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Abstract

Traditionally, the quest for truth led to two different strategies within the memory institutions: one was exclusive, focused only on a small corpus that excluded everything else. Another was inclusive with a goal of a universal corpus of collective memory. The pioneers of the Internet and World Wide Web have adopted the same strategies, but in their present form, neither of these positions is taking us closer to the age-old problems of truth.

Truth is about claims. These claims cannot always be proven by simple logic. In such cases the challenge lies in creating new links back to original sources, which will allow those who doubt, or those who wish to do further research to go forward. This seemingly simple alternative implies new roles for memory institutions and points to networks beyond the web. It points also to needs for multiple worlds, polyvalent links, levels of authority, and layers of certainty.

Ultimately, as with all other concepts, notions of truth have a history. If we created systems that excluded strictly on the basis of today’s notions of truth, we would exclude much of our collective memory, and the difficult lessons of how we arrived at our current position. A wiser way forward is to include our past and develop new tools to distinguish between its many layers.

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1. Introduction

Truth is an obvious, noble and elusive ideal. Truth entails the original and the pure. The history of philosophy and knowledge systems is the history of developing various criteria and techniques for determining and deciding when we accept something as true.¹ As a result we have a vast vocabulary to describe things outside this category. They are reflections, images, simulacra, similitudes, shadows, copies, surrogates, counterfeits, imposters, fakes or simply false.

Paradoxically, the human condition complicates and makes more elusive our desire for truth. The human condition has memory as one of its central themes. Memory takes individuals beyond immediate experience of the here and now to other places and times. Memory institutions in the form of libraries, museums and archives offer a collective memory, which gives us access to the experience of millions and potentially billions of individuals. The extent to which individuals expand their horizons towards this collective memory is one of the measures of human greatness. But there, as Hamlet would say, is the rub. For every step towards wider horizons is a step away from guaranteed certainty and truth. Certifying the truth of something in our presence may usually be relatively easy. Certifying the complete truth of something that happened thousands of years before we were born is typically not possible.

For at least two millennia, we have developed a series of ploys against these limitations. Librarians have developed classification systems to separate works of fact from those of fiction; to help distinguish between those works where we expect to find truth from those where we expect flights of fancy. There have also been two seemingly contradictory strategies. One has been a quest towards special collections which have only the classics, the jewels, the true, and to exclude everything else. A second strategy has nurtured the dream of a universal collection in order to give us access to everything available. In Antiquity, the Library of Alexandria became both an example and a symbol for this quest. In the 19th century Panizzi's vision inspired the British Library and new kinds of national libraries. These great collections greatly expanded the realms of research, but introduced new layers of challenges. They contained true records, and many records more memorable than necessarily true. Moreover, only persons who happened to be in centres such as London, Paris or Rome with time and means to study had access to such repositories.

With these visions of universal collections came the notion of a world brain, and new dreams of collective intelligence. With the advent of digital media, the Internet (1968), and the World Wide Web (1989, for the first time in history, it was now possible, technologically at least, for someone in a remote village, to have the same access as someone in the great centres. Access to anything, anywhere, anytime, which began as a slogan, seemed as if it could one day become a reality.

The pioneers of the Internet and the digital age are exploring both of the traditional strategies mentioned above. One group believes that the web should contain only that which is true. In the 1970s Bill Wood's work on semantic networks² began with the assumption that he was dealing only with premises that were true. Hence, much of the work towards a semantic web remains a quest for a closed system, a treasury of true statements in electronic form. This group tries to build logic into the system itself. The hope is to exclude untruth. A danger is a subtle censorship against the unfamiliar, creating barricades for the known, rather than paths

into the unknown. At best we will have a limited corpus of the certified, but lose access to all that is less certain, and open to discussion. In the realm pure science, this is a tempting goal. In the humane sciences, this is a direct threat to our collective memory.

Another group, symbolized by Google, pursues the quest for access to all the world's knowledge. This seems to pursue a quest for universal collections³ and visions of a global brain. The rhetoric is that simply typing in a word will lead us to the hits, often thousands or even millions. Users have the impression of seeing a stable list from a corpus. Instead, the lists are unstable.⁴ Google's business lies in improving the visibility of hits for companies that pay. So users see the hits of those who paid most to be visible, which amount to disguised forms of censorship, determined by purse strings and agendas which are not visible. An excellent business case does not always give a perfect picture of truth. In the long term, the main portal of our collective memory needs to be free of such distorting filters.

Neither of these two current strategies⁵ is taking us closer to the age-old problems of truth. In some senses, we seem further from that goal than a century ago. Philosophers such as Pierre Levy⁶ speak being overcome by a deluge of information in the digital age. They claim that mastery is no longer possible and that merely staying afloat represents as much as we might hope. This essay explores a more positive alternative, which requires that we redefine our notions of links, reconsider the roles of memory institutions and expand our visions of networks. As a preliminary step we need to go back to the notion of sources.

2. Sources

Renaissance humanists made famous the idea of going back to the sources,⁷ which have become a basis of modern scholarship. Claims in isolation are useless. The challenge is to provide sources for one's claims. Hereby, anyone who doubts the claim or wants to reconsider the evidence can do so, while those who wish to delve further into this subject know where to begin their further research. If absolute truth is often not possible, complete honesty about the evidence used to reach our position remains an essential ideal.

Alas, books have a serious flaw as a medium of communication. A reference in a book can point to a source, but this is typically in a place far away from the covers of the book in our hands. Hence, a footnote about a manuscript in the Vatican, while helpful, potentially implies major travels if we want to check the original or pursue study of its context.⁸

2a. Electronic Sources

Here digital media offer a major step forward. Electronic versions⁹ allow us to cite a source and can also take us directly to a website with a digital version of an original source that we are discussing. As a result, future readers of our claims can be spared plane flights and simply follow a link to return to the source. Hereby, the quest for sources (the return *ad fontes*) can be only a click away. This will change practices of scholarship and also points to new roles for memory institutions.

2b. Direct Links

Today's strategies lead us to all sites where a title is mentioned. If we type in *Last Supper, Milan* in Google, we receive 30,800 hits under images and 288,000 web sites. Meanwhile, there is only one original on the wall of the refectory in Santa Maria delle Grazie. Search

systems should provide direct links to the original and then list copies, facsimiles, discussions, opinions etc. Libraries distinguish between primary and secondary sources. A future web should do the same: first, take us to the original, the primary source and then list secondary images of and secondary literature about the original. In the case of images it will be useful to know how many generations¹⁰ an image is away from the original. In the case of texts, it will be useful to distinguish between official monographs and private websites. With this approach long lists of vague hits will dwindle to one initial direct link to the original, which then offers options for viewing related materials.

3. Memory Institutions

Electronic media bring at least three changes to the goals of memory institutions. First, preserving now entails both originals and digital surrogates. Second, making originals available now entails both on-site and on-line. Third, the quest for systematic access to titles of holdings now extends to systematic access of full contents of collections. These changes imply that traditional catalogues of authors, subjects and titles need to be linked with full contents of holdings and that the reference tools we used to find titles need to be freely accessible online in order to find our way through the colossal amounts of knowledge and information.

If books and sources are fully scanned, they can be omni-linked such that any word can take us to other sources. If we encounter an unfamiliar word, a dictionary link can provide a definition without requiring that we leave our desk and search for the word in the dictionary section of the reference room. If we encounter an unfamiliar place name, a geographical link can show us precisely where that place is situated. If we are reading a book of library A and this book refers to a source in library B, links should also take us to that document without requiring a mini-research project to track down the details of the source in question.

Such references to materials within collections are but a small part of the process. Typically a book refers to a painting in a gallery, a coin in a collection, an object in a museum, a monument in a city or a ruin in a landscape. Most of these objects lie outside the walls of the memory institution where the book lies and many lie beyond the walls of memory institutions. Making them accessible within the click of a link implies that the links of memory institutions must extend beyond their walls. Mastery of full contents within the walls of collections requires full mastery of contents beyond the walls of memory institutions. Ambient intelligence implies much more than wireless links. It implies that we rethink our notions of knowledge and networks.

4. Networks beyond the Web

The Internet began by linking a few individuals and grew into a number of networks linking individuals in many institutions. Terms such as World Wide Web and the semantic web still evoke images of an electronic space separate from the physical world; ideas of a limited, truthful container, which needs somehow to be sealed off and protected from doubt, uncertainty and untruth in the physical world beyond the World Wide Web. Many still think of the Internet as something limited to computers. Two developments of the past decade have rendered obsolete this seductive and misleading model.

First, there is a radical rise of sensors, which inspired the International Telecommunications Union to speak of an emerging Internet of Things¹¹, whereby cars, refrigerators and

effectively all everyday objects now have their own chips and sensors. This trend towards Smart Objects points to a new generation of ubiquitous, pervasive Internet. Second, there is an extraordinary rise in mobile devices. They have expanded to over three billion users with a growth rate of over one billion per year projected for the next six years, which entails a number larger than the population of the world. These developments in conjunction with the spread of fixed line, mobile and satellite communications introduce an age where clear distinctions between a closed network and an open, physical world are no longer possible. Shakespeare saw the world as a stage. Today all the world's a sensed stage.

All this is transforming the challenges of links. Born-digital has become an important buzzword and is often discussed as if it were an independent cloud. The real challenges lie in linking born-digital materials with the physical world. Links within networks need to be extended to links beyond networks. In a world with an Internet of Things, where everything has sensors, where there are permanent cameras in space and millions of cameras on earth, where there will soon be a 1:1 scale model of the entire earth, linking back to original sources is far more than a simple task of here or there a hyperlink. Linking is potentially with everything. These are already in the order of billions and will soon grow to hundreds of billions and beyond. The bad news is that unless we take careful measures our notions of privacy will be eroded. The good news is that we shall potentially be able to check almost all sources. This will only be possible if we improve and refine linking and searching strategies. Technologists have focused on faster and more efficient algorithms to a clear goal. In research, this is often the final stage of a process. Often we need help before we begin our queries, qua technical terms and contexts.

5. Technical Terms

Traditionally links to sources have been the domain of reference sections of memory institutions, which represent the repositories of this knowledge in the form of classification systems, dictionaries, encyclopaedias, bibliographies, abstracts, catalogues etc. So in addition to direct links to a given book or object, we also need links via these reference materials which can serve as entry portals to digital collections analogues to their physical counterparts. Reference works offer more than simple links to sources for which we have found claims. They can provide us with technical terms, related terms and contexts connected with the topic which we are searching and thus give us the necessary vocabulary to begin searching.

Today's search engines assume that we know the words for that which we are searching. The moment we delve beyond the obvious this is typically not the case. In historical searches, we may know that we want to study Northern India, but may well need help in learning the historical names of cities, persons and events. We may know Benares, but not know precisely when it was called Varinasi or when it was called Kashi (or Kasi). Similarly we may know the common name for a plant, but not its technical name. Knowing what we are searching for in general, is quite different from the specific names, terms and complex spellings of the things for which we are looking especially as we move into unfamiliar languages.

Fortunately, librarians and professionals in memory institutions have spent millennia mastering such problems of authority files for author's names, place names, standard and variant titles etc. This knowledge, which was once in the card files of catalogue rooms and reference sections of memory institutions and is now coming on-line needs to become part of our everyday search strategies. The mobile searcher of tomorrow needs the potentials of reference rooms as part of the Help function of their search devices. In quantitative terms this

implies a help function with the full text of at least 400,000 books. So help with navigating the help functions will become one of the new professions.

6. Multiple Worlds

This need for help goes beyond finding the right words and terms. It applies especially to the contexts of terms. Mediaeval scholars distinguished between metaphysical and physical worlds, and developed the idea of a scale of creation, between human, animal, vegetable and mineral worlds, which evolved into modern disciplines. The animal kingdom became biology, the vegetable kingdom became botany; the mineral kingdom became mineralogy and so on. These disciplines are the bases of our modern classification systems. Research scholars and scientists use these classification systems in classing new knowledge and librarians use these systems in classing the results of scholarship.

Linking these classification systems to search engines could greatly enhance the effectiveness of our searching. Almost everyone knows that there are fig trees but only experts can list the various species or know why *Ficus Religiosa* is linked to the Brahman Caste and why *Ficus Indica* is linked with the Kshatriya Caste. Most of us know that Prudence is a virtue. Few of us can describe the 7 virtues in both Catholicism and Buddhism, distinguish between the 7 Heavenly and 7 Contrary Virtues or list the 108 Virtues of the Holy Ones. Some of these lists are short. Sometimes they entail thousands of categories.

Seen as barriers to users, the details of such lists loom as an ultimate version of the trivia game. Seen as potential aids to users these lists become wonderful tools for providing us with the context of terms, which we are trying to understand. They offer lists of contextually important terms. We may know the words for the seven planets (or the nine planets in India), but usually do not know their names and associations in various traditions dealt with them differently. These lists and classes of earlier knowledge systems may no longer have the ontological value they once did, but their potential value as contextualizing tools remains. If we integrate them into our search engines, they provide us with further vocabulary and terms to search, with contexts and domains of knowledge of what is being studied. They are orientation tools. If these tools are further combined with choices of kinds of media we can both widen and deepen our searches and still maintain the precision needed to arrive each time with a manageable sets of links rather than the customary endless lists of imprecise hits.

This introduces both simple and more complex scenarios. A simple scenario is that we are studying the history of the basil plant. A multilingual thesaurus reminds us that in Sanskrit this is the Tulasi plant, whereupon we can search for discussions of tulasi in sacred texts, images of tulasi in paintings or botanical examples of tulasi in gardens. More complex scenarios are also foreseeable. Earlier cultures created their models of the universe through a complex set of links between microcosm-macrocosm. For instance, the basil plant as Tulasi was linked with the god Vishnu, specific places in a garden and specific feasts during the year. Planets were linked with days of the week, gods, colours, virtues, metals, gems. Some of these links pertained only to a particular caste or sect, others links remained intact across cultures, countries, and long periods of time.

The history of such links is an important dimension of the history of culture. Aby Warburg called them Orientation. They may not be true in a modern, Western scientific sense. There may be no logical method for determining whether name A or name B is the correct name for the Guardian of the East, but unless we understand these names and the systems most

dimensions of our past collective memory will remain a closed door. These links are a key to earlier philosophy, religion, science, and even architecture, which used these systems as their blueprints for construction. In a completely networked world, we can foresee standing in front of a great monument and call up knowledge stored in memory institutions. Conversely while studying in memory institutions or at home, we could begin by zooming into a place in the manner of Google Images today and then shift seamlessly to images of buildings at ground level, their contents and then back to repositories about those contents without needing to shift officially from one division of the software to another.

Moreover, if we use effectively distinctions between different worlds, then we can search systematically at will in different worlds. If we are searching for lions we can choose between physical lions in nature, metaphysical lions in religion, mythology and symbolism, lions in literature, and lions in art.¹² These could then be subdivided by names (who?), by species (what), geographically (where?) and temporally (when?) in order to arrive at lists considerably shorter and more manageable than the 94,500,000 Google offers for the word Lion in March 2008. If all the world's a sensor stage, the stage is set for new chapters in the history of knowledge, whereby the world of books and learning becomes an interface for the worlds of nature and imagination, while the book of Nature¹³ become an interface for the knowledge of memory institutions.

7. Limits of Links

A commitment towards comprehensive links within the metaphorical cloud of a World Wide Web and beyond it back to original persons, things and places in physical and other worlds opens many new dimensions for verifying the truth or truthfulness of claims. It is an excellent solution in cases where there are concrete records. The realities of history remind us that often the records we would have liked to have seen were not made, or they were destroyed in wars, natural disasters or simply through decay and neglect. As in the case of genealogical trees, there are some for which we can trace the links back a few generations, others which go back many centuries.

These cases of failed links may confirm that we cannot verify the complete truth about an object or artifact. At the same time, having a clear record of where links to originals are lacking, can also help avoid making unfounded claims where certainty is impossible. Failed links can help us avoid dead ends in our quest for knowledge and understanding. In the past we made maps of knowledge. In future we might make maps of what we cannot know and maps of what we do not yet know as new geographies of our ignorance.

8. Layered Hyperlinks

Even with such missing links, there will be plenty of links to study and layered links will be necessary to navigate efficiently. Ted Nelson is said to have coined the term hyperlink (1965),¹⁴ and their significance was further explored by Bill Woods¹⁵ and numerous scholars. Hyperlinks are now an everyday feature of the Web. For the most part, however, they remain single level links: i.e. one hot word leads to one connection somewhere else within or outside the text we happen to be reading. Hyperlinks can be expanded to omni-links thereby doing away with the need for distracting colours of hotwords.¹⁶ Moreover, these omni-links can become multi-layered such that we can choose at will whether we want a definition of a word, further definitions, encyclopedia entries or titles of relevant literature for further study of that

word. Sometimes we simply want a very specific name or date. At other times we are interested in learning about a person, monument or event in much more detail.

9. Levels of Authority

Librarians do not pretend to know the truth of books and materials in their collections. But their records carefully record publishers, whether the work is sponsored by an international organization, a national group or is simply a personal view. A book published by Cambridge University Press is not guaranteed to be true, but it is likely to have been more carefully vetted than some examples of the so-called gutter press. Similarly a medical book published or sponsored by the World Health Organization is likely to be more reliable than one written by a layman without a medical degree. In cases where we doubt credentials, and lack an Aleithiometer from the Golden Compass, such levels of authority could provide useful aides in orientation. With persons such as Einstein or a Nobel Prize winner, such searching for credentials would usually be superfluous. And sometimes, when we are searching for the frontiers of a thought or beliefs in a field, we may be interested in studying even those whose credentials have not been approved by the scholarly community. As historians it is useful to recall that the Royal College of Surgeons initially rejected William Harvey's correct claims re: circulation of the blood. Even so, having an indication of the authority of the person and their professional contexts is a useful additional tool.¹⁷

10. Layers of Certainty

If we examine closely historical scholarly literature where interpretation clearly plays a part, we find that there is a entire vocabulary to cover a spectrum of different degrees of certainty, ranging from doubtful and improbable to the almost positive. German has especially rich formulations such as “with possibility bordering on certainty (*mit an Sicherheit grenzenden Wahrscheinlichkeit*), which have their equivalents in French though various forms of the subjunctive. Some experts are willing to stake a reputation that a given painting is or is not by Rembrandt or some other well known painter. In most cases, however, they have a rich vocabulary to express doubts, alternatives and intuitions. Classing this spectrum of uncertainty-certainty could become the basis for future tools.

Sometimes what seems a matter of truth is also a matter of taste. We have guides for restaurants, for notable tourist sites, for wine, music, films and hotels. We have reviews for books. Once our collective memory is accessible in digital form, this principle can be taken much further. We could use the certainty-uncertainty spectrum as a barometer for claims.

This would lead beyond a simplistic history of claims and assertions. We could trace the history of degrees of certainty and uncertainty with respect to problematic objects and themes. This could become a further parameter and filter in our searches. Sometimes we are interested only those items about which there are no doubts. At other times we are interested in examining the borderline cases, the materials which are not in the central canon, but which may offer unexpected insights. Linking to domains beyond certainty often modifies the boundaries of our certainties.

11. Conclusions

Even the witty Oscar Wilde admitted that: truth is seldom pure and never simple. The pioneers of the Internet and World Wide Web are tending towards two camps. One has a quest to have a pure repository of truth that excludes many sources where logical truth is not

manifest. Another strives towards a universal repository that becomes a collective memory in digital form, much of which cannot be completely verified. This is a new form and scope of a much older debate, which persons in memory institutions, especially librarians, have been addressing since the beginnings of recorded history.

Pessimists have predicted that this will bring the equivalent of a second flood that inundates us with waves of unmanageable information. Our essay has proposed a more optimistic alternative by exploring the potentials of links back to the original. Such links are particularly useful in cases where truth of the original is a matter of debate.

Footnotes and references in books can only list sources which are often in institutions far removed from the text we are reading. Electronic links have the advantage that they can connect us directly with sources in other memory institutions. Many of these sources are monuments and sites that lie beyond the walls of these institutions and of the fixed networks. As we move towards a world of pervasive computing where ambient intelligence is more than a buzzword, the challenge lies in connecting the metaphorical information spaces of the world-wide-web with the physical worlds beyond it confines. To achieve this requires changing the roles of memory institutions and the networks that connect them.

Traditionally pointers to sources have been the domain of reference works in the reference sections of libraries. These can be useful in the journey back to original sources. Potentially they have other important uses. They can provide us with technical terms, related terms and contexts of the topics that interest us. They can offer valuable orientation through appropriate vocabulary in areas where we lack the terminology of a professional. Eventually these strategies can help us to navigate systematically through knowledge in multiple worlds rather than confronting us with millions of randomly ordered lists.

While immensely useful such links have clear limits. Obviously they cannot work in cases where there are no records, where records have been destroyed or are no longer accessible. To be effective we need to go beyond one-leveled hyperlinks to include omni-links and layered hyperlinks. These can be complemented by levels of authority and levels of certainty. Using such approaches will help us to identify those topics where certainty is not possible and take us back to the sources of truth wherever possible. The quest for verity requires also that we understand its limits.

Acknowledgments

I am grateful to my students Vasily and Alexander Churanov for their contributions to the vision of SUMS and thankful to Professor Frederic Andres for his generous encouragement. This essay is dedicated to my colleague and friend, Professor M. P. Satija, whom I met through the International Society for Knowledge Organization (ISKO) and who was one of the first Visiting Fellows at the Maastricht McLuhan Institute. Specialists in library science typically focus on either Eastern or Western systems. M. P. as he is affectionately called, is the rarest of individuals, who has studied the systems of both Ranganathan and Dewey. He bridges East and West on multiple levels. He combines practical dimensions of an active librarian, theoretical dimensions of a scholar with inspiring dimensions of a profound human being: modest, always gentle, penetrating like the wind (tui) of the I Ching, a peacemaker, with an almost wistful humour, always hinting towards a deeper dimension. India, as one of the oldest cultures has produced some of the subtlest approaches to truth. It is fitting therefore that this attempt to go beyond the sometimes simplistic black-white models of the West,

should look eastwards and pay tribute to a remarkable individual who personifies these themes.

Notes

¹ For instance, in India the Samkhya school has 3 means for certain knowledge, the Nyaya has 4 means and the Vedanta has 6 means of acquiring certain knowledge.

² William A. Woods, "What's in a Link: Foundations for Semantic Networks". In D. Bobrow and A. Collins (eds.), *Representation and Understanding: Studies in Cognitive Science*, New York: Academic Press, 1975. Reprinted in R. Brachman and H. Levesque (eds.), *Readings in Knowledge Representation*, San Mateo: Morgan Kaufmann, 1985. Also reprinted in Allan Collins and Edward E. Smith (eds.), *Readings in Cognitive Science*, San Mateo: Morgan Kaufmann, 1988. Cf. Bill Woods, External Website:

<http://research.sun.com/people/william.woods/>

³ Ironically the quest for universal collections often led to practices that led away from integration. Universal collections such as the British Museum introduced a series of sections for books, maps, drawings, newspapers. Similarly, universal search engines such as Google have introduced sections for the web, maps, images, Library catalogues offer us filters where we can search for materials in a specific medium: books, articles, films, music. Meanwhile search engines typically still list findings indiscriminately. If we ask for Mona Lisa, we get images of the painting in the Louvre, souvenirs, towels, toys, cartoons and a range of discussions from journalism to erudition. In a world with hundreds of billions of links we need integration not separation.

⁴ For instance, the number of hits for a relatively unknown name such as the present author often fluctuate by 40,000 hits within 24 hours. More interesting are statistics about political figures whose position in history is well established. Why, for instance should hits of Alexander the Great decrease fourfold and Hitler's hits increase nearly fivefold within in a our year period? During that time the Internet has expanded by over 500 million persons. Leaving aside the inevitable demise of some temporary websites there should be an overall increase in sites. This would suggest that Google is clearly not yet a reliable mirror of content on the web.

Leader	Hits in 2004	Hits in 2008
1. Charles V	29,600,000	12,600,000
2. George W. Bush	27,800,000	11,600,000
3. Alexander the Great	26,500,000	6,080,000
4. Hitler	8,560,000	32,700,000
5. Napoleon	8,410,000	27,000,000
6. Charlemagne	1,350,000	3,550,000
7. Mahatma Ghandi	1,120,000	4,140,000
8. Genghis Khan	374,000	1,310,000
9. Mao Tse Tung	361,000	700,000
10. Tamurlane	886	3,450

Table 1: Ten Political Leaders and their hits on Google (15.04.2005 and 05.03.2008) .

⁵ Seen as a simple opposition, the debate is in some senses misguided. In some topics and disciplines, truth, or at least very high levels of precision are possible. Physics and high level engineering are obvious examples. Building jet planes or automobiles without this standard of truth and precision would clearly be disastrous. In many disciplines, such precision and truth is simply not possible: e.g. history, archaeology and the humane sciences. Our libraries have

certain spaces for the disciplines where scientific certainty is possible, and other spaces for disciplines, where this certainty is not possible. We need equivalents in the emerging forms of cyberspace. We must continue striving for complete truth where possible, even if striving for a collective memory means that we must also include dimensions in the spectrum that leads towards uncertainty and doubt.

⁶ Pierre Lévy, *The Second Flood. Report on Cyberculture*, Brussels, European Union, 1996.

⁷ For instance, in the case of so-called *Donation of Constantine*, Lorenzo Valla showed that the words used in the document, postdated the early 4th Latin of Constantine: i.e. the text was a later fake rather than a true original. This re-reading of a crucial text was much more than a new view of a document. In a sense, it changed the relation of Church and State and changed the course of Western History. As long as persons merely believed what was claimed of an unseen document, they continued blindly on one path. As soon as someone studied carefully the source of the claims, another path opened.

The moral is simple. Access to and study of sources is a good thing, even if it sometimes upsets the power structures of the day. To enable this, we need to point clearly to sources we discuss. So footnotes and references gradually became a standard dimension of scholarly writing. In the nineteenth century, distinctions emerged between primary literature (the original sources) and secondary literature (articles and books discussing those sources). The search for source literature (*Quellenschriften*) became a scholar's version of a quest.

⁸ Microfilms seem to offer a shortcut but still require buying an expensive copy often prior to being certain whether the content of the document is truly relevant.

⁹ Most text processing programmes including the software in which this article is being written merely perpetuate these limitations of the earlier printed medium. Hence, the good news is that they provide us with new ways of adding footnotes, endnotes and references. The bad news is that they leave us with references to sources which are beyond our present document and thus still require a new expedition or at least a new series of searches to locate the source cited in our document. More is possible.

¹⁰ In theory the notion of generations does not apply in the digital world. In practice it remains because there is always the question of what has been digitized. Is the digital image of the Last Supper based on the original fresco, does it come from a published book, which used a photo from an agency which used a copy of an original photograph? Hence generations remain a challenge in the digital world.

¹¹ *The Internet of Things*, ITU Report, Geneva, 2005.

¹² Cf. the author's "The Lion and the Unicorn," *Convegno internazionale: Il Castello Svelato, Direzione Regionale per i Beni culturali e paesaggistici della Campania e Istituto di Cibernetica E. Caianiello of C.N.R.*, Castel del Ovo, Naples, 28 September -2 October, 2006, Naples, 2007 (in press).

¹³ Cf. the author's: "The New Book of Nature", *eARCOM 07. Sistemi informativi per l'Architettura Convegno Internazionale*, Con il Patrocinio di UNESCO. Ministero dei Beni Culturali, CIPA, Regione Marche, Ancona-Portonovo Hotel La Fonte, 17-18-19 Maggio 2007, Ancona: Alinea Editrice, 2007, pp. 659-669.

¹⁴ See Hyperlink in Wikipedia: <http://en.wikipedia.org/wiki/Hyperlink>

¹⁵ William A. Woods, as in note 2 above. Cf. Bill Woods, External Website:

<http://research.sun.com/people/william.woods/>

¹⁶ This principle has been demonstrated by Vasily and Alexander Churanov in a CD ROM and website of the author's Understanding New Media:

http://www.sumscorp.com/kavai/newmedia_cd/. Other dimensions are being explored by these students in their doctoral dissertations and their result will be accessible at the main SUMS site: <http://www.sumscorp.com> .

¹⁷ For another discussion of these problems see: Access Claims and Quality on the Internet: Future Challenges, *Progress in Informatics*, Tokyo, no. 2, November 2005, pp. 17-40. http://www.nii.ac.jp/pi/n2/2_17.pdf.