

CHANGING LANDSCAPE FOR THE INFORMATION PROFESSIONAL

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The first 'information age' was slow to evolve. The second, the 'Internet information age' has exploded. It provides a communication revolution for the citizen and industry. The role of the academic, the student and support services, including the library, must undergo enormous change.

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The first information age

Archaeology shows that man was carving on the tooth of a Woolly Mammoth 47,000 years ago; we have the oldest known animal carving [Marshack 1993, p15]¹ from 30,000 years BC and from 28,000 BC we have the phases of the moon carved into bone [Marshack p14]. During the next 25,000 years man developed the use of clay tablets and by 2,200 BC we have documents written on Papyrus and in Greece in 530 BC we have knowledge of a library. It is significant to note that in AD105 T'sai Lun invents paper and by 600 books were being printed in China. However it is not until 1309 that paper is known to have been used in England. The Europeans started to use the Chinese method of block printing and in 1453 we have the Gutenberg 42-line Bible being printed; 200 copies of the two volume Bible were printed using metal plates and about a quarter of all the originals created survive today. It is interesting to note that by 1814 steam-powered presses are printing *The Times* and just a few years later in 1839 Fox Talbot in Laycock, England is experimenting with black and white photography from negatives and by 1873 colour photography is being tried [Gernsheim, 1982]². Perhaps the next major arrival to impact upon printed text is the computer. The CD-ROM invented in 1985 allowed 270,000 papers of text on a single CD and opened to question the whole future of printed material as a subject for debate.

The history of the computer is nowhere nearly as interesting and for many of us it is a history that we have in part or fully lived. The stored programme computer was born in Manchester University just 51 years ago with the birth of 'Baby'. The evolution of the computer is easily traceable, and perhaps the most significant impact on the world of information came with the arrival in 1975 of both the PC and the Internet. Moores's Law states that the

performance of silicon microchips doubles every 18 months at no extra cost. It is likely that this law will be continued for at least another 10 years from now. Around 2000, with the next generation of processor chips, we can expect these to be exceeding 10 billion instructions per second. Similarly we can expect the memory chip to double the storage per dollar every 18 months. The PC, initially not seen as a consumer device, being expensive and restricted in performance, quickly evolved as a tool of the workplace and home. Moore's Law has resulted in microprocessors being embedded in a huge range of devices, (99% of all microprocessors are used as embedded devices), ranging from the child's toy to the washing machine. We are yet to see the results of these devices communicating with each other to predict and interpret our needs. The Internet was initially a research topic and tool developed in the late 1960s as an American Defense Department experiment to link computers in American Universities. Twenty years later it remained largely a research tool of the academic researcher and slowly it became widely accessible to the wider academic community including undergraduates. As students entered industry and commerce it became a perceived requirement waiting for a key application to justify the cost. The development of the World Wide Web (WWW) in 1989 and the multimedia browser in 1993 transformed the Internet to a tool - a pervasive world-wide environment for access to information and communications. By the end of year 2000 there will be in excess of 500 million Internet users. In the UK, of the 24 million households 6 million have a PC and 50% of those have a modem and are capable of accessing the Internet. A single change in the marketing of the net, free access from Internet Service Providers (ISP) has transformed the take-up of usage with a rapid explosion over the last six months. The Internet will be the network for access to information and entertainment. The current distribution networks for books, newspapers, journals, etc are based on diesel and will be threatened. The major bookshops have taken the threat from Amazon seriously and many have responded by establishing their own online bookshops but perhaps this is only a partial transformation towards the second information age.

The second information age

The computer and the Internet share some interesting characteristics of product cycle as compared with other technological developments in the marketplace. The PC has shared a rapid evolution into the marketplace with take-up of ownership having similar characteristics to the video recorder and domestic microwave oven but at a far steeper rate of acquisition. The Internet is likely to be significantly more rapid in its rise to market saturation due to new developments in terms of fast low-cost modems, ISDN based access, and emerging technologies such as Web-tv through the so-called 'set-top' box. The ubiquitous set-top box will provide interactive high-resolution TV services, communications, access to Web content, and a games console combined into a single low-cost unit. It is likely that the set-top box will carry either JAVA or a 'light' version of the Microsoft's Windows operating system such as Windows CE. Microsoft will be a dominant player as a consequence of their current dominance with 90% of the worlds computers (excluding games consoles) running their operating systems. However, development of the PC itself, with processors capable of accurate speech recognition may push the expectations of the set-top box yet further. It is worth noting that it is claimed in trade press leaks that the Sony Playstation-2 will be an order of magnitude more powerful than its predecessor; the processor of the Playstation-1 will be used as an I/O handling processor for the Playstation-2. It is anticipated that there will be ample capacity for voice recognition in this system and there are no plans for a keyboard interface. Inevitably the marketing of the system will be heavily subsidised on the assumption that income is to be generated from the DVD games it will run, or from the Internet games based on pay per use that will be accessible using the system.

The current storage of data on devices attached to the computers of the Internet is estimated to be about two exabytes and is growing rapidly due to the impact of Moore's Law on the cost and capacity of storage media. It is reasonable to assume that society will wish to digitise all non-electronic information content (writings, compositions, performances, recordings, images, etc.) over the next generation or two. Surprisingly, [M. Halper, 1997]³ this has been estimated by M.

Dertouzos (director of MIT Computer Science Laboratory) using calculations based on the requirements to digitise the Library of Congress (LOC). Using the LOC to scale to the world's treasure of resources, which he claims to be 10,000 LOC, this then requires less storage than that currently existing on the computers connected to the Internet. Given the on-line storage is estimated to grow by a factor of 30 over the next three years the additional requirement for a single copy is 'minimal'. However, even if the world's information was digitised we would require much improved mechanisms in electronic information management with search engines and information tools an order of magnitude more capable than those of today. It is inevitable for many physical resources that the requirements in terms of digitisation for certain objects of an artistic nature will change as techniques for representation change over time. However, for text and images high resolution digital representation should provide a firm foundation for most users requirements.

The technological revolution

The ease of doing E-commerce is a major source of disruption for many industries. E-retail is currently about selling physical goods electronically and distributing direct to the customer. However, there is an ever growing market for goods that need have no physical existence, information, computer-games, multi-media services including films and audio, software, etc. Many Internet based companies have very high share values on the world's stock markets, whilst never having delivered a profit. The market has confidence that there is enormous potential, however, the impact on traditional markets and suppliers may depend upon their ability to make predictions and react rapidly in response to perceived needs.

Today, we consider the PC in much the same light as yesterday we thought about the mainframe. It was a visible symbol of the power of the computing age that was managed, maintained and upheld. Today, and certainly tomorrow, we might have several PCs but increasingly we will own households full of appliances containing processors. There will be no need for computer literacy as these processors in our environment

will communicate and collaborate with each other to learn from our behaviour and predict our needs. It is likely that 'intelligent' clothes will mean that we are wearing processing capability that will travel with us and communicate in the environment. In many ways we are partially doing this today, the mobile phone is full of processing power and it communicates with the environment and tells it our current location so that we may be called and make calls. Imagine a world where our location and actions are constantly 'monitored' so that for example before we reach home the heating is enabled, the food prepared and cooked, and as we enter the security system acknowledges our arrival and media system has our favourite entertainment waiting to relax us.

The student and society

Consider the student in the widest sense, i.e. from child at school through to graduate/post-graduate and life-long learner. Education is more important than just preparation for employment; it is about citizenship and cohesive societies. Education consumes a high percentage of the national budget with a 'free' school place for every child and varying degrees of financial support throughout the lifetime of learning. The information society might easily partition the global society into those who do and those who do not have the skills and funding to support access to the information age. The ability to operate in an information culture is likely to be vital. The skills are learnt through a continuous experience of education and learning. It is perhaps worth considering what are the outcomes of this education, clearly it about employability. However, the failure to provide the basis of a good education has a serious impact on society as the disillusioned or poorly motivated juvenile is likely to become a continuous financial drain on society. At the minimal level this will be through the demands on the welfare state supporting the unemployable uneducated underclass. However, the uneducated often will not support the cohesive society and resorts to vandalism, crime, drug taking or trafficking, etc. There are twice as many youths currently held in secure environments compared to just a few years ago. The costs related to all aspects of juvenile crime

including prison, vandalism repairs and the insurance costs for this aspect, injury compensation and healthcare, etc. exceed the total cost of the education budget provided by government funding. It is thus vital that society should have a real concern to ensure that, wherever possible, juveniles should not drop out of education and encourage progression to the limit of their capability. Emphasis should be given to ensuring that resources are focussed to meet and support education needs as student problems are detected; the costs to address the issues that might arise later for society will be far greater. Failure to ensure social cohesion is very expensive and non-productive.

The future and learning

What is clear is that: the 'experts' will over-estimate the changes that will occur in the next couple of years but also desperately underestimate the changes that will occur in ten. Universities are experiencing the threats of a changing environment that have been felt in so many industries. Education and health are the two global 'mega-industries'. It is inevitable that new providers will attack both markets, but education is to be challenged at a time when technology is impacting the whole *raison-d'être* of delivery of learning. It is thus essential that our institutions consider the implications for themselves of the changing environment. It is clear that skills with information processing, media-creation and content-creation are going to be essential for the academic or para-academic. In the UK there is growing regionalism and it is inevitable that institutions within regions will work more collaboratively and there will be a thrust towards subject centres and centres of excellence providing focussed support. It is vital that institutions plan partnerships with companies that have the expertise in marketing, advertising and sales in the global market. It is interesting that in Scotland a group of business men have decided that they should capitalise on their country's strength in the education sector and have established Scottish Knowledge [Scottish Knowledge]⁴, a venture to promote Scottish universities distance learning materials abroad.

In the UK there is confusion relating to the Government agendas for education. The Labour

Government has stated its prime objective for the nation as: "Education, Education, Education...". The Prime Minister said, "The information superhighway should not just benefit the affluent or the metropolitan. Just as in the past books were a chance for ordinary people to better themselves, in the future online education will be a route to better prospects. But just as books are available from public libraries, the benefits of the superhighway must be there for everyone. This is a real chance for equality of opportunity" [Blair]⁵. The Government has launched a number of initiatives including the University for Industry (Ufi), the National Grid for Learning (NGfL), the Public Libraries network, the Schools network, etc. The country is addressing the issues of regionalism through the foundation of the Regional Development Agencies and Regional Chambers. The commitment is clear but with a myriad of schemes it is difficult to see the strategy. It is clear that life-long learning is of growing importance, universities must expect to play an important role in delivering the content. However, the funding model is changing with the expectation that the student will make a substantial contribution to the cost of the education received either at the time the education is received or through life-long taxation.

UK universities through the Thatcher era were required to be more efficient in both teaching and research. To a large degree this was achieved through competition, selectivity, league tables, Research Assessment Exercises (RAE), Teaching Quality Assessments, etc. Unfortunately, UK universities are now naturally competitors fighting for market share and resources. The number and diversity of institutions has increased significantly with higher education now being commonly achieved also in the Further Education Colleges. There has been a significant increase in mature students and an increasing tendency for students to seek 'local' education as a consequence of the additional costs associated with living away from home. Inevitably, competition hinders collaboration. If effective competition is to be achieved in the global education market for distance learning then it is essential that UK universities learn to collaborate to compete. This is inevitably going to be difficult after the years of ingrained competitiveness.

The current funding model for UK universities is very complex and in my opinion unsustainable. It is inevitable that a simpler model based on the customer buying services will come about by stealth as the direct funding from government is reduced. The customer will of course be able to choose from a global market of suppliers, offering a myriad of styles of learning. The customer will have to balance cost against quality, as for any other market commodity. Institutions are today providing ISP (Internet Service Providers) services, i.e. our students are being provided with Internet access, e-mail, Web-access, etc. Certainly in the UK this model is unlikely to survive due to the changing demands of the higher education customer. The arrival of 'free' ISP services, where income is derived from a small overhead on the call-charge won from the telephony provider to the ISP, is proving very attractive and has increased the number of ISP customers at a remarkable rate. Once customers have established a network identity it is unlikely that they will want to adopt a new identity whilst studying, instead they will request that we use their own identity to which our IT systems will require to interface. Thus I would suggest the inevitable rapid change of role for university IT services from providing ISP services to that of being a Point-of-Presence (POP), where the role is to deliver access to content and services to the Internet as for many other suppliers.

The future and university libraries

The library is perhaps a similar symbol to that described earlier - the mainframe. It has a significant and visible existence with a substantial staff associated with its running. However, we are all aware that in many disciplines it is no longer geographically the first point of call for certain materials. Just as the iceberg under the water supporting that visible above, is far greater; the library has significant staff and infrastructure overheads not visible to the user. Just as for the PC, the user quickly 'forgets' that there is an enormous infrastructure under-pinning the access to services that are now so common. The issue for university libraries, as suppliers of access to information, data sets, and other e-resources, is the costs that are associated with this service. The available funding in institutions grows only at the

rate of RPI (Retail Price Index) whilst inflation in book stock exceeds RPI and inflation for journals and e-resources exceeds ten per-cent. This is exacerbated by the growth in number and diversity of the requirements of the customers. Libraries have traditionally purchased physical stock, monographs and serials, and made them available to their customers. Today, libraries often broker the purchase of electronic resources to make them available to customers, this might be CD-ROMs or on-line electronic information services. Is this brokerage a sustainable role? Would the customer not prefer to make direct access of any service and use personal purchasing power rather than brokered access to a restricted subset of that available. I believe the model for the life-long learner, employee, enthusiast, is one where the customer will inevitably not wish the overhead cost of the middleman brokerage function.

The task for universities is to ensure that we provide our customers with the best possible learning mechanism and support environment. This is not to say that there is a single approach, but rather the institution is adopting a particular market stance based on a distinctive style for its content that can be understood and appreciated by the customer. The task for us is to ensure that the interface to this content is consistent, simple and scaleable. The universities ability to make content available and to market that content in the global marketplace is essential. It will be necessary to provide mechanisms to ensure that the authentication and charging of the customer are appropriately undertaken. The support environment for the customer is likely to include knowledge agents whose task will be to support the learner and seek resources on demand. The major challenge for us is to determine from where the skilled content producers and supporters for the learners are going to be derived. Library staff are traditionally very focussed on customer support whilst the IT specialists are more focussed on the support of systems and their services. The academic is not a trained content producer and will rarely have the appropriate skill sets for the task. Clearly there is a 'new industry' role [T.N. Speake]⁶ for the supporters of the academic in terms of creating and updating the environments in which learning is to occur. The new information professional and knowledge mediator must be

