LIBRARIES AND INFORMATION SYSTEMS - A FRUITFUL PARTNERSHIP

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It was a dramatic moment in the history of our civilisation when, in about the year 240 B.C., Archimedes leapt out of his bath and ran naked into the street of Syracuse shouting "Eureka" - "I have found it!" He had found the theoretical answer to a practical problem, that of finding the specific gravity of solids, known ever since as "Archimedes' Principle". We know this because Archimedes had written and published many books, on mathematics and mechanics, and some of these have survived and are preserved in libraries for us to use today. He made a major contribution to the progress of humanity, and over the centuries, that progress has been continually stimulated and accelerated by the invention of new theories, new tools and machines, which explain our world, and lighten the burden of securing the basic necessities of life.

Not all of these inventions turn out to be wholly beneficial, even if most inventors are armed with the best of intentions. Archimedes himself is also credited with the invention of engines of war and destruction. Even that most efficient tool, the book, has on rare occasions been misused to promote an evil message. Nevertheless, we can say with truth that without books and libraries there would be no civilisation, only existence. Each generation would be obliged to discover truths about the world around us; we should be able to use the knowledge of our forbears only through the often gnomic and unreliable benefit of oral traditions. Books and libraries have a far higher value, in terms both of explanation and of preservation.

Few inventions have had so rapid and wide-ranging effects as the various machines which now process data and information by electronic energy. But I hope and believe that even these remarkable engines will not supersede the book as an instrument for the transfer of information. I remain sceptical, particularly when I see the advocates of the paperless society and the electronic

library writing large books to support their case. I earnestly hope and believe also that libraries, as the records and memory of humanity, can form a fruitful partnership with the latest tools invented to ease the burden of our labour. Provided that these tools are efficiently operated by well-thought-out systems for organising and retrieving information, they offer the possibilities and opportunities for librarians and information specialists in all types of institution to meet the challenges of the new millennium.

First, though, I should like to explain my own attitude very clearly. If I stress the need for a continued recognition of the value of books as an efficient means of information transfer, it is certainly not because I see no value in these wonderful machines. I am not an intellectual Luddite, like those 18th century craftsmen who went round smashing up new machines which they thought would destroy their means of livelihood. I do not believe that the correct use of Information Technology will put the librarian-bookman out of work. Indeed, I can claim that my first books more than 30 years ago urged all my librarian colleagues to give more attention to developing information services by all possible means. My *Information service in libraries*, published in 1958, was the first of its kind in the English language (Note 1).

I am a firm believer that the correct use of all technology, as of all tools, provides an extension of the powers of the human body, enabling us to develop new skills and new systems, including systems of thought and philosophy. I am a very firm believer indeed in the physical law of "least work". I welcome any tool which will relieve me of hard work. Provided, that is, that the tool will do the work as well as I can, and preferably better. I fear that this has not always been the case with some applications of new information technology.

So, the challenge of the Information Age for us, I suggest, is to secure the maximum exploitation of all new media and new technology while preserving to the full the inspirational messages to be found in the books of great writers over the centuries. We should avoid the danger not always obvious, of reducing human beings to the status of servants of machines, because this will restrict

wide-ranging human thought and imagination to the level of binary digits; it is like having to make a conscious decision on which leg to move, each step we take in walking. We need analytical thinking about this relationship if we are to determine the correct use of new media and new methods.

We have, I think, mastered the first few generations of computer technology as applied to libraries and information systems. Yet I now hear of a new type of problem. Not only are we in some danger of being supplied with a surfeit of information, but the networking of networks, including the Internet of the global village, is in danger of degenerating into anarchy and the lawlessness of an information jungle.

I do not agree with Marshall McLuhan that "the medium is the message", but I do agree that the world has become the Global Village. Twenty years of teaching research students in Comparative Librarianship confirms this view, and I commend to your attention the FID publication, No. 659 *Place of information in the global problems of the world*, and in particular the paper by Professora Emilia Curras, of Toledo, Spain, "Science as a system of cyclic process of generation, processing, accumulation and transfer of scientific information" (Note 2). Modern IT as applied in networking enables us to have much better systems of communication with our fellow human beings across the world, but we have to ensure that what we communicate advances our mutual understanding as well as increasing our mutual stores of information.

Much confusion over this has been introduced by concentration on the growth of IT to the neglect of concern about the content of the information transferred. This is partly due to the physical nature of IT: the information and the message are in a way invisible until they are made visible on the screen. Further, each image has only a temporary existence in this visible form, and has to be obliterated before the next message can be made visible. Unless, of course, they are turned back into print.

This is illustrated by the growth of public concern over the "three-minute span of attention". Some educational research claims to have shown a marked decline in

the ability of schoolchildren in some countries to concentrate on one subject for more than about 3 minutes. This has been linked to the incessant interruption of TV programmes by advertisements which have nothing to do with the programmes they interrupt. This in turn has led to the decline of the programmes themselves into a series of incidents without much continuity, so that it does not matter much where the irrelevant matter appears. Hence the popularity of "soap opera".

The sinister effect of this is that it denies to the growing mind the chance to cultivate and exercise its latent power to engage in consecutive and integrated thought. This is of course vital for the growing mind to develop its power of creativity; the creative power, like any other skill, needs to be exercised in order to keep fit. And it needs to exercise itself on intricate and detailed structures of ideas, and not just on statements of facts, simply stated one after another, in random order and with no consideration of their interrelations. I suggest that this is what the *Report* of your SciTech Review has in mind when it refers to "the critical use of curiosity-driven research", in Section 8 (Note 3). In his 1970 Lecture to the John Dewey Society, Bentley Glass put it like this: "The data and the facts alone do not constitute knowledge in the sense of understanding. Information is useful, but the observations must be fitted into concepts and conceptual schemes ... what is necessary is insight..." (Note 4).

This does not mean that I attach no value to random juxtaposition, or what we like to call "serendipity". Random bits of information can spark a sense of a relationship, and indeed such a spark often contributes a vital element in the creativity process. Libraries can make a contribution in this, by virtue of the arrangement of the shelves, in classified sequences but allowing the reader easy means of browsing from one set of shelves - one set of information - to another. The point is that a random thought must find a place to fit in an existing context in order to make sense. Otherwise, it finds difficulty in obtaining an anchorage, a pattern into which it can fit, unexpectedly, and become fixed and a permanent part of an enlarged context. As Louis Pasteur said, "Chance favours the prepared

mind". Without finding a place in an existing pattern, a random thought may easily be lost, and the spark lost as well.

Having had this particular context of thought in my own mind for some years, mainly because of my interest in classification, I have derived some innocent entertainment from some of the latest ideas being put about in physics circles. It delights me to contemplate the idea that the flutter of a butterfly's wings in Mexico may set up a causal chain of events which ultimately results, after who knows how long a chain, in an earthquake in Japan. Of course, "chaos theory" must involve an almost unmeasurably long sequence of events, with many chance associations, and dependent on so many variables that the outcome would be hard to predict with any degree of confidence. Aristotle would not have regarded the butterfly's wing flutter as a sufficient cause, and probably not even a necessary cause either.

Yet the ability to make rational predictions, even if only on the basis of probability, is one of the main powers that science gives us. The creative scientist is the one who makes the imaginative connection between apparently unrelated ideas and facts to hazard the prediction of what might be the case - and what actually turns out to be the case.

Equally, the imaginative feats of writers like Jules Verne and H.G.Wells, or even by Gautier's Baron Munchausen, have proved to be remarkably close to the mark. And now, virtual reality can provide us with all sorts of experiences which we might never encounter in the real world.

In order, then, to combat this sinister tendency towards the 3-minute span of attention, we have to recognise the importance of the relationships between facts, as much as the facts themselves, by themselves. We need time to reflect, to consider, to consult a range of comment by different minds. We should therefore not take any new fact, or piece of equipment, however interesting or marvellous, and look at it in isolation. In systems terms, it is the tensions and interconnections between the elements of a situation, or parts of a machine, which provide the dynamic force for its development, and its significance. If we

understand the connections, we are able to plan correctly and thus enlarge our ability to cope with the environment in which we live and work. Only then shall we understand how to make the best and most profitable use of new media and new technology, in fruitful partnership with the old and trusted.

Let me give you a few examples to illustrate the point. Some years ago, two TV series were made in the U.K., one in Art and one in science. Kenneth Clark made the series called "Civilisation", mainly a history of the Fine Arts; Jacob Bronowski made the series called "The ascent of Man", and this was a history of the ways in which the human race has developed through the influence of scientific discovery and invention. Now, we have another series, David Attenborough on "The life of plants". We have libraries which provide the videos of these series for students to view in carrels. All 3 series have resulted in the publication of books so that the students can use both media together. All 3 series consisted of sequences of connected, integrated thought demonstrated by the succession of visual images drawn from many different sources and many places. All 3 series have also produced books which are best sellers, and to be found in many libraries, and all 3 books have continued to be immensely popular, because they not only record the programmes, but give time to consider and reflect on them.

The reverse sequence of events has also occurred. After Robert Latham had produced his masterly edition of the *Diary* of Samuel Pepys, he gave a programme on British television, in which he reviewed the life of Pepys, the way the *Diary* came to be written, how Pepys's shorthand came to be deciphered. The TV programme enhanced our understanding of the book in a way which would not have been possible through the medium of print alone. Later, another programme gave a highly entertaining version of Dr. Johnson's *Journals* of his tour of the Western Isles of Scotland.

These examples underline the value of attending to the interrelations between the different media, and of the ways in which each can be used to enhance the effectiveness of the others.

Some years ago, I ventured to put forward a small prophesy, based on the state of network technology and electronic mail at the time. I suggested that, in a few years, these would provide us with the system necessary to give a wide extension the services of Current Awareness, and Selective Dissemination of Information, long known as a manual operation in special and industrial libraries. This has become a reality, and can be international, with Internet and the World Wide Web, and no doubt others to follow, perhaps within several specialised areas for a start.

Once the reader profiles are recorded in a machine-readable file, organised by some recognised coding system, a faceted classification or the Broad System of Ordering sponsored by Unesco, it will be a relatively simple task for library and information staff to code incoming books and articles by the same system and enter these into the same file. The computer can then be asked to match one set of codes to the other, and print messages to despatch to readers whose codes match the incoming items. In this way, the readers receive a constant series of reminders that the library is there, always alert and watchful of their interests. Anyone who has operated such services, even manually, knows how valuable it is for the library to promote such interest. By automating the service, the most labour-intensive part of the task, that of selecting and despatch of the messages, is done by the computer.

My prophesy really amounted to an extension of this activity, by using the organising power of the classification technique of facet analysis. As you know, this means organising all the different aspects, or facets, of a subject, into sets, or categories of terms, each set being enumerated independently of all the others. Classifying a document is done by selecting and combining, as in a matrix, the terms from each facet which describe the subject of the document. In any system, or any collection of documents which have been coded in this way, it will be a simple task for a computer to list all combinations of terms which have not yet appeared in the collection. Many of these unused combinations may be impossible, or ridiculous, or not worth further attention. But the result will be a

list of hitherto unexplored relationships, and this is precisely where creativity comes into play, in identifying those combinations which be worth investigating further.

This idea originally applied to specialist areas because the sets of facets in one subject are already related to each other. They are terms within one specific discipline. However, it is interesting to see the papers by Don Swanson, of the Chicago Library School, in particular that one with the potent title, "The absence of co-citation as a clue to undiscovered causal connections" (Note 5). In the first of his series, "Historical note: information retrieval and the future of an illusion", he made the same point as I had, that new discoveries might be made by assembling parts of some whole "that had not previously been assembled". In this paper also, he points to the dangers of specialisation in the sciences, and the role of the Library in fighting against this; new information can be gained from the Library as well as from the laboratory. You will have noted that the *Report* of the Federal SciTech Review speaks throughout of the need for integration between the areas of science, social science, and the humanities

Swanson did not suggest using facet analysis, so let me give a small example from my own history. Some 40 years ago, I made a faceted classification scheme for Container Manufacture, which was later adapted and adopted by the European Packaging Federation for their documentation. In this scheme, one facet was for "Materials", and of course included terms like "metal" and "cardboard"; another facet was for "Processes", the methods and means for forming the materials into containers, and included the term "pressing", or "stamping", by presses. At that time, there was no known process by which cardboard could be formed into boxes by pressing; some 2 years later, a German patent was taken out for just this process. My scheme needed no alteration: classifying that patent meant simply combining two terms which were already present in two different facets, but which had never been used in combination before.

This theory has now been brilliantly advanced by Professor Clare Beghtol of Toronto, in her forthcoming paper, " 'Facets' as interdisciplinary undiscovered public knowledge"; I have had the pleasure of reading this paper in typescript, and I hope that it will be recognised as a seminal contribution to this line of thought, when published (Note 6).

When I first read Swanson's papers, I was in the process of revising Class J Education of the Bliss Bibliographic Classification, known as BC2. In this, I had drawn heavily on the schedules of other classes in BC2 for lists of terms in marginal subjects such as Psychology, Sociology, Economics, and Management. These lists had been drawn up by specialists in those fields, which I am not. Here are connections and interrelations across several fields, and they are not restricted to a single field, Education. I can see no technical reason why all the schedules of this classification should not be entered into a computer file; it is a simple operation, and indeed, the discussions at the British Classification Research Group already envisage, as a further step for the near future, if funds can be found for the data input, to enter these schedules on the Internet.

A librarian or researcher will then be able, by combining a term from a facet of one class with a term from a related facet in another class, to test on a bibliographical data base whether such a combination already existed in the literature; for example, combining a term from the Materials facet of one Technology with the Operations facet of another Technology

I suggest that this could lead to an outburst of intellectual energy in Library and Information Systems (LIS), and it depends entirely on the effective use of IT, combined with a well-organised collection of documents in a library; such a service would need both. The correct use of IT does not mean the use of IT for its own sake; it does not mean the use of IT because the library in the next town uses IT; and it certainly does not mean the use of IT to replace librarians and information specialists who have the skills necessary to provide this level of service. There is too much to be done in promoting the best use of systems for information transfer for the benefit of improved understanding among the peoples

of the world, and the advancement of learning. In order that librarians can cope successfully with this challenge and opportunity, then the way forward must be to develop the interrelations between traditional LIS methods, and the rapidly growing new systems given to us by the machines; not, I repeat, by replacing the old by the new.

But before we can promote a sensible understanding between our groups of professionals in LIS, and our groups of users, we must be sure that we first understand what we are talking about. There is a great deal of confusion arising in discussions about the use of IT, and we may perhaps clear up some of this confusion is we clarify the meanings of three words, often used as if they are synonyms, which they are not. I refer to the words "data", "information", and "knowledge". I have drawn up what I call a "Pyramid of Wisdom (9K)", which is a graphic illustration of the relationship, as I see it, between these three terms, to which I have added a fourth, "Wisdom". You will not often find the word "wisdom" in the literature of librarianship, and still less in the literature of IT.

The Pyramid rests on the great world of Nature; in Systems terms, the environment in which we live, and with which we are in constant interaction to improve our understanding of it. It includes other human beings, who form part of that environment, and which we call Society, or Community. From our interaction with Nature we produce enough to maintain our existence, to keep ourselves in health and comfort. This is the basic level of life, and it is an appalling fact that, with all our technology, we have not yet succeeded in organising society so that we achieve this aim for all the peoples of the world. We do not do much better than the animals, which we also exploit as part of the environment.

But at least we are conscious of this fact because, in the course of centuries, we have learnt to create systems of ideas, and systems for recording ideas, and this enables us to create civilisations which transcend the limitations of time and space. We have produced, collected and organised records in libraries, some of which have survived catastrophes like wars and earthquakes. We have gone

beyond the scope of the individual experience and memory, and have reached the level of a social memory, a library. We have the series:

Nature - Mankind - Investigation - Documents - Social Memory

In our interaction with the environment, we learn to recognise and distinguish between sensations, or percepts, and this is the first stage of cognition; it gives us what I know as "data", the single items of consciousness and thought. While these data have not yet been organised into systems of relationships, they have no special significance for us beyond the fact that they are there. They exist in the universe, whether we know about them or not. But thanks to the inventions of writing and recording, of libraries in which to keep the records, we do not have to discover every last fact for ourselves, over and over again in each generation.

But the data do not just lie around in the mind, like peas in a bag, but are organised by the relations of one to another into systems of ideas, and these are what I know as "information". The distinction is real because the process of organising is real and requires a conscious mental activity. It is possible because we have the power of the imagination: we can convert the isolated percepts into organised concepts, and this is the secondary stage of cognition.

It is certainly true that science advances through the patient accumulation of masses of facts, but scientific creativity consists of much more: recognition of relationships, and organisation into systems of ideas, information which has human significance and can provide a guide to action, what to do for the best in particular circumstances. There are fewer systems of information than there are bits of data, but they have a higher content of meaning, they have received some input of human imagination.

So we have two different types of question that may be put to a LIS: factual and referential. Any computer can provide the answer to a factual question, because the answer is a statement of fact, a bit of data. The answer to a referential question is not a statement of fact, but reference to several systems of facts, systems of ideas, organised and presented by many authors, past and present, at home and abroad; there must also be a store where the sources referred to

may be found, and we must also have leisure to read, ponder and pass judgements on what we read. Only thus do we pass beyond information. and gain knowledge.

The distinction I draw between information and knowledge may appear to be over-subtle, but I believe that it is real nonetheless. I describe knowledge as a system of information which has been assimilated into a human mind and thus given a pattern or structure which is unique. Every human being has a unique life history of experience and activity, including the activity of reading and the use of libraries. Each one of us has our own system of information, and this is what I mean by the word knowledge. This is more than a store of information, even though most of its content may be public, known to other people. But nobody knows just what I know, and however hard I try, and however patient my audience may be, I can never say everything I know. I may be able to communicate information; indeed, that is one of the reasons why I am here. But I cannot communicate knowledge.

I note that the same conclusion has been reached by workers in the former Soviet Union, summarised by Manfred Bonitz: "Knowledge is local, it is peculiar to a certain person at a definite point in time" (Note 7).

There are more separate bits of data than there are systems of information, and there are more systems of information than there are systems of knowledge. But the systems of knowledge have a richer content for each human being, because they form an integral part of the human personality.

And at the apex of the pyramid stands the concept of Wisdom.

Now just as it requires the intervention of a human mind to transform information into knowledge, so it requires another new element to transform knowledge into wisdom. This element consists of the individual person's life in a community, and the means by which knowledge can become wisdom through social experience is communication. Libraries and information systems hold a central position in this process, by virtue of being the social memory.

In the practice of librarianship, we have the responsibility of making the process easy, by inventing systems for storing and retrieving information from the records of civilisation, the social memory, so that it becomes easily accessible to our fellow human beings. We can play an active role in helping them along the path to wisdom.

Wisdom is founded on a wide knowledge and deep understanding of all the facets and events of life in a community, that is, on our relationships with living people, including the indirect relationships we have through books. And it is a curious thing that, while we may not be able to communicate our knowledge, we can, if we are wise, communicate wisdom because wisdom is, so to speak, the distilled essence of knowledge, and not the whole of it.

If this were not so, the wise women, and the wise men, of the tribe would not be able to guide the tribe in the search for what to do for the best. These elders represent the collective knowledge of their community; they are the "community personality", and epitomise its "culture" - its whole way of life. We are all shaped by the culture in which we grow up, and it is this social being which helps to shape our individual personalities. Without it, we cannot hope to attain to wisdom. Ancient tribes which had few or no records, or libraries in which to preserve them, had to rely solely on the recitations of the elders for their attainment of wisdom. We are more fortunate, we have the means for defying the limits of time and space; even if we do not always make the best use of them, the opportunities are there. Librarians have the responsibility to see that they are so used.

Indeed, this is one of the factors which make possible the exercise of the creative mind. For just as data and information lead up to knowledge and wisdom, so in its turn wisdom leads to an enhancement of personal knowledge, and the chance of new input into the store of public information - the reverse process, downwards in the pyramid of wisdom.

The discovery of new knowledge for ourselves, then, means the assimilation of public information into our unique context of thought. ie can establish relations

between ideas and concepts which are not available to anyone else, because no-one else has precisely the same system of information available. The creative power of our imagination enables us to detect what might be possible, even if no-one has thought it possible so far. W.I.B. Beveridge has brought us back to Archimedes: he calls it "the Eureka situation". "By intuition", he says, "*from random juxtaposition of ideas*, I mean the sudden linking of apparently unconnected ideas or pieces of information to form a new, meaningful relationship" (Note 8). Through the communications media, including LIS, these private leaps of the creative imagination can then be related to public information, and so contribute to the advancement of our civilisation.

How, then, may we define a fruitful partnership between our twin professions of librarian and information systems scientist in support of this adventure in creativity, and the pursuit of wisdom? If it is the nature of the creative mind that it sets out to grapple with the tensions and contradictions in the "paradigm", as Kuhn calls it, it follows that first of all one must know what the paradigm is (Note 9). There is no sense in grappling with problems in a state of blissful ignorance that someone has already solved them, The great fear of the research worker is that this may happen, and we all know that it does. Who invented the calculus, Newton or Leibnitz? The first duty we have, therefore, must be to provide all the information we have in our libraries about the paradigm, and indeed, "state of the art" surveys have become part of the expert information service.

Public information, integrated with personal knowledge, can together make the imaginative leap that characterises the creative process, and the combination is unique because personal knowledge is unique. But the sudden linking of apparently unconnected ideas becomes recognised as a truly new advance because it rests on a knowledge of public information accessible through a good LIS.

The distinctive element in wisdom is that it derives from social relations, and professional wisdom derives from relations between LIS staff and their community of users. Each LIS has its own community, with its characteristic

culture. As we know, one of the features of the special library, particularly in industrial science, has been for a long time that the staff play an active role in promoting the interests and activities of the organisation; there is a powerful self-interest in this: if the organisation prospers, the LIS staff also prosper. This is a stimulus to achieve a high order of professional skill, particularly in the business of anticipating users' needs before they are expressed. Nothing pleases the Director of Research more than finding on the desk information from the librarian which answer the very question the Director was about to ask.

In a paper to a Conference of the Scottish Library Association some years ago, I talked about the way in which, despite political discord, even war, the literary relations between the Scots and the English had remained fruitful and harmonious, and I used this to emphasise my point that information systems and services should cover the whole spectrum of human experience, the universe of knowledge, and help to promote the integration of different branches of public information (Note 10). Many colleagues have objected that this is a gigantic enterprise, beyond the resources of our profession. When I see men walking on the moon, or staying circling around in space for months on end, I find this a sadly defeatist argument. I have no doubt that if our profession grasps the splendid opportunities offered by advances in IT, as you have been discussing during this week, such objections will be shown up for the feeble things they are. It will require understanding of the nature of data, information, and knowledge. But I have no doubt that as your librarians and information specialists create and maintain a fruitful partnership between the social memories in libraries, and the efficient retrieval provided by modern IT, you will make a substantial and characteristic contribution to the realisation of your country's goals, to the quality of life of your people, and to the attainment of wisdom.

Endnotes

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