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ESSAYS PRESENTED TO ROBERT CRAIG

CHAPTER 6

DEVELOPMENTS IN INFORMATION TECHNOLOGY, NETWORKS AND SERVICES

DEREK LAW

The background

While there is some common consent that we are moving to an information society which will be based on a knowledge economy, some of the macro-trends to be seen in Scotland are worrying. New demographic projections show the Scottish population in decline and set to drop below five million, while month on month figures at the end of 2001 show Internet usage in the UK dropping for the first time. The former represents not only a declining birthrate but the traditional Scottish problem of exporting its most talented individuals, now those best equipped to deal with the emerging information society. The latter may reflect a growing disenchantment with the internet. One cause at least may be the failure of the telcos to deliver high speed connectivity to the home. Whatever the cause it would be difficult to base a knowledge economy on declining internet usage if the trend persists.

However, within Scotland itself there is a vibrant information science sector. Although only two universities (Robert Gordon and Strathclyde) have long-established departments of information science of the traditional sort, with the function of training librarians, at least four more have departments or groups working on elements of the information sector. In addition, the National Library of Scotland, the Scottish Consortium of University Research Libraries and the Scottish Library and Information Council have been keen proponents of digital libraries and related research. There is a wide recognition that, in a small country, moves towards significant resource sharing will be essential. That recognition does not however extend to the Scottish Parliament's Enterprise and Lifelong Learning Committee which noted that 'It does not appear, on present trends, that the main universities will become powerful drivers of the knowledge economy'¹, although it is unclear whether this says more about the Committee's lack of perception, or the universities' lack of marketing. Against that may be set the experience of small nations from Finland to Singapore², which have shown that national planning and government support can deliver fundamental change.

These larger trends may be taken to suggest that the move towards an information society is not a 'given' in which the only issue is the pace of change. However, the vibrancy of the public information sector, the access which we have to government and policy makers in a small country, and Scotland's long tradition of social and public service give grounds for believing that we can take advantage of government support to deliver the developing vision of Digital Scotland³. This initiative aims to 'achieve universal access to the Web, bridge the digital divide and help people achieve real benefits from the Web in their day-to-day lives ... [and] to make Scotland a world class digital nation'.

Technological, economic, sociological and governmental factors

The development of the infrastructure to support an information society is a seriously complicated endeavour much closer to rocket science than to plug and play. The skills associated with that development lie largely in higher education, where the Scottish Higher Education Funding Council's (SHEFC) early decision to invest in Metropolitan Area Networks – urban based broadband networks aimed at the research community – has given Scotland a significant cadre of experts in networking. Technology has, however, proved a never-ending treadmill, with a dizzying pace of change. Insofar as any trends can be detected, perhaps the most important are ubiquitous computing and the convergence of hand-held technologies.

Ubiquitous computing revolves around mobile computing devices. Although these have comparatively slow data transfer speeds compared with desktop devices on high speed networks, this is increasing rapidly and is in any case more than adequate for almost all normal and educational purposes. Coupled with operational Bluetooth enabled equipment, this wireless technology allows computers to be used anytime, anyhow, anywhere.

Although most laptops remain too heavy for easy casual use, a blizzard of new converged devices is emerging into the market place, from small sub-laptops, to Web-enabled mobile phones with MP3 players and handheld personal digital assistants (PDAs) with e-mail capabilities. This technology clearly has a long way to go, but we may expect soon to see acceptably sized devices which can cover all document and communication needs. This comes very close to the concept of wearable computing – a dream of mad scientists only three years ago!

However, technology is a necessary, but not sufficient, condition for the development of a knowledge economy. There is little value in placing technology on top of existing dysfunctional institutions. We need to build an Internet civil society which develops people rather than machines and which can understand that e-mail is more important than the Web, and that content production is more important than content consumption for a knowledge society. In fairness, investments in projects such as the Scottish Cultural Resources Access Network (SCRAN) and the NOF (New Opportunities Fund) funding for content creation suggest that this message is at least partly understood.

Much of the hope for the development of a knowledge economy must come from the development of an education system which itself recognises the use of technology in education. At present, we have in most cases what is known as 'The Vesalius Conundrum'. Were Vesalius to return to a university teaching hospital, he might enter a ward and would watch helpless and uncomprehending as surgeons carried out keyhole surgery on the heart. However, he could then enter the medical school and quite happily give a lecture to anatomy students on the circulation of the blood. This trend is changing, with the wish to move from 'sage on the stage to guide on the side'. Coupled with this conundrum is a growing failure to value information skills. This stems from the growth of the group described by Pluchak⁴ as 'the satisfied inept'; those who, because they can use the Internet for searching, assume that this is all that is required; those who confuse ease of use with ease of understanding.

At a UK level, all governments for the last thirty years have failed to understand that machinery does not fix social problems and institutions. A whole string of initiatives revolving around the concept of technology in the classroom have assumed that the placing of technology in educational settings will produce technologically gifted students. Uniformly, they have failed to provide adequate training, support or content, failing to grasp that the real costs and skills are associated with technology ownership, not technology acquisition, and that social issues and social organisation will determine the adoption of technology.

The Scottish Executive may be showing more prudence. Its Digital Scotland initiative does have a focus on technological infrastructure, but the appointment of programme advisers from the education and information sectors gives hope that there will be a real understanding of such issues. It must certainly rank as some form of achievement to have had a government minister solemnly declare the importance of metadata! The government agenda for a digital Scotland has two key features. The first revolves around social inclusion and remedying the democratic deficit. Technology has huge potential here, whether interactive broadband to the home, or wireless computing to personal devices. The digital divide is a pat phrase, covering many ills but describing a societal problem of great import and magnitude. Early attempts to tackle this can only be welcomed, provided that it is recognised that, ultimately, what will deal with these issues is not the technology itself, but content, training and support. The second key feature is open education and lifelong learning. Although Scotland has commendably high participation rates in tertiary education, there remains a significant need for lifelong learning, continuing professional development and re-skilling – issues which a variety of initiatives, such as Glasgow’s ‘Real – the Learning City’, are attempting to address.

A final challenge for government is not just to offer appropriate skills to its population, but to persuade them to remain in Scotland and help develop the Scottish knowledge economy.

The development of IT and networks

The Bangemann Report⁵ for the European Council infamously proposed that the creation of a network infrastructure was the responsibility of the market and not of the state. This conclusion was perhaps weakened by the author’s subsequent employment by a private sector telecommunications provider. Almost by definition, such networks will not stretch to non-profitable areas of the community and it must be the responsibility of the state, whether by direct provision or by contractual requirement, to ensure equal access for all.

Oddly, this has been recognised even in a UK driven by market theory. JANET was created at the height of the Thatcher era and has been followed in turn by NHSNet and the People’s Network. Each of these networks has recognised the desirability of connecting its entire community, to the benefit of all. The People’s Network is the latest recognition of this. This triumph of the Library and Information Commission is currently being rolled out and, although the funding is being bid for at local authority level, the clear intention is to build a distributed, rather than an incoherent, system.

Thus far, and most regrettably, there has been precious little interaction between these network sectors, despite meetings, seminars, projects and research. The philosophies of JANET (open network) and NHSNet (closed network), but both centrally organised, differ from that of the public library network, which is open, but locally managed. It is otiose to attempt to ascribe blame in all of this. JANET began first, simply because higher education had a greater and earlier need for high bandwidth than other sectors. The fact that this need stemmed from research possibly gave higher education rather superior notions of who they might talk to, but this has long gone and there is now a general desire for co-operation which only 'the system' and departmental budgeting prevents.

Robert Craig famously described this in a Scottish context, noting that we now face the prospect of building three tramways from Edinburgh to Glasgow rather than a single, fast Intercity service. There are some small signs of hope, in that JANET now extends into further education and some schools; local authority connections into schools can hardly ignore this. NHSNet looks much more difficult to link, but again one must hope that a small country will find it easier to rationalise and organise the management of scarce resources and be less patient of turf wars.

National initiatives

The arrival of the electronic library in the UK could be dated from 1990, when the Computer Board of the then University Grants Committee and the Research Councils decided to – or at least was persuaded to - invest in a national site licence for *Science Citation Index* for higher education. This developed as the BIDS service at the University of Bath⁶. This ultimately led to the Follett report and the major post-Follett series of projects and new services, all of which ensured that the information revolution remained high on the agenda of all universities for the following decade. A whole plethora of initiatives followed, initially mainly for higher education, but culminating in the People's Network and a £50 million programme for content creation from the New Opportunities Fund.

Tentative steps towards cross-sectoral co-operation were mounted by the Research Support Libraries Programme. These have really only borne fruit in Glasgow, where the Glasgow Digital Library has been set up as a cross-sectoral project embracing university, college and public libraries within the city and creating collections of digital resources of common interest on topics such as Red Clydeside. Even there, progress has been made in a rather slow and limited way.

More encouragingly, the British Library took possession of its magnificent new St Pancras building and was able to turn from a period of introspection to a more outgoing approach to partnership. This has led to the British Library's Co-operation and Partnership Programme⁷ whose main strand, the Full Disclosure project, aims to make available all of the nation's resources through a programme of retrospective catalogue conversion. Although this involves relatively small sums, the new leadership in this area suggests a welcome desire to break down sectoral boundaries.

Within Scotland, a consistent attempt has been made to develop a national strategy and national systems for the sharing of library resources. Much of this has been based

on work commissioned from the Centre for Digital Library Research at the University of Strathclyde⁸.

But perhaps the best example of cross-sectoral and cross-domain activity has been the aforementioned SCRAN⁹. This rich resource has proved an excellent example of nationally planned sharing of distributed resources. It has been much admired internationally and is a tribute to what vision and leadership can produce.

The creation, purchase and distribution of information

Singapore has quite properly had much praise for its vision of the intelligent island. Behind that lies a vision of the trading future of that country as an information entrepôt for South Asia. From this would seem to flow the concept of information arbitrage. This has a number of dimensions, as yet largely unexplored, although all would seem to stem naturally from a reformulation of Ranganathan as 'the right information to the right user at the right time'. Naturally and firstly comes the identification of the right product.

As information becomes a global commodity, so it can begin to be traded on that basis. *Medline* and *ERIC* can already be acquired on various bases, ranging from free to expensive, depending on how much added value the supplier provides. A next obvious step is time-shift purchase. It would make sense for UK libraries to purchase night-time only access to Australian based data (ie, day-time access in the UK), in order to smooth loads. Despite the rueful and widespread remark that WWW stands for World Wide Wait, little if any thought has thus far been given to database topology and how it can be bought and sold in relation to time. More generally, this can be seen as using professional skills to optimise value for money. Although initial interest has focused on content, there is a growing understanding that there are possibilities for new ways of offering services. Particular initial interest has been shown again in using time-shift to provide round the clock reference services in partnership with libraries in Australia. This would take advantage of the swiftness of Instant Messaging to use a fully staffed day-time library in Australia to deal with the minimal level of overnight inquiries in Scotland and *vice versa*. For the sake of some initial cost, but then marginal activity, it appears that an undreamt-of degree of comprehensiveness can be offered. We may expect that this initial thinking will lead to a flowering of distributed services whose costs can be borne jointly where they could not be supported individually.

Identifying Web sites is also a more complicated issue than at first appears. Initially, we have concentrated on the simple issues associated with quality. Which site is the most comprehensive and most accurate? At the same time, we note ruefully how inaccessible some sites are and that the average life of a URL compares favourably with that of butterflies, but little else. As yet, there has been almost no interest in developing an equation balancing accessibility with quality. Is a site which is 100% comprehensive, but effectively available only six hours a day, superior to a site which is, say, 75% comprehensive, but effectively available 24 hours a day? In other words, might the Pareto principle – the 80/20 rule – apply to information?

However, even if these new roles are developed and explored, the key role of the librarian remains the same as ever: to be independent, authoritative and right, through

the selection and provision of access to reliable resources which meet the needs of the client group

Implications for providers, libraries and users

Four major areas of activity pose challenges. The first challenge is content. Content selection is not in principle different from the work of a traditional acquisitions department. However, a range of options is beginning to open up which will make this a more complicated process. There is a growing interest in consortial licensing for regional groupings. The best deals seem to come with cross-sectoral agreements, where the whole educational system can be brought together and schools and colleges given access to research materials, effectively at marginal cost. However, there is also a need to consider the cost of mirroring information, as opposed to providing bandwidth to access it. At present this is a fairly tortuous process. There are no standard agreements for mirroring data and even at national level between government agencies, these can prove tortuous to provide. Famously, and after two years of negotiation, the National Institutes of Health's *Visible Human* database was only mirrored in the UK by placing it at Glasgow University. The NIH were worried about the potential longevity of the host and arrangements in case of failure. These worries only disappeared when it became clear that Glasgow University pre-dated Columbus's voyages to the Americas.

Much (too much?) energy has been expended on exploring purchasing models, considering subscription, leasing, purchase, pay-per-view and so forth. This has effectively been a debate conducted in the science-technology-medicine (STM) arena, focusing on expensive, big science journals. While expense is of course important, science nevertheless remains a minority activity in most institutions and there is a grave danger that we are developing models aimed at a minor sector of the market. Whether such models will be apt for small learned societies in the humanities is rarely considered. It is also at least arguable that we shall generate more 'free' and non-commercial material in an electronic environment and should therefore concentrate on developing models which look at the economic issues of data ownership, rather than at considering purchasing models which preserve the rights of global corporations. If such ideas as the Open Archives Initiative take off, the developing STM model will be seen as a temporary aberration rather than a path to the future.

A further important aspect of content is its creation. This is first manifested in the identification of content for creation. Commercial providers tend to digitise text-rich and therefore less expensive material, which is heavily used. Libraries tend to choose image-rich but relatively little used special collection and copyright free material, creating resources closer to exhibitions than publications. As both groups gingerly get to grips with the impact of digital material, the two approaches are both understandable and usefully complementary. A variation of this comes with born digital material. In truth, most published material is born digital these days and then converted to paper, but more dramatically, a whole range of new database resources has opened up, ranging from the images created by digital cameras, to satellite data, weather maps, genome databases, speech recognition, census data and so on.

In passing, one might note that much time and effort has been devoted to issues of intellectual property rights in content. No satisfactory agreed position has yet

emerged between, at one extreme the proponents of open systems, such as Ginsparg¹⁰ and Harnad¹¹, who believe in the free exchange of ideas, and leisure corporations, such as Disney, who see education as an extension of the entertainment industry. Some see this as a great barrier to digital developments, although another view is that the charging of VAT on electronic content is at least as big a barrier to its growth. While librarians have debated this with publishers in a rather isolated way, it has been enormously cheering in the last year to see the petition signed by 30,000 scientists from over 170 countries¹² calling for changes in the basis of journal publication. For the first time, it appears that scientists may be beginning to debate the future of scholarly communication. It may then be hoped that a new consensus will emerge eventually within the academy.

This leads to the second great challenge, which is in metadata. With some complacency, librarians are prone to amused commentary on the stumbling efforts of computer scientists to address metadata issues and to discover that the organisation of knowledge is indeed a difficult topic. However, our own profession's response of simply adding another field to the MARC record does not inspire huge confidence that we have undertaken a fundamental reappraisal of information in electronic formats. It is at first sight difficult to understand how systems designed for the description of unchanging physical objects placed in a single physical location are necessarily ideal for the description of changing and dynamic electronic content replicated in different forms at different places at different times. Nevertheless, metadata is our own area of professional competence and much time, effort and research are being expended on addressing these issues.

The third grand challenge is preservation. Preservation has been a major stumbling block to an enthusiastic switch to electronic collections. Much loved scary tales of changing technologies, of the real life-span of new storage technologies, of the problems of embedded software, have all contributed to an environment where it seems more prudent to retain the paper copy. Nor is it clear who 'owns' the preservation problem – publishers, national libraries or authors. In practice, significant research expenditure is beginning to bear fruit and projects such as CEDARS¹³ (CURL Exemplars in Digital Archives) at Leeds University and NEDLIB¹⁴ (Networked European Deposit Library) at the Royal Library in The Hague are beginning to show potential solutions.

The fourth and final challenge may loosely be described as user support. Law's Law¹³ decrees that 'User friendly systems aren't'. One of the expanding roles of librarians will be that of providing the initial training and ongoing support which will allow users to gain the most from systems. This author finds it no coincidence that the drive for single authentication and logon, as embodied in the ATHENS¹⁶ system for higher education, was developed through the former NISS service at the University of Bath in response to user need, rather than through commercial pressure. Commercial systems, it may be noted, chose to develop Digital Object Identifiers, a system of potential benefit to commercial suppliers, but of no real use or value to users.

Quality management

Older heads will remember the Youth Opportunities Schemes of the 1970s. Although primarily designed to curtail unemployment, it supported large numbers of projects in

libraries. These varied from catalogue retroconversion to major indexing projects, notably of local newspapers. These created a huge and rich resource which has largely been allowed to disappear through neglect. A recent attempt by this writer to discover the fate of one project revealed that the data were not simply created on now unplayable media, but that in any case the originals had been lost. This fate seems to have been replicated. While the waste of several million pounds in this way might seem comprehensible in the context of what was really a job creation scheme, the same fate seems to be approaching for the £50 million of data and metadata created via the Non-Formula Funding for Humanities programme. The Web site for the programme is now very difficult to find on the Web and when it is found, the data is progressively surrendering to entropy as links are broken and Web sites moved. It is to be hoped that the same fate does not befall the NOF funded projects, but, sadly there seems little effort thus far to learn the lessons of the past and to ensure that a preservation strategy is in place before the data are created.

A key issue in the failure to preserve data may be the absence of any recognised standards for data centres and, by extension, the absence of any authorised data repositories to manage and preserve both digitised and born digital material. Quite apart from the technical issues of media changes, technological obsolescence and media life-spans mentioned above, there is a range of issues such as version control, refresh rates and authoritativeness which have so far not been addressed. The imprint says a great deal about a book and its probable authority and we have expectations of the standard and quality of a work from, say, Edinburgh University Press. On the other hand the electronic address ed.ac.uk can (and does!) imply anything from material by a Nobel prize-winner to illegal or simply wrong information from a hijacked address. Some form of kite-marking of repositories will have to be brought into place to ensure trust and authority.

Although electronic legal deposit has been much bandied about and is a necessary and desirable step, it is less obvious that national libraries are the natural and normal repositories for these electronic data. To be sure, they must have a role in organising the deposit of electronic data, but, rather than recreating vast new structures, the standards and models to be followed may be better found in existing national data centres, such as EDINA at Edinburgh University.

Cross-sectoral activity and problems of sectoral boundaries

Cross-sectoral working was an issue high on the agenda of and much addressed by the Library and Information Commission, which believed passionately in it and which used its authority and its small pot of research funds to drive forward co-operative activity and to develop the People's Network initiative. Sadly its successor, Re:source has shown little interest in continuing this much admired work at a UK level and has even removed the pot of funding previously dedicated to library research. Fortunately, at a Scottish level, the Scottish Library and Information Council has provided a vehicle for ensuring that there is good library co-operation in Scotland, while the National Library of Scotland has also provided useful fora and partnerships for co-operation.

Despite the Scottish claim for a tradition of working together, much work has tended to be sectorally based. We can already see barriers and firewalls being erected

between different communities and it is important that these are broken down and a climate of trust created. For the first time in recent memory, the availability of money is not the first and over-riding concern. Much more important is the need to build trust so that local government can work with higher education, the health service with industry, even Glasgow with Edinburgh. Since devolution, Scotland has found a new sense both of community and purpose and there can rarely have been a better time to foster and improve community relationships. The Scottish Executive has a major role to play in facilitating these interactions.

The goal for all small countries must be a distributed national resource. The recent financial problems which have beset the National Library of Scotland¹⁷, forcing it to close the Scottish Science Library, have been a useful reminder of the need to maximise and share the range of resources in a situation where there are few, if any, comprehensive collections.

Conclusion

Robert Craig has worked tirelessly for the goals of sharing and co-operation across all sectors and for the role libraries and librarians should play in the transformation of Scotland to a knowledge based economy. Another Craig, Craig Brown, the former Scotland soccer manager, shares his sentiments on how that will be done. He remarked at the start of the Euro '96 campaign that 'Bagpipes and claymores won't win us games.'¹⁸ Only skill and competence win games. Both Craigs are determined to see a future Scotland with skills and competence in abundance.

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