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## **Thoughts on Computers and Knowledge**

October 1980

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### **Introduction**

If the ongoing explosion in knowledge is not to become counter productive, a reform is needed in its organization and classification. In the case of contemporary knowledge and information computers are opening the way to such a reform. In the case of historical knowledge, however, where the problem of efficient access is most critical, computers play only a minimal role. The essay which follows, outlines how the increased use of computers could bring dramatic improvements in both the classification and accessibility of our heritage.

Three general headings of historical knowledge are proposed: 1) the natural world, 2) the man made world, 3) the interaction of man and his world. Each of these will be considered in turn.

## 1. Natural World

This general heading can be subdivided into persons, things and places.

### 1.1. Persons

At present biographical information about persons is scattered in national dictionaries of biography; dictionaries relating to fields of endeavour such as the *Dictionary of Scientific Biography* for scientists and Thieme-Becker's *Künstlerlexikon* for artists; specialized biographical dictionaries ranging from Jocher's *Gelehrten Lexikon* to the modern *Who's Who*; and, of course, biographies relating to specific individuals. All these standard sources provide primarily verbal information about the persons in question.

With the aid of a computer the information available from these various biographies could be indicated. In addition portraits, engravings, statues, medals and other visual records of the person could be collected. In the case of outstanding persons, pictures of their birthplace, homes, tomb could be added. When possible a record of the persons' travels could be organized chronologically and geographically, such that one could, for example, see on a map precisely what journeys Erasmus made in a given year.

A chronological list of the person's writings should follow with standard locations for both manuscripts and printed works. In the case of an artist a chronological list of the person's paintings, sculptures etc. would follow. In the case of a scientist a chronological list with pictures of his inventions would follow. Problems will arise in deciding whether the person in question is historical or fictive (legendary etc.). In border line cases, a cross-reference with names in section 2B (see below) could be introduced.

All persons would be listed alphabetically. But, in addition, this information could be chronologically and geographically rearranged such that one could, for example, see with a map which medical doctors are recorded as being active in Basel in the period 1510-1520. The details of biographical knowledge could thus serve as a starting point in visualizing larger trends such as shifts in centres of learning.

### 1.2. Things

A similar means of classification could be introduced with respect to things be they animal, mineral or vegetable.

#### 1.2.1 Animal

Animals would be listed alphabetically. In the case of a given animal such as the lion the computer would record theories re: its development; a chronological list of literary and scientific descriptions and references and a corresponding chronological list of visual records. These would be stored in such a way that they would permit ready shuffling. Hence it would be possible to obtain in chronological succession pictures of all large-scale bronze lions known to have been produced in Europe between 1200-1250. Or,

adapting the methods of pattern recognition, one could programme the computer to make a search for all lions of a given iconographical type.

With such a method, the problem of the historical influence of Dürer's engraving of a rhinoceros, which Gombrich has outlined with a few key examples, could be traced comprehensively for this or any other animal within minutes. This would open the way for studies of the comparative influence of iconographical types.

At a later stage one would wish to supplement these macroscopic records with records at the microscopic level, thus providing information when the first known dissections of the animal were made and building up to what is effectively a historical case history of each animal. A corresponding procedure could be used in the classification of things mineral and vegetable.

### 1.2.2 Places

In terms of places one could make a systematic chronological or organization of various kinds of maps and align these with visual records of man-made constructions such that a student of the sixteenth century could, for example, see in succession all world maps produced in that century, then all maps of Europe, then maps of Italy, then of Umbria, then topographical maps of Florence, then visual records showing battles, royal entries or pageants in the city, then pictures of individual buildings.

For a city such as Florence, the computer would, moreover, have stored a complete set of historical records. This, combined with the detailed information listed under the category of persons would open up whole new approaches for the cultural historian. It would, for example, be possible to trace the journey of a sixteenth century emperor, pope or dignitary via maps on the one hand and pictures of his battles, entries, pageants, and related festivities on the other hand. In assessing the significance of such entries etc., comparisons quantitative and qualitative, could be made with contemporary, previous, and subsequent examples.

In having access to visual records ranging from world maps to topographical maps and ground plans of individual buildings the way would be open to a historical approach that was international and yet retained the very detailed information that is usually restricted to local histories.

## **2. Man Made World**

The same programme that set about to catalogue in Baconian fashion the verbal and visual information about the natural world could be extended to the man-made world. This category might conveniently be subdivided into A) Material and B) Mental/Spiritual.

## 2.1 Material

Under this heading would come all the constructions, instruments and inventions of man, ranging from castles, temples and cathedrals to burning mirrors, cranes, eyeglasses etc. Each construction say, a castle such as Harlech, would serve as a heading for information that would include ground-plans, historical pictures and modern photographs as well as the relevant written documents. There would in addition be cross-references to related structures. In the case of Harlech, for example, there would be reference to the other five castles constructed by Edward I when he was conquering N. Wales (1270 - 1290), namely Caernarvon, Beaumarais, Conway, Rudlan and Flint.

In addition to an alphabetical list, it could prove useful to arrange instruments and inventions in terms of categories such as extension of the senses, extension/intensification of the powers of nature and correlate these geographically and chronologically in order to perceive larger trends in the development of technology and culture.

## 2.2. Mental/Spiritual

Corresponding to the biographical list of real persons there would be a list of all supernatural, legendary or fictive persons/personifications i. e. gods, heroes, literary figures and allegories. Each of these would again serve as heading for the relevant verbal and visual information.

In the case of an example such as Christ where historical reality combined with supernatural dimensions have generated a highly evolved iconography one would wish to introduce subheadings in the visual records such as Birth, Flight into Egypt, Virgin and Child, Presentation in the Temple, Last Supper, Death on the Cross, Taking Down from the Cross and Resurrection.

A geographical and chronological correlation of these themes would open the way to studies of iconographic trends, for example, whether birth, childhood, youth, death or resurrection received particular attention. These trends in the representation of the life of Christ could subsequently be compared with representations of the lives of various saints, heroes etc.

A systematic list of personification, e. g. war as Mars, love as Venus etc. bringing together both verbal and visual records would open new avenues of study for comparative ethnology. Trends to verbalize certain themes and visualize others could also be identified.

That which applies to persons could be applied equally to imaginary things be they animal, such as the phoenix; mineral, such as the philosopher's stone; or vegetable, such as the elixir of life, or places, such as Atlantis or Mount Meru.

A similar method could be introduced to record the mathematical tradition. If the corpus of classical geometry were stored along with the various mediaeval manuscript versions it

would be possible, through an adaptation of simple pattern recognition methods, to begin with a geometrical diagram in say, the writings of Galileo or Leonardo and to determine a) whether it had a classical precedent and b) via which of the mediaeval manuscript traditions it came.

### **3. Man in Interaction with the Natural World**

This third heading could be subdivided under the headings: a) struggle/work, b) leisure/play and c) man en route.

#### **3.1 Struggle/Work**

This subheading would be further divided into persons and things. Struggle with persons would include records verbal and visual of fighting, battles, war. Among things animal, struggle would include hunting, the preparation of the things hunted and the selling thereof. Among things mineral this heading would entail mining. Among things vegetable struggle/work would entail agriculture.

Such an arrangement would again open the way for studies in trends of expression, whether the emphasis of a period be on production/acquisition of a thing, on its preparation or on its consumption.

#### **3.2 Leisure/Play**

This heading would include subdivisions as eating, drinking, dancing, singing, games and sport. Comparison with the previous category would reveal the trends whereby themes of struggle/work become themes of play/leisure: e. g. human fighting tends to become wrestling and play fighting; the task of hunting/fishing tends to become the sport thereof.

#### **3.3. Man en route**

This subheading would involve the theme of persons en route be it by foot, by horse, by carriage or some other means.

### **4. Further Categories**

In the case of matters listed under the headings man made world and man in interaction with the natural world, further categories could be introduced. Are the matters real, projected (in the sense of planned) or imaginary? How does the emphasis within these categories change with them? And how can the trends that arise therefrom serve the cultural historian?

One consequence of this systematic arrangement of knowledge would be that it allows one to approach in concrete terms hitherto largely abstract questions such as the shift from religion to secularism. For one could now trace how a scene such as the Supper at Emmaus became transformed from a theme which dominated the entire picture to one

which occupied a small section of the background of a still life painting of fruit, e. g. F. Snyders.

In other cases this shift could be studied by a comparison of related themes. For example, st. Matthew was a money collector, and thus a painting such as Ter Bruggen's Calling of saint Matthew portrayed this aspect as a secondary point. In later paintings this theme of money collecting gradually moves into the foreground until what had been a religious painting emerges as a painting of a secular profession.

The distinction between descriptive and prescriptive images would be another general heading which could be introduced. Of particular interest here would be a systematic cataloguing of the pattern books and a search for their echoes in painting. The impact of such books relative to the oral tradition of the master/apprentice within the schools would be a further domain of study. Not only the tradition of knowledge, but changing trends therein could then be examined.

## **5. The Third Revolution in Knowledge**

The revolution involved in such a re-organization of knowledge would be comparable only to two earlier turning points: one described by Plato in his *Phaedrus*, when man began to consider the possibility of relying on the written word rather than on memory, the other which took place in the fifteenth century when man decided to transfer his tradition of knowledge from manuscripts to printed books.

## **6. Practical Considerations**

The project may at first appear immense and utopian but it would, on reflection, involve highly practical aspects. The scholar who now needs to scurry to various biographical dictionaries, would then gain much more merely by pressing a button. Indeed in our day it still tends to take more time to locate a document than to read it. With a computer this would be reversed.

In a sense the computer project would represent a systematic approach to many existing efforts to organize verbal and visual knowledge in specialized areas and as such would involve a coordination of projects such as the Index to Christian Art, the Photo Marburg Collection, the de Witt collection at the Courtauld Institute and the photographic Collections of the Warburg Institute, I Tatti and so on.

At present there are almost universal complaints against the tendency of scholars to produce ever greater numbers of articles which, it is assumed, are necessary for promotion. If contributions to the computer project became a recognized aspect of academic promotion, vast amounts of intellectual energy could be redirected for this task. With worldwide cooperation the great challenge would emerge as a project that could be reached in a generation, or two at most.