-CENL.pdf
[62] «La Bibliothèque Numérique favorisera la diversité culturelle » , *YouTube*, October 2007:
http://www.youtube.com/watch?v=iB3MdbZfuDo&mode=user&search=

[63] Unit E 4:
http://ec.europa.eu/information_society/activities/digital_libraries/unit_e4/index_en.htm
[64] TEL: http://www.edlproject.eu/digital_libraries.php#worldwide
[65] Horst Forster, "The i2010 digital libraries Initiative", *APE Conference*, Berlin, 23 January 2007
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_e/speech-ape-23jan2007-v2_en.pdf
[66] Scott Ard, "Google's 300 Year Plan", *CNET News*, 30 June, 2005
http://www.news.com/8301-10784_3-5770305-7.html
[67] It took 20 years to achieve Universal Mobile Telephone Services (UMTS). Siemens predicts that we shall achieve integration of Cable TV, Telephony and Internet systems by 2015. How many years will it take to achieve full interoperability within this new framework?
[68] The German project BAM (Bibliotheken, Archiven und Museen) captures the spirit of what is needed. Distributed European Electronic Resource (DEER) is one of the possible names that has been put forward.
[69] See Suzanne Keene, Francesca Monti, *Foundation for Distributed European Resource (DEER)*, London: University College, 2003.
[70] MORESS Project. First Year Activities Report 2003-2004
http://sid.ish-lyon.cnrs.fr/document/MORESSRapportEN300304.pdf
[71] Telesophy: http://www.canis.uiuc.edu/projects/telesophy/telesophy002.html
[72] For instance, arXiv.org , which began at Los Alamos now provides "Open access to 454,302 e-prints in Physics, Mathematics, Computer Science, Quantitative Biology and Statistics." arXiv.org: http://arxiv.org/
Cf. http://www.nature.com/nature/debates/e-access/Articles/ginsparg.html
[73]e-infrastructures:
http://events.ibbt.be/grid2007/pdf/Gasos.pdf?PHPSESSID=59121ca59df2f27b166443220119ebec
[74] When the first trans-Canada telephone system was completed in 1932 it was called the Copper Highway. See the CRTC site:
http://www.crtc.gc.ca/eng/BACKGRND/Brochures/B19903.htm
This was a forerunner of the later information highway metaphor.
[75] These differences have been discussed in detail in the author's *Augmented Knowledge and Culture.* Churchill once described Britain and America as two countries separated by a single language. Differences of usage often lead to confusion in the realm of culture. For instance, in North America there is an Archives and Museums Informatics group. Their use of Archives is generic in the sense of any document in memory institutions and very different than the technical usage in Europe, as found. For instance, in Hans Hofman (National Archives of the Netherlands*),*"The Archival Perspective: Preserving Records over Time", *Memory in Digits*., Vilnius, 4-5 October 2007 (In Press): http://www.kf.vu.lt/atmintis/en/?m=5
[76] Europa: http://europa.eu/abc/12lessons/lesson_8/index_en.htm
[77] Knowledge Society:
http://ec.europa.eu/employment_social/knowledge_society/library_en.htm
[78] EU Research: http://ec.europa.eu/commission_barroso/potocnik/indexnf_en.htm
For a document defining the Knowledge Society see:
http://www.eurofound.europa.eu/pubdocs/2004/14/en/1/ef0414en.pdf
[79] Adam: http://www.sacred-texts.com/time/timeline.htm
[80] The semantic web is now being touted as a new paradigm of how we should develop. And yet when we search the archives of the W3 Consortium we find that the lectures where Tim Berners Lee first explored these ideas in Brisbane (1998) and Toronto (1999) are no longer accessible.

[81] Cf. the authors Infrastructures for Ways of Knowing in E-Europe, 2004. http://www.sumscorp.com/articles/pdf/2004%20Infrastructures%20For%20Ways%20of%20Knowing.pdf

[82] For a more detailed discussion see: ”Access Claims and Quality on the Internet: Future Challenges”, *Progress in Informatics*, Tokyo, no. 2, November 2005, pp. 17-40.