

Designing Interfaces for Distributed Electronic Collections: The Lessons of Traditional Librarianship

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Digital libraries, to fulfil their true potential, must display features and exploit skills more readily associated with traditional library service. To an extent this has already happened: collection management has become the process of Internet resource discovery, while document cataloguing skills have been applied to the creation of Internet resource metadata repositories. This paper argues that there are certain areas of traditional classification, knowledge management and physical library arrangement that have special applicability to electronic collection building. However, librarians have

often failed to appreciate this relevance. In particular, they have not recognised the significance of browsing in the traditional library, and have replicated this failure in their approach to electronic collection building. Concentrating on British academic libraries, this paper explores knowledge management at the level of the local library, the Metropolitan Area Network and the United Kingdom's Distributed National Electronic Resource. The principle of ownership of intellectual property is examined in terms of its relationship with interface design. Positive future trends are described.

Introduction

The 'death' of traditional librarianship

Much recent speculation about the growth of the Internet and World Wide Web (WWW) implies no future role for the library and the librarian, as we have known them. When asked to look something up in the traditional way, a representative student at Cornell replied, 'I don't do libraries' (Lesk 1999). A naïve eavesdropper to this comment might well ask why should the information seekers of today visit the traditional library? They can sit at home, flipping between t.v. and p.c., while Internet search engines deliver full text information to their desk top, together with fast food and mp3 files. In this vision of the information future, the librarian is no more than a forlorn figure, left cataloguing unused tomes in draughty

unpopulated reference halls, while the real action is out there on 'the net'.

Inadequacies of scholarly electronic information systems

This vision is, of course, nonsense. In the few brief years since the emergence of the first successful Internet browser in 1994 the colossal inadequacies of the Internet as a medium for scholarly communication in comparison with the established library system have been well documented. For example, for a period in the 1990s, European access to the rich WWW resources of the United States ceased to exist in the afternoon due to network overload and server inadequacy. But at that same time, no one would have relied on a library in which half the stock could only be consulted before lunchtime. And today as ever, the fact that

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Interfaces in the traditional library environment

Traditional library interface design

At first, the skills of interface design might seem to be a computing scientist's black art, confined to the recesses of textbooks on HCI (human-computer interaction), task analysis and the like. But librarians have always been good at offering library users workable interfaces to their collections. They may not have realised this – rather like Moliere's bourgeois gentilhomme Monsieur Jourdain, who was delighted to discover that he had been speaking in prose all his life without even knowing it. Nevertheless, it is true. Traditional librarians do not just build document collections; they also make them usable by exploiting 'interface' mechanisms such as classification schemes and author-title catalogues.

There is no doubt that the networks are now offering us rich datasets, but the problems of exploiting such datasets are often problems of interface design. The data on offer is rich and useful, but its sheer quantity and heterogeneity mean that the data is often not usable. Is there anything that the traditional skills and techniques of librarianship can offer to help deal with these problems?

Browsability in the traditional library

Firstly, let us consider the types of interfaces traditionally exploited by librarians. One type of information retrieval technique familiar to the traditional library user is the technique of browsing (O'Connor 1988). This activity is characterised by individual examination of full text documents or data items in an extended process of sampling and serendipity. Browsing is sometimes looked down upon as random, laborious and unskilled. In this negative view browsing occurs when you can't search quickly and efficiently in a library catalogue for a few relevant books on a topic. Instead you go straight to the shelf and start browsing the stock until you happen across a relevant item after wasting time looking at scores of irrelevant items. However, this is not browsing, merely bad library use (Marchionini 1996).

Librarians, being sensible and pragmatic professionals, who recognise the need to deal with users as they are, have always respected the in-

anyone can put anything up on the WWW means that anyone does. If any self-respecting librarian tried to build a collection from the donations and vanity publications that regularly find their way into a library's mailbox, they would be soon unemployed. Yet much of the Internet comprises just such a library collection. So why should the yardstick measuring the traditional library and the WWW resources of the Internet be any different? (Law 2000)

The ideal vision of an information future is one where the networks take on many of the qualities of the traditional library system. This means that the Internet must emulate a genuine library system of scholarly communication, in which, for example, it is broadly possible to identify any recent published work of genuine quality from anywhere in the world and, whether or not one has identified a location for the item, to obtain it by borrowing or copying (Law 1999). This can only happen if the agents of change who shape and form the networks acknowledge the role of librarians, and librarians themselves retain their professional confidence and remain fully engaged in shaping and forming the future of electronic information.

Common features of the traditional and the electronic library

Thus, because there is such a strong relationship between traditional library tasks and the task of building new digital libraries, librarians have an important role to play in the new information order. There are a number of ways in which this is already happening. For example, the traditional task of intelligent collection building translates into the task of Internet resource discovery and listing. The process of stock acquisition becomes the creation of mirror and cache as electronic collections are built on local file servers and accessed over an intranet. The skill of classification has become the art of knowledge management. Preservation is now the process of backing up to long-term data archives, while information skills training remains a necessity wherever information sources are not self-evidently usable.

However, there is one aspect of the interrelated tasks of traditional library classification and knowledge management that is worth treating in greater detail. This is the role of interface design.

formation retrieval technique of browsing. After all, people do it, and it works. So they provide 'interface mechanisms' to their collections that facilitate the activity of browsing. In this context, 'interface mechanism' can be a fancy phrase for a classification scheme. Librarians classify stock and place it on the shelf in subject order. This means that the main disadvantage of browsing – it is a weak information retrieval technique for dealing with large data sets – is offset. The library user who browses intelligently can always find a number of usable small subject areas of shelving in which to browse if they exploit library classification schemes as a segmenting device (Morse 1973). Good browsing requires both an intelligent information user and a collection with a browsable interface (above all, shelves arranged by subject).

Relationship of browsability with other traditional library features

The browsability of a library collection also depends on other successful features of the traditional library being in place.

Collection development

Firstly, effective collection development means that a good library collection concentrates on subject material that is relevant to its local clientele, while also imposing a quality threshold (for example, unlike the Internet, low quality free material is excluded). Both these collection development activities make the collection more concentrated than it otherwise would be, which in turn enhances browsability. Thus, by filtering out the superfluous the traditional library offsets to some extent the prime disadvantage of browsing, which is that its effectiveness decreases the larger the data collection explored.

Principle of holdings

Secondly, libraries can control the interface to their collections because they possess the materials in their collections and are committed to building an archive of documents. Because the stock is in the possession of the institution, the library can make the collections usable by imposing a single, coherent shelf-ordering scheme on their stock, or by creating browsable current display areas of recent journals parts. The creation of a usable collection is entirely dependent on ownership of material, with-

Table 1. Summary: Juxtaposition of characteristic features of browsing and searching

Characteristics of browsing:	Characteristics of searching:
Extended and serendipitous.	Instantaneous and focused.
Tends to be more intuitive.	Search rules need to be learnt.
Contextual subject knowledge important.	Little contextual knowledge needed.
Preferred by users who have subject knowledge.	Preferred by librarians, with less subject knowledge.
Involves direct perusal of full text.	Metadata/document surrogates predominate.
Most effective with small datasets.	Effectiveness is size independent.
Good for trawling distributed collections.	Good for exploring a large, single collection.

out which there is no freedom to configure stock into the best possible arrangements for the user.

Searching in the traditional library

The other information retrieval technique used in traditional libraries is the familiar one of searching. Searching is a different process from browsing in that it involves the creation of a search strategy to be performed on an information retrieval system. Unlike browsing, where the user controls each step in their information retrieval process, searching involves learning a set of search rules, creating a search statement and then giving control of the retrieval to a system that carries out the search according to those rules. This system can be an old-fashioned card catalogue, which mechanises the retrieval of relevant information by author, title or subject searching. Or the system can be computer-based (though conceptually the searches that computers perform are no different). However, online public catalogue systems have made this process more obviously a mechanised process, independent of user control, because they rely on the impersonal electronic execution of search algorithms.

Table 1 is a summary and comparison of the chief characteristics of browsing and searching.

Interfaces in the electronic library

Searching the electronic library

The growth of the electronic library has been identified largely with electronic searching rather than electronic browsing. The advent of library

OPACs (online public access catalogues) alongside pay-for-view mediated online searching initially established searching as the main information retrieval technique of the electronic library. The domination of the electronic search was then perpetuated by the introduction of end user searching.

One consequence of this has been the multitude of different search interfaces that bewilder the contemporary electronic library user. In turn, another consequence has been an over emphasis on explaining these interfaces by user education librarians. The need to explain a multitude of search interfaces is not unsurprising. However, it does fly in the face of decades of experience of traditional library user education, where intuitive and unmediated activities such as browsing at shelves arranged with classification schemes, and current awareness raising through browsing current serials display were rightly encouraged. How do these retrieval techniques carry over into the electronic library?

Browsing and the electronic library

The domination of the search-based approach to the electronic library led librarians to neglect the role of electronic browsing. Because of this, the resurgence of the role of browsing in the electronic age happened initially outside of libraries with the advent of the World Wide Web, the vast open information network which was trawled with software packages called, logically enough, 'browsers'. Although the role of Internet search engines such as AltaVista and Lycos showed how the World Wide Web needed to present itself through the medium of a search interface, much of the nature of Internet search engine use remains closer to browsing than searching.

For example, when users first input a set of keywords into an Internet search engine in the mid-1990s, it was less important for them to have learnt the abstract search rules of a search system. The relevance ranking algorithms of the search engines operated invisibly to the user. Similarly, Web page metadata is invisible to the WWW searcher, although it is used in the machine process of retrieval. As in a library shelf browse, the user samples the full text of a Web document, not the metadata.

This contrasts with an OPAC or bibliographic database search where the metadata of the docu-

ment surrogate or catalogue record predominates and is viewed in full by the user instead of the full text. Moreover, the enormous retrievals thrown back by Internet search engines entail a great deal of extended browsing of such full text Web document lists by the user, in contrast to the tightly defined list of twenty or so bibliographic records that are the ideal outcome of the effective online search.

However, browsing Web sites on the Internet has largely been an activity undertaken alongside but not inside the virtual space of the digital library. Similarly, inside the digital library we do not yet find full and whole-hearted exploration of browsable interfaces for electronic library services, despite the historical importance of browsing the traditional library. Nor have influential advocates of electronic browsing such as Bates (1989) or Marchionini (1999) had much of an impact at practitioner level.

It is time for librarians to acknowledge that the attraction of surfing the World Wide Web lies in the Web's user-friendliness, that is, in its browsability. It is the interface rather than the content of the Web that attracts users to it. Thus, there is little point in simply attacking the Web in terms of its information content, which librarians are wont to do (Doran 1995), when what makes it attractive is its usability rather than its content.

The way forward, therefore, lies in making electronic library services look more like the Web, not just in making the content of the Web as good as a high quality library. The irony is that in so doing, librarians will be importing the browsability of the traditional library service back into their electronic services. This is a lesson that librarians need not have learnt from Tim Berners-Lee and the World Wide Web Consortium (W3C) – it was simply a question of the profession staying true to its traditional practices.

Interface design and the holdings principle in the electronic library

It is a commonplace of modern librarianship to lament the way in which we in UK Higher Education donate our intellectual property freely to commercial publishers, who then sell it back to us at a hefty price. This is normally regarded as a failure in financial terms and network access terms – re-importing our intellectual property is

expensive and involves navigating to commercial publishers' servers across the clogged arteries of the Internet. However it is also a catastrophe in terms of usable interface design.

When an institution leases a commercial electronic information service from a publisher it leases the interface. And worse, when it leases many commercial services from many publishers, it leases many interfaces. Imagine a traditional library where books from one publisher could only be leased for three years and were classified in Dewey Decimal, whereas books from another publisher were leased for a year but classified in Library of Congress. Imagine a library faced with this problem for all sixty publishers represented in the Association of American University Presses Online Catalog. If you tried to combine monographs from all of these publishers in one single collection in a single shelf sequence, you would end up with a dog's dinner of differently classified material.

Nevertheless, this is what today's academic libraries increasingly have to do – they have to put a single local library WWW interface over a host of disparate leased commercial interfaces. In consequence, they must then run a complex and highly resource-intensive user education programme to support the cacophony of services which jostle together uneasily beneath the local WWW service interface. Unfortunately, most academic libraries are rather good at these user education programmes, thus preserving the status quo and removing pressure from publishers to do better.

Z39.50, only a partial solution

One interesting answer to the problem of supporting multiple search interfaces for a broad group of users is to use Z39.50 search protocol solutions. In this approach librarians implement a common standard for search systems in order to make them interoperable. A single local Z39.50 search interface is thus enabled to search a number of other remote Z39.50 databases. Given that most libraries just about manage to train users to use one search interface, their local OPAC, with a minimum of user education effort, this answer seems to deal with the library interface problem quite conclusively. That local interface becomes the interface to all other services.

Putting aside the technical and administrative obstacles of implementing Z39.50 protocols, this solution is obviously only a partial one. It represents a very powerful but nevertheless one-sided continuation of the recent history of interface design in libraries, which holds that a search solution is the key to digital library usability. Given the amount of net surfing taking place outside of the digital library environment, this is not a belief founded on observation of user behaviour.

The way forward

Traditional library strengths

To summarise, these are the traditional library achievements most relevant to the digital library:

- Hardcopy libraries are usable because they have good interfaces. They may not often be called interfaces, any more than you would describe a good door handle as a triumph of 'portal interface design', but it is in the nature of a good interface to go unnoticed. Just because something is invisible does not mean it is not there.
- There are two types of interface that traditionally work well in libraries, searchable interfaces and browsable interfaces.
- It is only possible to provide a usable library collection if you own it, because total possession gives you the maximum ability to control your stock and the interfaces to it.

The growth of networked electronic information in worldwide higher education is in many ways due to its replication of the virtues of the traditional library. Where digital library developments have fallen short, they have done so very often because they have failed to replicate the virtues of the traditional library. What follows are a variety of ways in which electronic library services can reproduce the particular features of the traditional library that this paper wishes to highlight.

Use of MANs for electronic collections

Both in traditional and digital libraries, possession is not just nine tenths of the law, it is ten tenths – if not more! But if academic intellectual property is to be repossessed by its producers,

where is this material to be held, how is it to be managed and by whom? One approach is to promote the mirroring, caching and archiving of data at Metropolitan Area Network (MAN) level as a possible approach to the building of such digital libraries, a model that was outlined in the late 1990s (Law 1998).

The devolved archiving of digital material on a regional co-operative basis provides an acceptable compromise between local storage at the single institutional level and remote storage in centralised national data centres. Local storage of electronic data has been impractical in the UK, where higher education libraries, unlike their U.S. counterparts, have never had the resources to acquire significant data collections on a single institution basis. By contrast, national data centres may exploit considerable consortial buying power and enjoy significant economies of scale, but are remote from the scholarly communities that they serve. Regional or MAN-based digital collections can avoid the weaknesses and preserve the strengths of both models. In particular, such an arrangement gives a good degree of local control to the community that produces and uses such data, while consortial economies of scale are maintained. Indeed, cross-sector alliances between higher, further and secondary education might well be easier to achieve at the regional level than at the national level, creating greater buying power for a comprehensive national grid of MAN-based consortia than a single national consortium arrangement with no cross-sector alliances.

There are other trends demonstrating the movement toward such a model. For example, the distribution of networked material in the late 1990s to a series of worldwide servers was one of the solutions that improved access to American Internet resources for European users. As access problems increase again with time, the logical development of this strategy may be to distribute such data further down the line to regional servers such as those administered over the MANs. And the question of what sort of material is best stored at metropolitan area level and what should be held elsewhere in many ways resembles a traditional problem of library acquisitions policy. The local library holds what its users demand frequently, but offers remote access to material consulted less often. A regional caching strategy might do something very similar.

A virtual area such as the MAN thus reflects the concept of the library – a collection of relevant material made available in a defined space (physical or electronic) by professional intermediaries in the most efficient and economic way. This concept also gives the electronic collection manager total freedom to control and optimise the interface to the material within their possession for a given user group within a defined virtual space. And the material can also be so organised that it is preserved for the future, while all the issues to do with rights of access and obligations of ownership are properly managed (Law 1997).

Ways of optimising digital library interface design

Modern OPACs

Create interface variety: Yahoo-like filters

Modern OPACs are already offering a variety of interface options, including a range of listing devices and browsable filters that complement and enrich the search functionality of these powerful database systems. In this sense the best OPAC interface is a service that presents itself more like Yahoo, with its searching and filtering interface, rather than just a simple search mechanism. This is a great step forward from the early days of the electronic library, where electronic searching relegated browsing purely to the realm of traditional collections (Ayris 1995).

Choose browsing approach to extended collections

The browsable OPAC retains its role as a powerful search tool, but with the new possibility of added layers of distributed searching that offer an optimal combination of rich information content and interface variety. The goal is not one of searching many collections simultaneously in a single pass, but of offering the choice to move from a local collection to other distributed collections in a user-controlled sequence of extended inquiry. Recent innovations such as SFX show how important this development has become, with a new emphasis on the creation of paths through extended services and browsing through a consultation chain (Van Stompel and Hochstetbach 1999).

Library Web pages

Offer browsable local electronic holdings

It would be interesting to discover how much use of books in the typical academic library is attributable to students finding such material via hard copy reading lists rather than via searches on the OPAC. Such evidence might give a salutary indication to librarians about how users really do find their most heavily used items. It might also show the searchable OPAC to be a less important tool for the average undergraduate than previously imagined.

Given that undergraduate teaching material is the high volume use material in any Higher Education library, it is likely that browsing comprehensive Web-based lists of recommended reading will be a highly popular digital library service. It is likely that department-mounted Web lists of recommended reading already provide much useful information to students, showing how browsable resources in the electronic library tend to mushroom outside the electronic library, not within it.

Similarly, self-contained Web-mounted browsable lists of exam papers are likely to be well used, rather than searchable catalogue records of exam papers hidden in the OPAC. It would be interesting to compare libraries' approaches to digitisation of exam papers, and see whether libraries prefer to list these resources in their OPACs or in separate Web pages. Again actual observation of how users prefer to use such material should be a definitive factor in such choices.

Provide user-friendly Web taxonomies

Library Web pages often display fewer user-friendly browsable features than the traditional library space. For example, key parts of the traditional academic library space are configured around tasks. There are clear areas for researchers to browse recent serial literature, whereas other space is reserved for undergraduates to explore short loan material. The reservation of a given space for certain tasks is a highly effective part of interface design practice (Lewis and Rieman 1995).

However, library Web pages are often different, showing a preference for type taxonomies rather than task-oriented lists. A typical top level menu of a set of library Web pages might list the following types of information: *Library guides*, *Library publications*, *Library Databases*, *Electronic Journals*,

Search engines, *CD-ROM network* (etc.). This preference for type taxonomies, which do not demonstrate the tasks for which the information listed can be used, is akin to arranging library shelves purely by the physical format of books (outsize books versus normal size books) rather than by task (short loan borrowing versus current serials browsing) or subject (library classification schemes). If physical library space is often allocated to certain tasks, then it is logical that virtual library space should be similarly allocated, thus maximising browsability.

This implies that the type distinctions *Electronic Journals*, *Databases* and *CD-ROM network* might be better listed under a top level menu with the task distinctions *Browse the current research literature* (instead of *Electronic Journals*) and *Do a literature Search* (leading to *Databases* and *CD-ROM Network*).

Actual observation of how users execute tasks in a library's Web space is the only sure guide to how these menus should be configured. Type taxonomies are easier to set up because they emerge from the nature of the data listed, rather than from examination of user behaviour. But this also means they can be hard to use.

Avoid data overload in Library Web pages

Browsable interfaces to Web pages are extremely sensitive to the size of data content. A given set of pages with a well-organised structure will not readily be able to accommodate regular expansion without the structure being altered in some fundamental way. This is quite different from a library catalogue, which can accommodate expansion of numbers of records without an equivalent loss of usability. The density of information in some sets of library Web pages, where those pages have been packed with extra information over several years creates a sense of cognitive overload in the user and prevents effective browsing. The watchword of the traditional librarian, create segments to help browsing, still applies in the digital library (Morse 1973). If we appreciate this, we will change the way we design our library Web environments.

Current awareness searching and current awareness browsing

Despite the fact that traditional libraries create current serials display areas for browsing recent

research, when current awareness skills are taught in the electronic library, user education librarians recommend current awareness *searching* – that is, a regular search executed over the most recent records added to a database. This is a powerful current awareness technique, but for many academics this search technique is a poor substitute for hard copy browsing. This is not necessarily because academics prefer hard copy to electronic information, they may simply prefer browsing to searching.

Academics are likely to find browsable Web environments of their favourite journals arranged by journal title more congenial. Many academics do actually create such Web resources for themselves. This again shows how electronic browsing tends to spring up outside of the library world rather than inside it, and that the forms of task execution recommended by librarians differ from the preferences of users themselves.

The United Kingdom Distributed National Electronic Resource

The above suggestions are just potential ways of enhancing interface usability in familiar electronic knowledge management tools. The real challenge lies with expanding UK higher education's electronic collections in such a way that much more complex interface solutions are required at a national level. This will demand a more ambitious form of knowledge management, one that acknowledges the full richness and variety of user information retrieval strategies.

In the UK, the commitment of the Joint Information Systems Committee (JISC) to the Distributed National Electronic Resource (DNER) opens up the greatest possibilities for sophisticated development of high quality interfaces to electronic collections held across a variety of locations in the country. Local digital collections of exam papers are simply the starting point for much more varied and rich collections of local materials, leading into a larger national framework of portals and gateways.

The DNER will thus display many of the features of the traditional library, in that unifying metadata structures will sit across separately defined resource collections, which the user will be able to explore in their own right through appropriate interfaces.

Gateways and portals are important aspects of the navigation system. The JISC will provide multiple gateways, some based on subjects or disciplines, some based on services, and others developed locally or regionally. Each gateway should provide access to the full range of resources but will offer a range of "views" for different ways of presenting them to the user. (JISC 1999)

This concept of a 'range of views' encompasses the diversity of searchable and browsable interfaces that we have described above. The idea of the DNER thus extends the idea of the hybrid library by adding the model of a hybrid interface to the other hybrid models that have been associated with it (Pinfield and Dempsey 2001).

Conclusion

The concept of the Distributed National Electronic Resource enshrines the principle of taking possession of data in order to exploit it fully. Secondly, because it is a distributed resource rather than a centralised resource, it will be 'surfed' via browsers as much as searched in its entirety via a single 'quasi-catalogue' interface. These are two underlying principles of the traditional library collection emphasised by this paper, ownership and distributed browsability. The current intellectual property order militates against these two principles: data providers today only allow us in UK higher education to borrow electronically the sort of intellectual content that we used to possess outright as hardcopy materials. In consequence, we also have to borrow the interfaces to such material. It is as if we are not clever enough to be allowed to archive data any more, nor insightful enough to understand how to make these collections usable to people. It appears that librarians have experienced a collective loss of nerve.

Hopefully, by emphasising the quality and sophistication of a traditional library service and the way in which most of its features transfer into the digital library, this paper in some part shows how foolish and unnecessary such a loss of nerve is. Not only are librarians themselves badly served by such lack of faith. Users of digital information are badly served, and the networks cannot achieve their full potential. Better to abandon this position of timorous mediocrity and create a MAN-

based distributed electronic collection that is recognisably a fulfilment of an admirable library heritage.

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