The future of books in an electronic era

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ABSTRACT

Books form an important part of human culture. They can be used to document, entertain, inform and instruct. Conventional approaches to book production have involved either manual or mechanical binding of sheets of paper in order to form an organised, structured, composite entity. New publication media now offer many alternative approaches to the creation of books and the ways in which they can be disseminated and used. This paper therefore discusses the growing importance of electronic publication. It then uses a case study to illustrate the influence that online books and other forms of electronic document might have on conventional publishing processes.

INTRODUCTION [Slide 1, 2]

Nowadays, books are an 'everyday' phenomenon with which virtually everyone is familiar. Indeed, these entities form an important aspect of almost every human culture. In order to understand the roles that these objects play, and the influence that they have on human beings, it is necessary to analyse their 'emergence' and evolution in terms of 'systems theory'. That is, we need to identify their position and function within the hierarchy of systems that make up the physical and abstract universes within which we ourselves exist.

[Slide 3] According to Checkland (1972), there are four generic types of system into which all others may be classified. He refers to these as:

- natural systems
- **[Slide 4]** human activity systems
- designed physical systems
- designed abstract systems

[Slide 5] From an egocentric perspective, human activity systems are probably the most important. This class of system involves individuals (or groups of people working together in a collaborative way) realising the goals and ambitions that they set for themselves - or with which they are confronted. Undoubtedly, two of the most important types of activity in which human-beings participate are: communication (both with self and with others) and cognition. **[Slide 6]** Cognition is important because it involves both conscious and involuntary mental processes which can create knowledge structures 'in our heads' (Rogers et al, 1992). The significance of these structures lies in the fact that, ultimately, they are responsible for all higher-order human behaviour.

[Slide 7] Bearing in mind what has been said above, it is relatively easy to identify the roles that books play within the context of human activity systems. According to Checkland's taxonomy, books are examples of 'designed physical systems'. Their purpose is to support the two types of human activity referred to above (communication and cognition). Along with other related artefacts, books enable us to communicate with each other through the exchange of written information; they also allow us to store vast amounts of static, visual material which can be used by individuals in order to initiate and sustain the development of complex and sophisticated knowledge structures (Barker et al, 1998a; 1998b).

Undoubtedly, since their conception some centuries ago, books have become an effective and efficient mechanism by which to communicate ideas, observations, commentary, legislation,

musical score, plays, stories, poetry, science, mathematics, and so on. Naturally, despite their utility, conventional books that are published 'on paper' have numerous limitations (Barker and Manji, 1988). It is therefore necessary to consider how alternative forms of book, that are published on other media, might overcome some of these limitations (Haynes, 1994).

[Slide 8] Naturally, changing the medium upon which books are published will have many 'knock on' effects. For example, the medium that is used to publish a book will strongly influence the properties of that book (such as its readability and its interactivity). Similarly, different media are likely to influence the availability of a book and the ease with which its contents can be created (writing factors) and/or accessed (reading factors).

Following on from what has been said above, the remainder of this paper explores some of the issues involved in using books that are published on different media forms - such as CD-ROM, computer hard-disk and computer networks. The next section of the paper therefore discusses the underlying reading and writing processes that are involved in creating and using books. This is followed by a discussion of the growing need for some of the new types of 'electronic book' that are now starting to become available as a consequence of readily available electronic publishing media. Some of the important aspects of electronic publication processes are then discussed and these are then illustrated by a short case study involving the development of an in-house intranet/Internet publishing facility for electronic books and online documents. Finally, some future possible developments in this area are briefly reviewed.

READING AND WRITING PROCESSES [Slide 9]

[Slide 10] Naturally, there are two basic physical processes involved in using books: writing (which enables books to be produced) and reading (which enables their contents to be assimilated). This paper considers the effects that different publication media have on these basic processes. By doing this it should be possible to assess what influence new publication media are likely to have on the production, distribution and utility of conventional books in an electronic era in which computers and digital information communication technologies are playing an increasingly significant role.

[Slide 11] For a variety of different reasons reading and writing processes have been extensively studied by psychologists and computer scientists (Card, Moran and Newell, 1983). Writing and reading are fundamental processes that require quite sophisticated combinations of both physical (motor) and cognitive skills. The nature of the skills required to facilitate these activities depends critically upon the medium (for example, paper or computer) that is used. This is especially the case for writing operations - which might involve using a pen or pencil, a stylus, a typewriter or a computer keyboard.

Of course, in many ways, writing and reading are complementary processes in that one deals with information output (from self to self or from self to others) while the other deals with the input of previously written information. This material might have been produced by self (for consumption by self) or by others. As is discussed below the self-self write/read cycle often acts as a useful and powerful aide-mémoire process.

[Slide 12] Writing is essentially an 'exteriorisation' process in which ideas and thoughts are committed to some external storage medium (usually either paper or a computer screen via a keyboard). There are three basic underlying motivations for writing activity. First, to communicate one's ideas and thoughts to others. Second, to enable us (as individuals) to overcome the limitations of our short-term memories (often, things which are not written down are forgotten). Third, to facilitate thinking and cognitive processing activities through self-dialogue techniques involving various types of write-read cycle. Naturally, each of these writing functions assumes an associated reading ability.

Reading is a process by which external material is 'internalised' (not usually in a verbatim fashion) and incorporated into appropriate cognitive structures - such as associations, lists, scripts, plans, schemata and mental models. During reading activities a variety of different types of filtering process are likely to take place in order to skip over material that is either already known or which is redundant or unimportant. A range of sophisticated information extraction processes are then used to 'pull out' the important items from a printed corpus of material. Obviously, the ease with which information can be extracted will depend upon the ways in which the important ideas are coded and expressed.

[Slide 13]Naturally, people's abilities with respect to reading and writing skills will vary considerably
depending upon their innate characteristics and their prior experience. Their abilities will also depend upon the nature of the media involved. In general, because of the types of motor skill that are employed, reading processes tend to proceed at faster rates than writing processes -

although these rates will depend upon the relative complexity of the materials being processed.For many people writing by hand (using a pen or pencil)is faster than typing or using a computer keyboard.However, for expert users, keyboards can be used to achieve greater speeds of data transfer. Unfortunately, many of the results of experiments to compare reading rates from computer screens and from paper have been inconclusive. Naturally, reading rates from screens will increase as the size, resolution and quality of information presentation improve. However, many people dislike reading substantial volumes of information from computer screens. This finding is likely to have a significant influence on the ways in which electronic books and online documents are created and used.

THE NEED FOR NEW TYPES OF BOOK [Slide 14]

As has previously been suggested in this paper, books provide a powerful and cost-effective mechanism for the storage, retrieval, display and communication of information. Despite their tremendous utility (and popularity), there are many reasons why we should now consider a partial shift away from the use of conventional paper-based books towards the greater use of publications that are based on the use of electronic media (Barker, 1997b).**[Slide 15]**

Because of the rapidly emerging era of digital information and communications technologies, this section of the paper now considers some of the more important reasons why we should contemplate the more extensive use of electronic books (as opposed to paper-based books) in order to support the types of human activity that were discussed earlier in the paper. Five basic issues are considered: first, the problems associated with the ever increasing publication rate of both paper-based and electronic documents; second, the limitations imposed by the rates at which humans can read text-based material; third, the implications of 'media competition'; fourth, the speed and accuracy with which electronic material can be accessed; and fifth, the ways in which electronic material can be re-organised in dynamic ways in order to achieve more flexible presentation and access. Finally, a proposal is made relating to the partitioning of information across different media - each medium being used to support those reading and writing processes for which it is best suited.

Issue 1: Publication Rates [Slide 16]

Because of the importance of books, many new and progressive developments have been made in the printing and publishing industries. These have made it much easier to publish books - both in terms of the basic processes involved and the relative costs incurred. This has meant that there has been a rapid increase in both the quantity and the variety of books that are now available both in libraries and in bookstores. This situation has a number of implications for users of books.

In my view there are four major issues that need to be considered. These are itemised and briefly discussed below.

- First, because there are now more books being published than ever before, it is becoming increasingly more difficult to keep abreast of what is happening in the world - both in general terms and with respect to particular subjects of study. This means that subject specialists are having to become even more specialist if they are to keep up with the progress that is being made.

- Second, because of the many different perspectives that can be imposed on a particular subject area, relevant material often gets distributed and 'spread out' across numerous publication sources. Invariably, this makes it very difficult to locate and retrieve sought-after items of information - unless they are available in electronic form.

- Third, there is a physical storage issue that must be considered. Conventional books take up quite a substantial amount of shelf space. Increasing amounts of office (and library) space therefore have to be relegated to storing the ever increasing volume of paper-based books that is now becoming available.

- Fourth, despite the efficiency of publication processes (both paper-based and electronic), published material soon goes 'out of date' - particularly that relating to scientific and technical domains.

Although the above list of issues is not in any way comprehensive, it does serve to reflect a growing motivation for wanting to consider how we can best use electronic publication methods in order to provide easier and more effective access to stored information. Of course, this is likely to involve automated methods of composing and analysing collections of material using sophisticated computer-based techniques.

Issue 2: Reading Rates

As we have established in an earlier part of this paper, reading is an important method of assimilating information so as to facilitate the creation of cognitive structures. Of course, it is important to realise that extracting information from conventional text-based sources can be a slow process. We have recently illustrated the relative 'slowness' of book reading (as compared with other visual methods of information processing) within the context of studying the development of mental models. Our experiments showed that, for a given level of reading complexity, reading a given topic from a conventional book took substantially longer than watching the same material presented in the form of a video production. We also found that the quality of the mental models that were produced (in terms of their richness and retention) were much greater in the case of watching videos than was the case with reading books. Bearing this in mind, it is important to consider how best to incorporate 'richer' media forms (such as pictures, sound and video) into future electronic book productions.

Issue 3: Media Competition [Slide 17]

Each individual only has a limited amount of reading time available. Obviously, as new media (such as television, radio, video, and so on) have emerged, they have placed demands on individuals for their time - often at the expense of 'reading time'. In view of what was said in the previous section this is understandable. If other media can lead to the more effective and more efficient development of mental models, they are likely to be used instead of reading processes. One of our current research projects on 'Multimedia Performance Support Systems' is intended to study some of these issues (Hudson, 1998). Naturally, the use of multimedia (and hypermedia) techniques within electronic books is a very attractive proposition - if they can lead to the creation of richer and more effective mental models (Tan, 1998).

Issue 4: Access Speeds and Retrieval Accuracy

In order to investigate the potential utility of electronic publication as a mechanism for browsing and searching large amounts of computer-based material, Egan et al (1989) developed an electronic book facility that they referred to as the 'SuperBook' system. As part of the project they conducted an extensive formative evaluation (Landauer et al, 1993). This evaluation involved comparing the performance of SuperBook with conventional printed material. Two important variables were investigated: retrieval time and search accuracy. After some initial 'tuning' of the SuperBook system, their results showed that it out-performed the paper book on both counts. Obviously, this is an important finding which strongly supports the case for the more widespread use of electronic book systems.

Issue 5: Flexibility

One of the major limitations of paper-based publications is their static nature. This imposes significant inflexibility on them in terms of: how information can be stored within them; when, where and how they can be accessed; and the ways in which their contents can be displayed. In contrast, a major attraction associated with holding information in electronic form is the potential flexibility that this approach offers. This flexibility can be derived at a number of different levels - for example, the methods that are employed to store information, the medium/media that are used, the locations at which material is stored, how it is retrieved, by whom and how it is subsequently displayed. In principle, different users of a given corpus of electronic information can use it in different ways - both with respect to controlling how it is accessed and how it may subsequently be processed and visualised.

Recommendations [Slide 18]

Bearing in mind the five points raised above, it is becoming increasingly apparent that new ways of publishing books are needed (Haynes, 1994; Sherman, 1993; Barker, 1991; 1997a; 1997b). These new techniques should allow the flexible flow of information across different media forms in a dynamic way - to suit an individual's (or group's) 'needs of the moment'. Furthermore, it is my belief that many new concepts such as 'living' information, flexible access and dynamic presentation methods need to be more widely adopted and implemented within electronic books and other related types of document (Barker, 1996a). In addition, it is my opinion that we urgently need to develop new techniques for automatically processing the information that is held in electronic form in order to provide users with more powerful ways (than is currently possible) of obtaining the material that they require - as they need it, when they need it and wherever they need it (Barker, 1996b; 1997b; 1997c).

Undoubtedly, electronic publication and access to information is likely to grow substantially in importance in the future. Despite this, it is unlikely to totally supplant publication on paper. Nor should it! In my opinion, it is important to realise that each publication medium has its strengths and weaknesses and should be used for what it is good at. Therefore, an important task for the

future will be the identification of a holistic 'media utilisation strategy' that utilises each storage and publication medium to best advantage.

PUBLICATION ISSUES [Slide 19, 20, 21]

In the previous sections of this paper, it has been suggested that we should make greater use of electronic documents (in general) and electronic books (in particular) in order to support those aspects of human activity which could benefit from this approach. Naturally, if electronic publications are to become more widely used in the future, then it is imperative that we provide appropriate infrastructures which make their production and subsequent use as easy as possible. This section of the paper therefore briefly reviews some of the major publication issues that need to be considered when contemplating the use of electronic documents. Five topics are discussed: choice of publication medium; choice of authoring tool; delivery platform independence; and the need for rigorous (but flexible) 'base-line' standards.

Choice of Publication Medium [Slide 22]

Currently, four basic types of media are in popular use for the publication of documents and books: paper, computer disks, CD-ROM and computer networks. These can be used to create two broad categories of document: personal documents that belong to (and can only be accessed by) an individual, group or organisation; and public documents that are published and made available to anybody who wants to access them. The ease with which these two broad types of document can be created will obviously depend upon which of the four basic media listed above is selected as the primary publication medium. Naturally, this choice will also significantly influence the basic properties of the documents that are created. Bearing this in mind, we have classified documents into three basic types: static, dynamic and living (Barker, 1996).

Two other important properties that are strongly effected by the characteristics of the publishing medium are: interactivity and accessibility. Interactivity refers to the ability of a document to 'respond' to messages sent to it by way of its end-user interface. Obviously, how a document responds and the types of message that can be sent to it will depend upon its purpose and the way in which it has been designed. Accessibility refers to the ease with which a document can be obtained and subsequently read. Usually, network publication (on an intranet, extranet or public network) enhances the ease with which a document can be obtained. However, that document may not be understandable unless an appropriate 'reader software' facility is available to 'decode' it. Increasingly, with respect to network publication, 'standard' browsers are now being employed for document access and reading. These are normally augmented by various 'helper' applications and 'plugins' in situations where these are necessary. Usually, the nature of the reader software that is employed will depend upon the type of authoring tool that has been used to create a document.

Choice of Authoring Tool [Slide 23]

At present, no one authoring tool is capable of producing all the different types of electronic document that an individual or an organisation is likely to need. Invariably, therefore, the type of tool that is used in any given situation will depend upon the type of document that is to be created and the sort of task or activity that it is to serve - for example, a memo, email, diagram, web page, letter, journal article, lecture presentation, and so on.

Conventional textual documents can be produced by means of a simple text editor; however, more sophisticated documents containing advanced 'layout' and 'decorative' effects need to employ a word-processing system. If there are embedded links to other documents or resources then some other hypertext authoring system has to be employed. Similarly, if one's intent is to produce a lecture presentation then a package such as Microsoft's PowerPoint might be the most appropriate choice of authoring tool. Increasingly, there is a move towards the use of 'integrated' authoring packages (such as Microsoft's Office 97) for the creation of many electronic documents. Such systems usually enable electronic objects to be easily transferred from one specific tool to another by means of 'cut and paste' operations.

Depending upon the types of document that are to be produced, many other special purpose packages are also available to facilitate the authoring process. Typical examples of these include systems like: IADS (an interactive SGML-based authoring system); Adobe Acrobat - which uses 'portable document format' (PDF) files; HotMetal PRO (a HTML editing facility) and Microsoft's Multimedia Viewer system. In our research and development work we have used each of these tools quite extensively (Tan, 1998). For example, the Microsoft package has been used in order to produce portable, online technical documentation to support the use of our personal notebook computer systems. These electronic publications have meant that the use of paper-based documentation for these computers can be completely dispensed with.

Delivery Platform Independence [Slide 24]

Ideally, access to electronic books and other forms of online document should, in principle, not be influenced by the nature of the delivery platform that is employed to access them. Of course, in practice, this is rarely the case. Undoubtedly, in the past, there have been many different types of delivery platform dependency - both in terms of software availability and hardware compatibility (such as screen resolution, colour palette, CPU speed, and so on). However, having said this, there is no doubt that the widespread availability of the Internet (and related intranet technologies) has provided significant motivation for overcoming many of the problems associated with delivery platform incompatibilities. Indeed, the Internet itself (through the extensive use of 'standard' markup techniques and information exchange protocols) has provided a valuable mechanism for achieving platform independent access to substantial volumes of electronic information. The implications of this are quite significant. It means, for example, that particular items of information can now be made accessible through a desktop computer, a portable notebook PC or a palmtop computer - provided a suitable browser is available and an appropriate network connection can be established (Barker, 1996b).

Because of the growing importance of teleworking (from fixed locations) and mobile computing (from variable, often unforeseen, locations) the ability to access electronic documents in a platform independent way will continue to be a major imperative both for producers of future delivery platforms and for information providers. As is discussed in the following section, this is only likely to be achieved through rigorous adherence to appropriately designed international standards.

The Need for Standards [Slide 25]

Standards have an important role to play within all areas of human endeavour. Of course, they assume particular importance within the context of global communications and the provision of distributed access to electronic information. As was mentioned in the previous section, much of the success of the Internet has been due, in no small way, to the development and adherence to agreed upon standards. These may be internationally defined standards (such as those agreed by the International Standards Organisation and related bodies) or they may be de facto standards (such as Adobe's PDF files for electronic publishing). The importance of adopting standard conventions, techniques and 'evolution pathways' lies in the fact that they provide a common base-line for developers and users to work to. Without such base-lines it becomes impossible to make sound scientific and technical progress in an economical way. Undoubtedly, one of the most useful developments in the electronic publishing arena has been the introduction of SGML and its associated derivatives (Bryan, 1988). This ensures that all documents produced to the requirements of this standard are usable within any other platform that also adopts its conventions.

Of course, in the area of electronic books and online information provision there is always intense competition to provide new facilities, novel functions and better facilities than those of a competitor - often to the detriment of users. In my view, it is important to enforce rigorous, but flexible, base-line standards in order to protect users' interests. By doing this the electronic publishing industries will gain the respect and reliability that conventional paper-based publishers now enjoy. Unfortunately, we are currently some way off from achieving this - primarily due to uncontrolled and ad hoc developments and a lack of regard for the needs and abilities of users.

CASE STUDY - INTRANET/INTERNET AND CD-ROM PUBLISHING [Slide 26]

Like many other organisations that make extensive use of computer systems, we have been attempting to move away from our dependence on paper as a storage and communication medium - turning instead towards the use of electronic techniques. Obviously, the motivation for wanting to undergo this transition can arise from a number of different sources. Amongst **[Slide 27]** the most important reasons that we have are: (1) the continually rising cost of photocopying and related reprographic services; (2) the easier accessibility and ease of distribution of electronic documents; (3) their reduced storage requirements compared with paper; (4) the ease with which they can be shared; and (5) the special types of interactivity and 'intelligence' that can be built into online documents. This latter reason is very attractive since it implies that many new types ofdocument can be created that have no corresponding counter-part within paper-based media.

The basic approach that we have adopted involves the use of an organisation-wide, local area network with gateway facilities to national networks - and, hence, the Internet and World Wide Web. An important component of our network system are the intranet servers that are used to store and distribute our collections of electronic documents. These servers are also used to store the various digital library systems that house our collections of electronic books, technical

manuals and the wide range of other multimedia resources that are necessary to support our organisational activities. The basic network system is built around an inter-connected array of Sun Microsystems and Silicon Graphics computers. This central core of resources provides the main computing facility for the organisation as a whole and for many of its constituent departments. **[Slide 28]** The system is based on a standard UNIX environment; our intranet facilities are therefore provided as part of the UNIX filestore.

In addition to UNIX-based workstations, the other main type of end-user access to the network described above is achieved through the use of personal computers. These are mainly IBM compatible desktop and notebook systems (mostly Pentiums) that run a variant of Microsoft's Windows (3.1x, '95 or NT). A number of CD-ROM write/read stations are also attached to the network system. These enable users to transfer materials from the UNIX filestore or a personal computer to compact disk. Using these facilities it is extremely easy to publish electronically on an intranet server, on a local or remote Internet server or on a CD-ROM platter. It is also relatively easy to publish (using suitable network connections) on a computer hard disk, flexible diskette or solid state disk - the latter are used primarily in hand-held palmtop computers. This type of arrangement therefore makes it very easy to disseminate electronic documents locally (via an intranet) and/or globally (through the Internet). Alternatively, copies of documents can be transferred to standalone computers (workstations, notebooks and palmtops) for non-network, off-line access (Barker, 1996b).

A number of high-speed print stations are also attached to the network system. These are used to facilitate printing of electronic documents (or sections of them) in paper form - for those who wish to have them. For a variety of different reasons, there are still many people who prefer to work with paper documents. In addition, many users currently dislike reading significant quantities of material from a computer screen and, instead, prefer to read from paper. As was pointed out in the beginning of the paper, this situation may change as better, and more acceptable, screen-based reading mechanisms evolve.

[Slide 29]A wide variety of different sorts of electronic document are stored within the intranet/Internet servers that make up our online electronic publication system. These fall into two broad categories. First, those which have been primarily designed totally for network publication and use in an online (network-wise) mode. Second, those that are designed essentially for network distribution and which are used mainly in off-line mode - that is, they do not rely upon the presence of a network connection in order to use them once they have been down-loaded.

The first category of electronic document mentioned above will normally have been marked up in HTML and may involve the use of JavaScript and/or Java in order to enhance their interactivity and/or built-in intelligence. They will be capable of being read and used directly by the various browsers that are installed on client computers (such as Netscape and Lynx). Because they are designed for network use, they cannot be accessed and/or used without a relevant network connection. Often these documents will involve quite sophisticated, dynamic client/server information exchange. Examples of such publications include technical manuals, interactive electronic books, administrative material, online forms, and so on.

[Slide 30, 31, 32, 33] The second category of electronic document that we employ is normally created in an off-line mode (network-wise) and will then have been mounted on a server in order to distribute them electronically. These documents will usually have been created by some non-network application such as Microsoft's Word for Windows (memos, correspondence, technical reports, papers, manuscripts, books, and so on), Excel (technical data and experimental results), PowerPoint (diagrams and lecture presentations), ToolBook and Adobe Acrobat (electronic books). There are two ways in which these types of document can be accessed. First, by simply down-loading them and using them within their parent application in off-line mode; and second, by 'adding' the parent application as a 'helper' or plug-in facility to the browser that is used on the client workstation. We use each of these techniques quite extensively.

Within our electronic publishing system there is a tremendous range of documents available - both in terms of the variety of parent applications from which they originate and in terms of the purpose and functions that they perform. Naturally, our gradual movement away from paper as our primary storage and communication mechanism will require some form of rationalisation in the future - both with respect to ongoing costs (in terms of providing technical support and site licences for the products that we use) and compatibility issues (in the context of newly emerging, more sophisticated and easier to use authoring and publication tools).

FUTURE POSSIBILITIES [Slide 34, 35, 36, 37]

There are many attractive features associated with the more extensive use of an electronic publishing infrastructure. Some of the most important of these include the ability to create new types of publication such as 'webzines', living books, electronic conference proceedings and interactive books that embed various sorts of animation and multimedia effect (Barker, 1996a; Deep and Holfelder, 1996; Gloor, 1997). In addition, it is also possible to use electronic publishing media in order to create and provide new types of service. Two examples of these new services include: (1) the personal information alerting (or current awareness) services that many publishers now provide via electronic mail; and (2) the supply of electronic journals to libraries and institutions - as is illustrated by the TULIP project that has recently been undertaken by Elsevier (Zijlstra, 1994). In addition, we are likely to see these basic concepts applied to the dissemination of books and other types of publication (Barker, 1997c).

As more and more material is published electronically, there will be a growing need for the realisation of appropriate standards in order to ensure the accessibility of the available resources. Currently, many publishers use SGML for this purpose (Zijlstra, 1994; Maunder, 1994). However, SGML has many limitations. Undoubtedly, the availability of many new types of interactive, hypermedia, web-based publications will tax this standard to its limits. It will therefore be interesting to see how it adapts in order to meet the new demands being placed upon it.

In our own electronic publishing system we currently do not use SGML or any other standard (other than that imposed by HTML). However, in the future, as part of our rationalisation process (that was referred to in the previous section) we will need to consider the direction in which we should proceed. There are supporters for the use of SGML and there are also many who would prefer the use of the PDF 'de facto' standard associated with Adobe Acrobat (Deep and Holfelder, 1996). However, at present we are undecided about which 'standards strategy' we should adopt.

CONCLUSION [Slide 38, 39]

Information is a commodity that is of vital importance to everyone. Individuals use this resource in order to build sophisticated knowledge structures in their heads. depending upon their specific needs and interests, different individuals use different subsets of the global stock of information that exists. In the past, a wide range of paper-based approaches have been used to provide access to information. Undoubtedly, books (and related artefacts) have been one of the most common. Nowadays, there is an increasing interest in the use of electronic books and other forms of online documentation in order to disseminate information and provide global access to it. This can be achieved through the use of portable access stations such as notebook and palmtop computers. Despite the growing popularity of electronic forms of information, printed media will continue to be used for those purposes for which it is useful and convenient. In the future we will therefore need a comprehensive 'media strategy' which allows information to be moved from one medium to another as the needs of its users change.

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