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## **Electronic Media in the Study of Alberti**

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### **Abstract**

The implications of electronic media for the study of Leon Battista Alberti are explored, with particular reference to his work on perspective. Various possibilities of viewing bibliographical materials are demonstrated: chronological lists, standard titles, variant titles, manuscripts, languages, single works, two or more works, complete works. It is shown how one can move from titles to full contents of a treatise. Using the software package, AutoCAD, the principles of Alberti's legitimate construction (*costruzione legittima*) are demonstrated. The role of computers in dealing with different readings and alternative or even conflicting interpretations is discussed and illustrated. Connections with Piero della Francesca and Leonardo da Vinci are shown. Available on-line materials on the Internet concerning Alberti are indicated. New possibilities within Renaissance culture are suggested using the author's software, a System for Universal Media Searching (SUMS © 1993-1995), which will be used for a CD-ROM version of the acts, for a new bibliography on Alberti and for the first edition of his complete works.

### **Résumé**

L'implication des media électroniques dans l'étude des travaux de Leon Battista Alberti est considérée, du point de vue en particulier de ses oeuvres sur la perspective linéaire. On démontre les diverses possibilités de consulter des matériaux bibliographiques en tant que listes chronologiques, des titres standards, des titres alternatifs, des manuscrits, des langues, des oeuvres isolées, deux oeuvres ensemble ou des oeuvres complètes: comment, par exemple, on peut naviguer d'un titre jusqu'au contenu d'un traité. En utilisant le logiciel AutoCAD, on fait une reconstitution des principes de la construction légitime d'Alberti. On montre comment l'ordinateur peut aider le chercheur en considérant des diverses lectures, et des interprétations alternatives même en opposition. Ses liens à la tradition qui continue avec Piero della Francesca et Léonard de Vinci sont décrits. Quelques renseignements sur Alberti sur l'Internet sont signalés. Des nouvelles possibilités pour les études sur la Renaissance sont suggérées, en employant le logiciel SUMS (System for Universal Media Searching © 1993-1995), que l'on prévoit d'utiliser dans une version CD-ROM des Actes du Congrès, pour la bibliographie Alberti et pour la première édition de ses oeuvres complètes.

### **Riassunto**

L'uso delle medie elettroniche per la ricerca su Leon Battista Alberti è esposto, in particolare per quanto il suo lavoro sulla prospettiva. Varie possibilità di consultare le materie bibliografiche sono elaborate: liste cronologiche, titoli standard e varianti, manoscritti, lingue, opere singoli, due opere insieme e opere complete. Si dimostra come l'utente può andare da un titolo al testo integrale di un trattato. Utilizzando il software AutoCAD si ricostruisce lo sviluppo della costruzione legittima. Si fa vedere come

l'ordinatore puo aiutare nelle diverse lezioni di un testo, con interpretazioni sia alternativi, e neanche in opposizione. I legami colla tradizione che continua attraverso Piero della Francesca e Leonardo da Vinci sono esposte. Varie materiali già da consultare sul'Internet sono accenati. Nuove possibilità per la ricerca della cultura rinascimentale sono suggeriti, utilizzando SUMS (System for Universal Media Searching © 1993-1995), il che servira di basa per una versione CD-ROM degli Atti, per una bibliografia su Alberti, e per la prima edizione dei suoi opere complete.

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## **1. Introduction**

This paper draws attention to some possibilities and implications of electronic media using Leon Battista Alberti as an example, focussing in particular on his treatises on perspective. It uses as its starting point a demonstration of the author's software, a System for Universal Media Searching (SUMS © 1993-1995), to illustrate two concepts: multivalent bibliography and integration of different levels of knowledge. Bibliographical and other possibilities of the world wide web are explored, as are potentials of analyses, interactive verbal and visual commentaries.

## **2. Multivalent Bibliography**

Traditional bibliographies offer mainly lists of authors and titles. SUMS offers a number of other views of the same material. Initially one can choose between primary literature, secondary literature or both. One can then choose in terms of different questions: who? (names), what? (bibliographies, key words, languages, titles), where? (places) and when? (dates, i.e. chronological lists).

Names provides one with a list of eight choices: names in general, authors, editors, illustrators, translators, printed for, publishers and sellers. If one chooses names (in general) this gives a combined list of all the other categories: authors, editors, illustrators,

etc. One can type in variant names and still arrive at the standard name. For instance, Albertus noster, Baptista[e], Leo Noster gives one Alberti, Leon Battista. This also presents one with a list of standard titles and a series of choices: variant titles, manuscripts, languages, locations. Choosing one of the standard titles gives one three more choices: single works, two or more works, complete works. Variant titles gives one all the different names of a treatise in different languages. Languages gives one a breakdown of the languages in which a treatise was published. This helps one to determine the range of influence of a text. Did it affect only its native scene, or was its impact international? In the case of Alberti's *On painting*, it appears in six languages (Latin, Italian, German, French, English and Polish). Locations allows one to search for local, national or international copies.

Bibliographies provides one with the 36 earlier bibliographies on perspective, beginning with author, date and number of titles. On choosing one of these bibliographies, one is given a full list of the books known to them. Key words gives one subsets of the whole. Languages provides a breakdown by language. Places gives a breakdown in terms of countries where books were published, with a further breakdown of number of books published in a given city within a country. Dates gives a chronological list of titles.<sup>1</sup>

The ability to search the same materials through all these different kinds of lists may seem and even be simple in its effect, but it is nonetheless anything but trivial. Traditional library catalogues including those considered standard, such as the Library of Congress, typically list books by author and then in alphabetical order ignoring changes in language. This means that a person interested in the number of editions of Alberti's *On painting* available in that catalogue cannot merely look under *O* for *On painting* or *P* for *(On) Painting*. Some editions will be under *D* as in *De pictura*, *Della pittura* or *De la peinture*; others under *T* as in *Traktat von der Malerei* while still others may be under *M* as in *(O) Malarstwie* (Polish).

Similar rules obtain in the Bibliothèque Nationale. Users of the British Library catalogue are somewhat helped in the case of authors with many publications inasmuch that headings are given for their major works, with subheadings to indicate single works, two or more works and complete works. The general absence of such helpful tools helps explain why there has been so little systematic attention to the history of editions (cf. figure 1 below). SUMS, by contrast, gives one access to various editions of *On painting* without having to look under O, P, D, T, M etc. If a user is interested in just how many variant versions a single title has, SUMS also provides them with this. In the case of *On painting*, the number is 46.

### **3. Levels of Knowledge**

Traditionally each level of knowledge was stored independently. Lists of terms, as in classifications, were kept in one place; definitions as in dictionaries in another,

explanations as in encyclopaedias in a third, titles in a fourth, abstracts in a fifth, full contents in a sixth and interpretations somewhere else again. SUMS permits an integration of these different levels of knowledge such that one can go from a dictionary definition, to titles, to full texts and various levels of interpretation seamlessly.

### 3. Earlier Bibliographies.

Because the SUMS approach includes all earlier bibliographies on a subject it is possible to trace not only the growth of the field as a whole but also changing awareness of individuals. In the case of Alberti's work on perspective, for instance, one finds that the early bibliographies in the sixteenth century (Lomazzo), seventeenth century (Hulsius, Draudius, Lipenius) and the early eighteenth century (Pellegrino, Sturm) made no reference to his *On painting*, *Elements of painting*, or *Mathematical games*. Even after isolated bibliographers began mentioning Alberti, a number of eighteenth century bibliographers continued to make no reference to him: (Anonymous 1717, Doppelmayer, Wolff, Tiraboschi, Malton). This tradition continued through the nineteenth century (Comolli, Rogg, Fielding, Beelitz, Löffelholz, Anonymous 1876, Soden-Smith) and well into the twentieth century (Loria, Amsterdam Catalogue, Schmid, Berlin Catalogue, and Schasfoort).

Fullenius (1711) was the first bibliographer to mention Alberti's 1649 Amsterdam edition of *On painting*, which was printed along with Vitruvius. Murr (1770) cited the 1651 Paris edition. Haym (1773) cited three editions: 1547 Venice, 1565 Monte Regale and 1651 Paris edition. Scheibel (1778) referred for the first time to a 1511 Nürnberg edition, subsequently mentioned also by Murhard and Poudra, of which no actual copy has ever come to my attention. In addition, Scheibel referred to four other editions: 1540 Basle, 1565 Monte Regale, 1649 Amsterdam, 1651 Paris. Murhard (1805) mentioned four editions: 1511 Nürnberg, 1540 Basle, 1565 Monte Regale, 1649 Amsterdam. Cicognara (1821) referred to five editions: 1547 Venice, 1565 Monte Regale, 1726 London, 1547 Venice, 1649 Amsterdam. Poudra (1864) mentioned three editions: 1511, 1547, 1804. Riccardi (1889) mentioned one edition, 1843 Florence, to which he referred again in Riccardi (1893). Fowler (1961) also referred to five editions: 1547 Venice, 1565 Monte Regale, 1568 Venice, 1726 London, and 1782 Bologna.

It was not until the 1970's that a more comprehensive picture began to emerge. In terms of manuscripts, Spencer (1956) identified eleven. Since then Grayson has greatly expanded that number. In terms of editions, the librarian at Giessen, Schüling (1973) cited twelve: (1540, 1540, 1547, 1547, 1558, 1565, 1568, 1582, 1888, 1950, 1956, 1966, 1970). The architect, Vagnetti (1979), who was the greatest bibliographer in the field to date, noted twenty editions of *On painting*: (1540, 1547, 1565, 1568, 1651, 1733, 1782, 1804, 1843, 1847, 1868, 1877, 1890, 1913, 1950, 1956, 1970, 1972, 1973, 1975). A survey of these editions is provided by figure 1.

The present author's bibliography records forty six editions of *On painting* (see figure 2), five of *Elements of painting* and two of *Mathematical games*. Hence, it is only at the end

1590	Lomazzo	0	1821	Cicognara	5
1605	Hulsius	0	1830	Rogg	0
1610	Draudius	0	1836	Fielding	0
1651	Leonardo	0	1861	Beelitz	0
1682	Lipenius	0	1864	Poudra	3
1704	Pellegrino	0	1873	Löffelholz	0
1706	Sturm	0	1876	Anonymous	0
1711	Fullenius	1	1888	Soden-Smith	0
1717	Anonymous	0	1889	Riccardi	1
1730	Doppelmayr	0	1893	Riccardi	1
1750	Wolff	0	1921	Loria	0
1770	Murr	1	1934	Amsterdam	0
1772	Tiraboschi	0	1934	Schmid	0
1773	Haym	3	1939	Berlin	0
1778	Scheibel	5	1961	Fowler	5
1783	Malton	0	1973	Schüling	12
1791	Comolli	0	1979	Vagnetti	20
1805	Murhard	4	1986	Schasfoort	0
			1995	Veltman	46

Fig. 1. Dates, authors of bibliographies and number of books on perspective by Alberti listed therein.

of the twentieth century that the full impact of Alberti's oeuvre is beginning to come to light. If one examines this list more closely one discovers that only 16 of these editions, i.e. thirty two percent, were published in Italy. England produced nine; the United States produced six; Germany produced four editions; Switzerland produced three; France, Spain and Austria two, the Netherlands and Poland, one edition. One also notices that publication of Alberti's treatise have varied considerably over the centuries. In the fifteenth century there were no published editions. In the sixteenth century there were ten. In the seventeenth this declined to two. In the eighteenth there were eight; in the nineteenth century there were nine and in the twentieth century there were seventeen. In other words there have been more publications in this century than in any previous century.

This growing awareness of the primary sources, is paralleled to a considerable extent by the numbers of publications in the secondary literature concerning Alberti's perspective studies (figure 3). In the second half of the eighteenth and first half of the nineteenth centuries there was only one article, that of Muratori (1751). If one looks at successive decades in the latter nineteenth and in the course of the twentieth centuries, one notes, following the appearance of Janitschek's edition (1877), a gradual rise by about one publication per decade. It was not until the 1950's that this pattern changed with a near doubling of publications. The 1960's saw a trebling of publications. If we return to publications of primary sources (fig.2) it will be noted that there have been fifteen editions of Alberti since 1950. This is more than the total number of publications throughout the sixteenth and seventeenth centuries.

The above analyses were done manually. With the increasing interoperability between databases and spreadsheet packages a number of these queries could be dynamically linked such that statistics are automatically updated as new titles and other materials become available. Such statistics exemplify ways in which computerized bibliographies such as that provided by SUMS help us to discern patterns in the influence of an author and in scholarship concerning them. We learn, for instance, that there has been much more attention paid to Alberti in the latter half of the twentieth century than in any previous half century.

1511	Nurnberg?	1827	Madrid
1540	Basle	1840	Milan
1540	Basle	1841	Florence
1547	Venice	1868	Paris
1547	Nurnberg	1877	Vienna
1558	Nurnberg	1888	Vienna
1565	Monte Regale	1913	Lanciano
1568	Florence	1934	Lanciano
1568	Venice	1950	Florence
1582	Basel	1956	London
1649	Amsterdam	1956	New Haven
1651	Paris	1963	Warsaw
1726	London	1966	London
1730	London	1966	New Haven
1733	Naples	1970	Osnabruck
1739	London	1971	Forest Grove
1751	London	1972	London
1782	Bologna	1972	Forest Grove
1782	Madrid	1975	Bari
1786	Bologna	1977	London
1803	Milan	1989	London
1804	Perugia	1989	New York
1804	Milan	1991	New York

Fig. 2 Forty six editions of Alberti's On painting.

1750-1859	1	1920-1929	5
1860-1869	1	1930-1939	6
1870-1879	0	1940-1949	6
1880-1889	2	1950-1959	11
1890-1899	3	1960-1969	34
1900-1909	0	1970-1979	14
1910-1919	4		

Figure 3. Dates and number of articles and/or books on Alberti's perspective. .

This invites new questions: Why do these patterns occur? What for instance has made Alberti so popular in the past generation? One answer would be that there is an increasing interest in the origins of perspective, as reflected also by the title of Professor Damisch's recent book<sup>2</sup>. Alberti, as the author of the first treatise on perspective, has thus acquired increasing attention, as did his contemporary Brunelleschi, who did the first demonstrations on perspective. If we examine the pattern of secondary literature (articles and books) on Brunelleschi we again note that more has been written on him in the past half century than at any other period. The same trends are found in scholarship on other fifteenth century theorists on perspective such as Piero della Francesca and Leonardo da Vinci.

Just over a half century ago, scholars such as Novotny (1939), believed that interest in scientific perspective had ended at the time of Cezanne. The above examples confirm that there has been a serious revival in perspective and that the new interest in Alberti is part of a larger pattern.<sup>3</sup>

#### 4. World Wide Web

The materials of the bibliography on perspective cited above were acquired in the latter 1960's and throughout the seventies in a traditional manner: from basic bibliographies in the field, national book catalogues, working in some forty major libraries, through interlibrary loan and through written contact with an additional one hundred and forty libraries. Today this would be done differently. Within ten years the whole process will be very different again. It is an awareness of these changes and the quest to keep pace with them that has prevented the bibliography from being published thus far.

Libraries are becoming connected electronically. Major networks such as the Research Libraries Information Network (RLIN), which had 13 million titles in 1984, have increased to over 70 million in eleven years. This and related networks such as the Online Computer Library Center (OCLC) require annual subscriptions by universities or individuals.

A great number of other library systems are free to anyone with access to the Internet through the World Wide Web. To date most of these are still through Telnet, such that one has a text only interface. However, libraries are beginning to have direct World Wide Web home pages. The Robarts library in Toronto is a good example. If, for instance one types in Leon Battista Alberti one is told that Leon occurs 17505 times, Battista occurs 2845 times, Leon Battista occurs 197 times, Alberti occurs 1140 times while Leon Battista Alberti occurs 78 times. If one asks for Leon Battista Alberti and ti[tle] *Della pittura* one receives the foregoing plus the following:

Ti[tle]: *Della* occurs 14343 times

Ti[tle]: *Della pittura* occurs 451 times

Leon Battista Alberti and Ti[tle]: *Della pittura* occurs in 2 records.

As in the case of traditional library catalogues discussed earlier, this electronic version is limited to purely alphabetical lists such that a person interested in all editions of *On painting* needs to make further queries for Leon Battista Alberti and ti[tle] *De pictura* which yields two titles, then again for Leon Battista Alberti and ti[tle] *On painting* which yields seven titles and so on.

Bologna is another example. One can, for instance, type in the author Alberti and the title, *Della pittura*. This gives one a single hit, namely the edition of Bologna 1992. If one types in Alberti, Leon Battista, one receives twelve references, of which one is again the same edition of *On painting*. In the library of the Technical University of Vienna, which has a more elaborate approach, the same request produces sixteen matching items, including Milan 1804, Vienna 1877, Stuttgart 1981 and Milan 1989.

While the ability to search on-line in this way is exciting, these systems still assume a human interface, i.e. that an individual will navigate through various author and subject lists on the basis of decisions made as they proceed. A user of Mosaic or Netscape, for instance, is usually expected to type in a hyper-text transfer protocol (http). This is often long, frequently awkward and sometimes difficult. In the long run it will also become unnecessary. Since databases are electronic the interface to them can be machine programme oriented such that a programme can automatically search for the existence of a title in multiple locations.

At present a user searching in a library such as Toronto, chooses whether they are interested in only ten hits, one hundred, some other number, or simply all. In future this principle will be extendable to the number of libraries one wishes to search and the size of the sample one is searching for in those libraries. Hence it will be possible to extend the query about editions to the number of extant copies within any edition. To date attempts in this direction such as the monumental *Union Catalogue of Incunables* (*Gesamt-Katalog der Wiegendrucke*), have been the product of heroic teamwork and co-operation continuing even with the barriers of an iron curtain (for a number of years separating the East German headquarters from other participants in the West). In future much of this work can be automated.

This is by no means to say that all problems will be solved, even if we can use computers to trace the number and location of books in an edition and changing patterns in publication of a book. Size is another factor which may be equally and sometimes more important in trying to understand the history of how a book was received by its readership or so called audience. It may make all the difference whether the book was an elaborate folio edition (2o) or a popular octavo edition (8o). For the early period, we need, in addition, to know about the relative roles of manuscripts versus books. For instance, although there were no printed editions of *On painting* in Italy until 1547, we know from various sources that Alberti was certainly being studied in the century between the time he wrote his treatise and when it was published.

## **5. On-Line Texts**

Meanwhile the possibility looms of having all major texts on-line and increasingly, all the great manuscripts. Just as some companies are vaunting video on demand, others are planning to offer the great treatises on demand. It is technically already possible to create on-line reprints of rare manuscripts, postcards of special pages and posters of outstanding images therein. The major problem lies in reaching agreement about appropriate billing strategies and some more fundamental questions: should access be purely in terms of money? Is culture business? Is culture a question of who can pay most? Will only the rich be scholars? Or is our cultural heritage, paid with by taxpayers' money, something that should remain accessible to all? Copyright and billing procedures are the subject of much discussion.<sup>4</sup>

Some idea of what is becoming possible is given by Internet sites such as the Vatican exhibit at the Library of Congress, which already contains sample pages from Alberti's manuscripts, notably his *Description of the City of Rome* (<http://sunsite.unc.edu/expo/vatican.exhibit/exhibit/b-archeology/images/arch08.jpg>). Last year, with support from a French insurance company, the full text of all the Urbino manuscripts, (Urb. Lat.), nearly 2000 texts which had been filmed were recorded on three analogue video discs and made available through the French Embassy in Rome. Meanwhile, IBM has a pilot project whereby sample manuscripts of the Vatican are being scanned. This is a first stage of a larger plan to scan in all the manuscripts in the Vatican collection, and in turn but one step in a global digital library project whereby manuscripts and books in the Catalogo de los Indios (Madrid), the Luther Library (Wittenberg), the Los Angeles Public Library and the Institute of Scientific Information as well as images from the Edo Museum (Tokyo) are being scanned in systematically.

Scholars traditionally made their own excerpts or even their personal handwritten copies of books, sometimes with the help of amanuenses. In the last two generations the serious advent of microfilm has brought about a transitional revolution, or rather pointed to a whole new pattern, whereby we can theoretically make our personal collection of all the treatises that interest us. With the advent of electronic libraries in the true sense all this could become a reality, provided that pricing mechanisms do not destroy the new market that business seems to believe it sees.

At present many electronic services do not take into account some of the very different spellings of titles mentioned above. As a result one still needs to search for the same book anew each time one changes a language. If more libraries were to adopt the methods introduced by Utrecht and some of the Swiss libraries, then one could search for editions multilingually. The challenge lies in making these superficially difficult problems of translation disappear behind a front-end that is entirely simple for users.

Electronic services also tend to consider browsing a document as being billable in the same way as if one were reading a document. This overlooks entirely the very different scholarly functions entailed in the two exercises. Browsing typically involves scanning a text in order to find a specific passage, phrase or word: a process that will one day be automated. Reading entails careful study: a process which cannot be automated.

## 6. Analyses

Computers are affecting much more than our references to texts, they are transforming the way in which we analyse texts themselves. Traditionally scholars studied words in isolation. They might ponder upon its meaning, consulting various dictionaries and encyclopaedias in the process, in order to gain some appreciation of the history of a term. In rare cases they would take the trouble to count how many times a crucial word was used in a text, but any such decision entailed great investments of time. With the advent of computers this is no longer a problem. It is a perfectly routine matter to determine the number of times a term is used either in a single text or in a number of texts. One can even choose to see all the passages entailed in context.

Dictionaries such as *Websters* are now on line, as is the *Oxford English Dictionary* (for a fee). Hence, whenever one is faced with a difficult term, instead of needing to get up and find the appropriate historical or etymological dictionary, one can simply consult these on-line. For the moment this still needs to be done manually, but it is perfectly possible from a technical point of view, to have this automated, such that one could in future have access to the complete history of usage of a term. This will lead to a new history of etymologies. For instance, a scholar interested in Alberti's use of *istoria* could trace all uses thereof in his *On painting*, his other treatises, earlier sources as well as later treatises which build on this tradition.

That which applies to terms will apply equally to phrases, quotes and passages. Great texts such as the *Bible* are already online. Major projects such as the *Thesaurus Linguae Graecae* and the *Thesaurus Linguae Latinae* are already in electronic form. As this corpus of classical literature becomes available online it will become possible to choose any passage in a text by an author such as Alberti, and check its source in Greek and or Roman literature. In the past scholars steeped themselves in the *Bible* and the classics and relied on their memory to recognize a quote. The new computerized access will lead gradually to a whole new history of quotations and perhaps a quite different view of the history of plagiarism.

## 7. Interactive Verbal Commentaries

The cynic may say that all this is bad for the business of scholarship, that all those monks who traditionally copied manuscripts, all those eager readers around the great libraries who, for a "small fee" would find the necessary passages, read them and even translate them from an all too tedious Latin scrawl, all those noble predecessors to the xerox machine and the photographic camera, will be out of a job. This may be true in the narrow sense: they will be out of those jobs. But there will also be many new kinds of scholarly jobs.

The systematic tracing of editions outlined above is but one example of this. The fact that the best bibliographies of perspective, even a decade ago were only aware of twenty editions of Alberti's *On painting*, when there are at least forty six, has the simple

corollary that no one has yet been aware of, let alone studied in detail the complete history of this treatise nor for that matter any other. In the past generation the heroic efforts of a Professor Lücke have vastly increased our awareness of Alberti's basic terms, but here again, hardly anyone has actually read and studied all of these in context let alone all the literature concerning them.

Indeed the whole nature of what it means to study is changing. In the past a serious scholar retreated to the quiet of their den or library, emerging only for food, sleep and other bodily functions. Study meant reading, making notes, writing letters to colleagues and sometimes visiting them.

Now these operations are being automated. Even the simplest tools on the Internet such as Mosaic, have a built in ability to make annotations to any document or picture which one sees on the World Wide Web and these can be shared at a distance. With the advent of OLE 2 (Object Linking and Embedding) and DLLs (Dynamic Link Libraries), it is increasingly possible to develop interoperability between databases, standard text packages (e.g. Word, Word Perfect); spreadsheets and graphics packages. Hence one could find a passage on the Internet, copy it into one's essay in a text processing package and then write commentaries on it.

Bernard Stiegler, in a recent paper on the *Geography of knowledge*<sup>5</sup>, referred to hyperprocessing and identified four basic operations of qualification: keywords, personal notes, commentaries, and links to other documents. A new system, developed by the University of Compiègne, slated to be used in the new Bibliothèque de France, will integrate these operations into the everyday tools of readers and scholars. Hence where earlier generations focussed on copying, future generations may well focus on new kinds and combinations of verbal commentaries.

Related to this a new emphasis on oral communication. Video-conferencing tools are moving off the big screens of boardrooms and onto the smaller screens of personal computers, and will eventually be capable of shifting from the personal space of a home computer to the public spaces of a classroom or a meeting. Present video-conferencing methods are still too primitive in that they are still limited to 640 x 480 resolution, but with the advent of broadband communications it will be possible to view and compare alternative versions of manuscripts and rare editions at a distance, without incurring the risk of sending the precious document to another country or even half way around the world. Scholars in different cities will be able to discuss texts at a distance, comparing the ductus of various manuscripts, comparing notes interactively or collaboratively. Traditionally scholars of major bibliographies have personally checked references and have made a point of having rare books in their hands before making their entries. This meant a great deal of time spent in travel. Much of this can now be done from one's home site, with the advantage that one could call up one's screen versions from several locations for purposes of comparison and contrast.

The advent of voice activated systems, at present used mainly for the handicapped introduces a new dimension to this shift towards oral communication. Computerized

versions of the dictaphone may conjure up the science fiction computers of *Star Trek* or HAL in *Space Odyssey 2001*. They also play a role in eroding the notion of text as something sacred, thus re-introducing problems well known to the Middle Ages.

To characterize these developments merely as a shift from written back to oral communications would however be simplistic. The revolution that is underway is not about replacing one medium with another. Electronic culture means that oral, aural, written and printed modes all become interchangeable. For this reason computers do not create a paperless office or society. They create new relations between our spoken words, our written words and our printed ones. Computers are about creating a complete interoperability between these different modes of expression.

This interoperability introduces new challenges. Because texts are so easily changed we need methods to check when things are changed and protocols for who is allowed to change what, when. The business world is resolving this with new software for what is now termed version control. Scholars need their own equivalent. In the past scholars often distinguished themselves through the precision, the range and the quality of their texts supplemented where necessary by footnotes. As the instruments of editing and intervening increase, we need, in addition to footnotes which merely point to sources, new techniques for identifying whether a text is original, who has altered what and to what extent, and where possible, to indicate the number of generations a text is distant from its parent. We need modern versions of methods developed by manuscript experts, computer equivalents of family trees for manuscripts (stemmata) of how one set of manuscripts affected the other. IBM, for instance, is developing an electronic equivalent to watermarks in order to control the provenance of digital documents. Hence the new electronic tools will generate a need for a whole new set of tools and new jobs through the servicing thereof.

The advent of these new tools for version control have profound implications for movements such as deconstruction(ism), which have rightly drawn attention to the new levels of instability in modern texts, but probably overemphasized the levels of uncertainty introduced thereby. If, for example, methods of version control were introduced into different manuscripts and editions of Alberti, most arguments concerning the instability of texts would disappear.

Because electronic media allow us to search for any word, phrase, or passage, they also permit us to trace any use of and intervention in the text, they have enormous implications for the field of reception studies which focus on the effects of texts on users. In the past such efforts have been manual and laborious. For instance, great libraries such as the Herzog August Bibliothek have painstakingly made records of daily readers' attendance over the centuries and in many cases even have records of which books were actually consulted by readers.

Computers and electronic media now permit one to trace all texts consulted by a user, the length of time these texts were consulted (which provides some clues concerning the intensity of study) and every keystroke made. This conjures up new dangers of

surveillance on the one hand. On the other hand, it simultaneously opens enormous new fields with respect to reception theory.

## 7. Reconstructions

That which applies to verbal records applies equally to visual materials, such that there will effectively be interactive visual commentaries also. Computers have permitted the introduction of hypertext which is now being extended to hyperimages or hypericonics.<sup>6</sup> This has important implications for the various scanning projects that are presently underway, for it means that it is not enough merely to produce digital forms of articles and books on screen. One will wish to link often poor black and white images with proper colour images. In addition if a text refers to a painting by Botticelli such as the *Birth of Spring (Primavera)*, one can make a link to an image of that painting. At present this is being done manually. In future many of these links can be done automatically, such that one can have instant hyper-textual and hyper-iconic links.

While such links presently entail hypertext markup language (html), new standards entailing standard graphic markup language (sgml) and virtual reality markup language (vrml) are being explored. In the near future it may well be possible to link texts automatically with corresponding virtual reality walk- and fly-throughs .

In addition to creating links with places and objects that are elsewhere, computers can help to visualize verbal descriptions for which there is no extant original. For instance, the present demonstration uses a software package, AutoCAD<sup>7</sup>, to demonstrate the principles of Alberti's legitimate construction (*costruzione legittima*). Since the earliest extant manuscripts of Alberti's treatise are without diagrams, it is not it is not surprising that there should be different interpretations concerning the precise details of his construction. In this case there are at least three major alternatives, namely:

1) where the panel on which the lines intersect is separate from the frontal plane as suggested by Klein (1961)<sup>8</sup> and Grayson (1964)<sup>9</sup>.

2) where the panel is flush with the left boundary of the frontal view as in Filarete's manuscript (Florence, Magliabecchia II I, 140, fol. 177v, c. 1464) and in Panofsky (1927)<sup>10</sup>;

3) where the panel is flush with the centre of the frontal view as is found in the Lucca manuscript of Alberti's *On painting* and which has led Parronchi (1964)<sup>11</sup> to claim that the legitimate construction is equivalent to the distance point construction.

AutoCAD allows us to re-create these steps systematically and to show how these interpretations relate to each step in the verbal description. The resulting diagram of the legitimate construction which is two-dimensional can then be rendered in three-dimensions such that one recognizes its equivalence to the window method. This

principle, when extended, becomes a Renaissance interior which can then be related to those in painting practice such as Masolino's painted room in Castiglione d'Olona. Computers thus help in illustrating, comparing, and weighing the relative value of different readings and alternative or even conflicting interpretations.

Such reconstructions also serve in showing the development of a succession of ground plans, how these relate to elevations, models and the actual churches. Reconstructions can help in illustrating the processes underlying building technologies. Hence they are as useful in understanding otherwise invisible structures in the built environment as in helping us to see and understand functions of lost buildings and possible structures of projected ones. That which applies to architecture applies equally to machines and even mechanical functions, such that one could, for instance, visualize the propositions of the *Mathematical games* of Alberti.

## 9. Conclusions.

The implications of electronic media for scholarship are enormous. The above list is merely a quick checklist of some possibilities rather than being an exhaustive study. At the level of context, electronic media give us new access to reference tools such as classification systems, dictionaries and encyclopaedias. At the level of bibliography electronic lists bring the enormous advantage that they offer multiple views of the same material, inviting us to statistical analysis of trends that was previously unthinkable.

At the level of partial content they offer new access to abstracts and summaries. At the level of content they bring new access to the sources themselves. This access is enhanced by a series of hyper-textual and hyper-iconic connections which serve further to re-contextualize isolated articles and books. These sources are also enhanced by the presence of commentaries and annotations at different levels. Finally, electronic media enable users to view and create their own reconstructions, adding to the world that is, contexts of what might have been. We noted that all this is not without its dangers. Unless we create new techniques for tracing the heritage of our sources, determining who made changes when, we shall slip further away from constructive criticism and evermore towards deconstruction.

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7 June 1995.

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<sup>1</sup> For an introductory article concerning SUMS see:

“A Front-end for Multi-valent, Multi-cultural Searching”, *ALT News 04, Applied Learning Technologies in Europe*, February 1994, pp. 8-9, 14.

This and the following more technical descriptions of the system are available on-line. See: <http://www.mcluhan.utoronto.ca>

"Multidimensional Bibliography and Classification, Eröffnungsvortrag": *Anwendungen in der Klassifikation. Proceedings 8 Jahrestagung der Gesellschaft für Klassifikation eV*, ed. Rolf G. Hensler (Teil I), (Hof Geismar, 1984), (Frankfurt, Indeks Verlag, 1984), pp.57-75.(*Studien zur Klassifikation*, Bd. 14 SK 14) and more recently: “Knowledge package construction and conceptual navigation using a System for Universal Media Searching (SUMS © 1994)”, *Writers at work: professional writing in the computerized*

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*environment*, ed. Thea van der Geest, Mike Sharples, Chris Neuwirth, Norwood: Ablex, 1994, (in press). Publication linked with: *Writing conferences, European Association for research on learning and instruction. Special interest group writing and 7th European conference on writing and computers, Utrecht, October 19-21, 21, 1994, Abstracts*, Utrecht, p. 181.

Applications of SUMS to art history in general have been discussed in:

"Past Imprecision for Future Standards: Computers and New Roads to Knowledge", *Computers and the History of Art*, London, vol. 4.1, 1993, pp. 17-32; "Can Museum Computer Networks Change Our Views of Knowledge?", *Museums and Information. New Technological Horizons. Proceedings*, Ottawa: Canadian Heritage Information Network, (1992), pp. 101-108; "A New Classification for Art," *Die Klassifikation und ihr Umfeld. Proceedings 10. Jahrestagung der Gesellschaft für Klassifikation eV*, eds. P. O. Degens et al., (Frankfurt, Indeks Verlag, 1986), pp.77-84, (Studien sur Klassifikation, Bd. 17); Guest Editor of the first issue of *Knowledge Organization* (formerly *International Classification*), including an editorial "Computers and the Visual Arts" and an article "Electronic Media and Visual Knowledge", Frankfurt, vol. 20, no. 1, 1993, pp. 2-3, 47-53.

"McLuhan, Museums and Education", *Museums and Technology: special issue of The Muse*, Ottawa, vol. IX, no. 2, (Summer-Fall, 1991), pp.78-85.

Philosophical implications have been discussed in: "New Media and New Knowledge", *Proceedings of the Third Canadian Conference on Foundations and Applications of General Science Theory: Universal Knowledge Tools and their Applications*, Ryerson, 5-8 June 1993, Toronto: Ryerson Polytechnic University, 1993, pp. 347-358; "Elektronische Medien, Die Wiedergeburt der Perspektive und die Fragmentierung der Perspektive": *Illusion und Simulation*, ed. Stefan Iglhaut, Munich: Klaus Boer Verlag, 1994 (in press); "Computers and a new Philosophy of Knowledge", *International Classification*, Frankfurt, vol. 18, (1991), pp. 2-12; "Thoughts on the Reorganization of Knowledge", *Automatisierung in der Klassifikation eV*, ed. Ingetraut Dahlberg (Teil I), Königswinter/Rhein, 5.-8. (April 1983), (Frankfurt: Indeks Verlag, 1983), pp.141-150. (*Studien zur Klassifikation*, Bd. 13, SK 13).

For educational implications see: "A Databank on Perspective: The Concept of Knowledge Packages", *Metodologia della ricerca: orientamenti attuali. Congresso internazionale in onore di Eugenio Battisti*, Milan, 1991, *Arte Lombarda*, Milan, 1994, n. 3-4, parte secunda, pp. 166-170; "How the information highway can transform education. Reflections on McLuhan's vision", *Multicomm '94, Program and Proceedings*, Vancouver: University of British Columbia Continuing Studies, 1994, pp. 221-247; "The Electronic Highway and Education: New Doors to keep Open", *Learntec 93, Europäischer Kongress für Bildungstechnologie und betriebliche Bildung, Tagungsband*, ed. Uwe Beck, Winfried Sommer, Berlin: Springer Verlag, pp. 423-434.

"Computers and the Transformation of Knowledge", *The Challenge of Lifelong Learning in an Era of Global Change*, Couchiching Institute on Public Affairs, 1993 Conference Proceedings, Toronto, pp. 23-25; "Databanks in Education", *The 12th E.C.O.O. and the 8th I.C.T.E. Joint Conference*, Toronto, (May 1991), pp.412-418; "Knowledge Packages", *The 12th E.C.O.O. and the 8th I.C.T.E. Joint Conference*, Toronto, (May 1991), pp.757-759.

<sup>2</sup> Hubert Damisch, *Les origines de la perspective*, Paris: Flammarion, 1987.

<sup>3</sup> See: "Developments in Perspective", *Visual Mathematics*, ed. Michele Emmer, Cambridge, Mass.: M.I.T. Press, 1993, pp. 199-205. For further context on the historiography of perspective in the twentieth century see: "Panofsky's Perspective: a Half Century Later," *Atti del convegno internazionale di studi: la prospettiva rinascimentale*, Milan 1977, ed. Marisa Dalai-Emiliani (Florence, Centro Di, 1980),

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pp.565-584; "Literature on Perspective. 1971-1983," *Marburger Jahrbuch*, Marburg, Vol. 21, (1986), pp.135-207.

<sup>4</sup> See, for instance, the recent conference proceedings: *Protecting and Exploiting Copyright in Multimedia. New Problems...New Solutions*, Toronto: The Canadian Institute, 1995. For a European viewpoint see: ESPRIT Project 5469 CITED (Copyright in Translated Electronic Documents), Boston Spa: British Library, 1995.

<sup>5</sup> Bernard Stiegler, "Géographie de la connaissance", *Texte et ordinateur: les mutations du lire écrire*, ed. Jacques Anis et Jean Louis Lebave, Centre de Recherches linguistiques de l'Université Paris X Nanterre, 1993.

<sup>6</sup> See, for instance, the article by Gerhard Nauta, "Hypericonics. Hypertext and the Social Construction of Information about the History of Artistic Notions", *Knowledge Organization* (formerly *International Classification*), Frankfurt, vol. 20, no. 1, 1993, pp. 35-46.

<sup>7</sup> We are grateful to be a test site for Autodesk products.

<sup>8</sup> Robert Klein, "Les humanistes et la science", *Bibliothèque d'humanisme et Renaissance*, Genève, vol. XXIII, 1961, pp. 12 ff.

<sup>9</sup> Cecil Grayson, "Leon Battista Alberti's costruzione legittima", *Italian Studies*, Manchester, vol. XIX, 1964, pp. 14-27.

<sup>10</sup> Erwin Panofsky, "Die Perspektive als symbolische Form", *Beiträge der Bibliothek Warburg*, Leipzig, 1927, pp. 258-330.

<sup>11</sup> Alessandro Parronchi, "La costruzione legittima è uguale alla costruzione con punti di distanza", *Rinascimento*, Florence, vol. XV, 1964, pp. 35-40.