

Working paper:

The developing roles of digital library intermediaries

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The roles and value of digital library intermediaries (both human and software based) have been a controversial topic, with strong arguments emerging for disintermediation and for information users having direct access to information. Counter-arguments highlight the important function of intermediaries in supporting effective digital library implementation and utilization. We need to understand the diverse roles of digital library intermediaries to identify what requires mediation, both online and offline, and what does not. Although domain specific librarian / user interactions (e.g. academic library consultations) have been reviewed by others, a detailed account of digital library intermediary roles across domains has not been presented. In this paper we review three different approaches to digital library intermediation for patients, clinicians and academics. Findings from in-depth interviews and focus groups with 56 participants have highlighted the importance of flexible context-dependent support at both the information and digital resource level. Four intermediary roles for mediation between users and digital resources, as well as the information contained therein, have been identified. These can be summarised as: creating awareness; making accessible; supporting interpretation (or making it usable); and ensuring quality. In one study, all these roles were adopted by an information expert (i.e. librarian). In the other two studies, some were taken by information

experts and others by domain experts (e.g lecturers, doctors) or left unsupported. These findings highlight future challenges for digital library developers: digital library systems need to make use of and support the changing roles of intermediaries (both human and software) as well as end-users as information provision shifts towards digital means.

Introduction

As the complexity of the internet increases, users encounter, and require support at, various levels of interaction. A wide variety of digital resources with different levels of quality and usability have to be negotiated along with the information itself. Many digital library developers see the problem as one of control and customisation (Hicks, 2003; Graham et al, 2002), so they are designing systems to provide improved end-user manipulation and personalisation of resources (e.g. ACM digital library binders¹). However, there is a user overhead with customising resources when users do not need or want this level of control (Adams & Blandford, 2005). With information gathering being peripheral to many daily work practices, digital library users need many tasks to be taken on or supported by intermediaries. Some digital library designers have realised this and are producing agent intermediaries and pro-active digital library mechanisms (e.g. recommender systems) to take on these roles (Smeaton & Callan, 2005). Recent digital library developments have concentrated on software mediated support for finding and making sense of information (Zhang & Quintana, 2005; Mukhopadhyay *et al*, 2005). However, it is still unclear what exactly these intermediary roles are, how complex they are and which aspects require social qualities that are hard to replicate online. It may be appropriate to design digital library systems to support human intermediary tasks more explicitly than current ones do. There is a need for a clear analysis of these changing digital library intermediary roles in the complex contexts many people work in. In the clinical domain, for example, information gathering is essential but peripheral to the main work practices: clinicians' primarily aim to diagnose and treat patients as quickly and effectively as possible.

¹ <http://portal.acm.org/dl.cfm>

Similarly, academics' primary role is to teach and conduct research as effectively as possible. Although these domains have different social structures, management practices and core goals, they both require input from information resources – often without adequate time to become information experts. Consequently, in both domains the role of digital library information intermediaries (both human and software) is growing in importance (Adams & Blandford, 2005).

As digital libraries gain a central role in the working lives of many professionals, the roles of librarians, as intermediaries between users, information and information resources, are evolving. Consequently, these roles can often appear unclear. Ambiguity in the intermediary role may have led to the view that information users should be given direct access to information resources ('disintermediation') to index and maintain assets themselves (Duncan & Ekmekioglu, 2003). The arguments for disintermediation centre around the empowerment users receive through direct access to information. Even supporters of intermediation (e.g. Nardi & O'Day, 1996) have argued that direct access to resources, mediated only by technology, is beneficial and that human (or software agent) gatekeepers are neither desirable nor practical. Ehrlich & Cash (1999), in contrast, argue that end user access still requires the expertise of intermediary service support. It is the social and collaborative elements of information seeking and ratification that are emphasised as important aspects of intermediation (Fisher et al, 2004). Several authors also argue that social elements of information seeking must be appreciated to avoid digital libraries being limited to the role of 'passive warehouses' (Ackerman, 1994; Brewer et al, 1996; Pettigrew, 1999; Fisher et al, 2004). Reviewing arguments for disintermediation and for solely intermediated services, it could be concluded that reality is found between these two extremes (Borgman, 2001; Gristock and Mansell, 1998). Ultimately, however, it is hard to argue for or against functions which are still so ambiguous. It is clear that the role of a digital library is changing, as are the functions of online and off-line intermediaries (Borgman, 2001; Brewer et al, 1996). Understanding these changing roles can help digital library designers develop allocate intermediation roles appropriately between people and technology by understanding what aspects of these roles can be

replaced by agent based systems, and which rely on human social characteristics (e.g. relationships, high-level problem solving), and thus human intermediaries, who themselves require online support (e.g. expert intermediary tailorability).

One aspect of digital library mediation that has been overlooked is the importance of the expertise of, and trust in, information intermediaries. Digital library users continue to use intermediary support in their information searching, filtering and use; however, these roles are often taken on by colleagues, superiors, peers and the press (Brewer et al, 1996). Cunningham et al (2001) note the importance of colleagues as primary sources of information about and instead of digital libraries. Although an important resource, as non-experts in information intermediation, there is a risk that they may misdirect, misinform and confuse users. The quality of these resources is often determined and maintained by information experts (e.g. librarians) under implicit rules (Vishik & Whinston, 1999; Borgman, 2001). Expert information intermediaries, who understand these implicit rules, are better able to assess information resource quality than those less well qualified. Their accuracy and speed in finding appropriate resources contributes to the trust others invest in them (Murphy & Adams, 2005).

Not only are there many intermediary roles, but the roles vary across domains and are influenced by how users interact with those intermediaries, with information and with resources that contain that information. Users' diverse needs are also continually changing, demanding different intermediary roles. In order to design the powerful digital libraries users require, it is also important to understand how intermediary roles change through the users' 'information journey' (Adams & Blandford, 2005). This paper identifies and categorizes intermediary roles according to context and user needs.

Background

To understand the changing roles of intermediaries in the digital age, an appreciation is required of the development of digital library research. Initially, automating libraries was the main driver behind developing digital library systems (Adkinson & Stearns, 1967). However, the importance of human

computer interaction and social issues was later recognised and digital library development started to take account of such concerns (Lucier & Dooley, 1985; Fox et al, 1993; Marshall & Bly, 2004). More recently, this research has led to an recognition of the importance of understanding organisational change and context of use (Covi & Kling, 1997; Pettigrew, 1999; Fidel et al, 2004; Fisher et al, 2004; Holmstrom, 2004). Through all these developments there have been growing questions of the role of digital library intermediaries.

With the growth of networked services, more and more people from different backgrounds and cultures, and with varying skills, are using digital libraries. For example, lawyers (Kuhlthau & Tama, 2001) and journalists (Attfield and Dowell, 2003) depend on access to reliable information, and may often make use of electronic information resources. Within academia, the importance of recognising roles and supporting them within digital library design has been noted (Covi & Kling, 1997). However, there is a need to identify the different roles expert information intermediaries can take in response to user needs in order to recognise potential design implications. The work reported here focuses on two domains in which the use of electronic information is relatively mature, namely academia and health services.

Information Intermediary Roles

There is an extensive literature in the library reference services domain about the role of the library intermediary in information seeking (e.g. Bates, 1981; Borgman, 1984; Harter & Hert, 1997; Drenth et al, 1991). Taylor (1968) highlighted the important role of intermediaries in supporting clarification of end-users' often poorly articulated information needs. Information seeking was identified as a process of negotiation and communication with users as they travel from vague to clearer needs. Looking to the future, Gristock & Mansell (1998) detail the growing number of intermediary roles that will be required as digital library usage increases. They argue that, as distributed digital resources grow in importance, so will those individuals who can add value to the resources and information through information access, assimilation, merging and re-creation to suit users needs.

Many expert information intermediary roles identified within previous research have concentrated on accessing and manipulating information for users. Metoyer-Duran (1991) identified information gatekeeper types, two of which, the *'broker'* (providing information access) and *'information professional'* (providing information integration and transformation) are most relevant to digital library intermediaries. Kajberg (1997) argues that digital library technology is beginning to shape librarian intermediary roles to produce new professional identities such as the *'net navigator'*, the *'information consultant'*, the *'gatekeeper'* and the *'educator'*. These again concentrate on the aspects of accessing and manipulating information with the added role of training the user. Through detailed empirical analysis, Wu and Liu (2003) identified three roles and elicitation styles for academic and research intermediaries that were essentially the same as those. Their *'information problem detection'* approach is similar to the notion of librarian intermediation highlighted by Belkin (1980) and Theng (2002). Here the librarian, it is suggested, acts as a kind of psychotherapist whose skilful questioning supports the user in understanding their own needs and then supports them in meeting those needs. Theng (2002) argues that current digital library designs provide limited support for this need. However, Wu and Liu (2003) argue that within the academic domain this is a little used approach. Instead, they suggest that academic library intermediaries mainly take the role of *'database instructor'*. In this role, the intermediary instructs the user about database usage without reference to an individual user's information needs. The next most common role, they suggest, is supporting the *'query formulation process'*, whereby the intermediary focuses on the formulation of good search terms. The distinctions highlighted in these different approaches also relate to a change in the perspective of digital library intermediaries from that of being asset managers to that of being customer relationship managers (Holmstrom, 2004).

The growth of the Internet and digital libraries means that information intermediary roles will need to be flexible and user focused. Ehlich & Cash (1999) suggest that these new intermediary roles can be taken on by humans or systems, but that they should seek to aggregate, personalize and assure the

quality of information. Quality control is an important intermediary role in digital resources highlighted by many researchers (e.g. Borgman, 2001; Vishik & Whinston, 1999). However as Vishik and Whinston (1999) note, this role requires a great deal of trust on the part of user as they often have no expertise in assessing the quality of information resources, and thus rely heavily on the intermediaries' abilities. Once trust is established, they argue, this in turn promotes trusted relationships between the user and primary information provider, and supports the intermediary's regulatory role between the producer and consumer of information.

There are many different accounts of intermediary roles within specific domains (e.g. Wu & Liu, 2003; Fisher et al, 2004). However, there are few accounts that deal with users' changing needs, motivations and contexts of use across different domains. It is the contextual differences that have led to the different approaches to intermediary support found in the studies that are reported in this paper.

Context and Digital Library Intermediaries

Fisher et al (2004) highlight the importance of context for guiding information behaviour for digital libraries. In particular the importance of 'information grounds' (Pettigrew, 1999), the phenomenon of people coming together to share information informally and serendipitously, is highlighted.

Covi & Kling (1997) also argue that understanding the wider context of technology is essential to understanding digital library roles and how they are implemented in different social worlds: you need to understand these wider contextual issues before you can understand the user and intermediary roles within those contexts. Within the academic domain, many web accessible digital libraries seek, if sometimes inadequately, to support not only research activities but also students in their educational goals. Some digital libraries are designed to enable the full potential of distance learning to be realized. With the support of appropriate digital libraries, distance / part-time learning and continued professional development deliverers could encourage students to assimilate and understand information appropriate for their learning needs wherever and whenever they want it.

To understand academic digital library intermediaries' roles, it is important to understand users' needs and usage patterns within context. Web-accessible digital libraries for academic purposes must facilitate users from vastly different cultures and backgrounds in establishing a shared understanding of the content and usage for that system. Furthermore, the continual intake of new users at the beginning of courses means that digital library skills for educational purposes must be quickly and easily assimilated. When these factors are considered it is easy to understand that academic librarians might place great emphasis on training as an intermediary's role. However, this picture does not fit that of the lecturers who, although in the same domain, require a different kind of support from an intermediary. Within other domains this type of intermediary role is also not appropriate as users' preconceptions, abilities, time-constraints and on-going support typically differ from those of students within the academic domain.

Within the clinical domain, there has been a growing focus on improved application of existing knowledge through the use of current best evidence in clinical decision-making. Web accessible digital libraries offer the potential to greatly increase access to reputable information in the clinical field, and thus greatly benefit users. However, within this domain the timeliness of this information is paramount. Reddy & Dourish (2002) highlight the importance of information being available at a glance to members of a clinical unit. The major problems encountered within this domain centre around users' negative technology perceptions, poor skills, time constraints, and access to technology and expert intermediary support.

When hospital information systems were first introduced, it was found that the greatest difficulties in their deployment lay not with technical issues but with the users, their reactions to its introduction and the acquisition of new skills (Harrison, 1991). Recent health informatics research also reveals that social and organizational factors can determine the success or failure of healthcare IT developments (Gremy & Bonnin, 1995; Heathfield, 1999). Relationships and tensions between communities of practice have a strong impact on changing technology and procedures within the health domain

(Adams, Blandford & Lunt, 2005). The diverse organizational culture of hospital structures, made up of many different professions with their own specific social identifiers, can often produce conflicts between those professions (Morgan, 1991; Turner, 1987). Symon et al (1996) have identified, within a hospital scenario, how social structures and work practices can be disrupted by technology implementation. One important role for intermediaries is to mitigate against these disruptive forces within the context of use.

A key aspect in the awareness and usage of digital resources relates to how the technology is implemented and accessed by the users. Adams and Blandford (2002) identify ways in which social and organisational structures can impact upon users' awareness and acceptance of digital library resources. Todd et al (2003) highlight the fact that nurses' current work-practices (e.g. shift patterns, ward-bound duties) restrict their access to libraries, the internet and information intermediaries. These continuing problems within the health domain are inhibitors to the growth of digital library use.

In the clinical domain patients are often not considered as digital library users. They have, however, empowered themselves by utilizing the Internet and digital libraries to answer questions that traditional information pamphlets cannot answer. Unfortunately the variability in skill levels and computer access for the public have led to impoverished accounts of their use of these resources. Often research highlights issues around the digital divide (e.g. Cotten, 2001) and the high level of poor quality health information on the Internet (e.g. Crocco et al, 2002). However, the role of digital library information intermediaries for patients has not been discussed; this is one of the themes of this paper.

Research Method

Three studies were conducted and results were obtained from 56 participants who were either digital library intermediaries (librarians, nurses and information professionals) or information users (patients, clinicians and academics). A definition of a 'Digital Library' was not introduced by the researchers so that users were allowed to explore what they perceived a digital library to be. In practice, the users or

intermediaries from each domain were able to describe and subsequently refer to the digital libraries they used. Data was gathered, compared and contrasted, to identify context specific and generic issues across these domains and contexts of use. The three contexts were: a hospital setting; a patient call centre; and a university.

Study 1: Hospital

One study investigated a health service project in which hospital clinicians had support from outreach clinical librarian intermediaries. The project aimed to support clinicians in their digital library searches by providing direct contact with a clinical librarian (CL), so that the 'library would come to them'. The clinical librarian interacted with clinical teams to facilitate interactions that would support the implementation of evidence-based medicine (EBM). A representative from each team was chosen to facilitate the team–library interactions at the beginning of the project. The clinical librarian initially interacted with the teams as a whole (e.g. at team meetings, ward rounds etc.) and also with the representative. As relationships were built up between the CL and team members, personal contacts were made via email, phone and at scheduled drop-in sessions where the CL was available at the team's site. The CL initially provided a digital information searching and training service (e.g. digital library and Internet searching and clinical question framing) appropriate to the teams' and individuals' needs. However, the CL role during the project progressed far beyond this (see results).

26 in-depth interviews were conducted across 8 different clinical teams. Five of the interviews were conducted with key stakeholders (e.g. project co-coordinators, project librarians and Information Management and Technology staff), while the other 21 interviews were conducted with a spread of clinicians (e.g. consultants, doctors, nurses, social workers, physiotherapists, psychiatrists and psychologists). The interviews, together with an observational study of the team and information mediator collaborating during a drop-in session, took place over a 6 month period. Although a wide variety of digital resources were mentioned, the three main digital libraries discussed were Medline, the Cochrane library and the UK National electronic Library of Health (NeLH).

Study 2: Patient call centre

Study 2 focused on activity within a NHS Direct call centre (which provides health information to the public via the telephone). One centre in a national network of such centres was investigated. Any member of the public can call the centre to present symptoms or health questions, and be directed towards a health or information advisor. The health advisors provide callers with recommendations for their next course of action (e.g. see the doctor, go to hospital, take an aspirin), while the information advisors provide them with any information required (from online and offline resources). Callers are directed to one or other of the advisors depending on the nature of their queries. The advisors have either a clinical (e.g. nurses) or information (e.g. librarian) background.

6 interviews were conducted with information, nursing and centre managers and health and information advisors. Ethnographic observations of the centre and of calls taken over a 3 month period were also undertaken. Although a wide variety of digital resources were mentioned, the three main digital libraries discussed were again Medline, the Cochrane library and the UK National electronic Library of Health.

Study 3: University

The third study looked at lecturers, academic librarians and outreach librarian intermediaries. Data was gathered from a London-based university that is split over several geographically distributed campuses. Focus groups and in-depth interviews were used to gather data from 25 academics and librarians from 4 different campuses within the university. 10 of those interviewed were from Humanities, 10 from Computer Science and 4 from Business, the split of the sample being approximately 50% librarians, 50% academics. The final respondent was from a key managerial role within library services. The academics were selected from all levels within their departments (i.e. Lecturer, Senior Lecturer, Reader, Professor). There was also a representative sample from each department of teaching and non-teaching staff. Of the 13 librarians interviewed, the majority were subject librarians with responsibility for acquiring and supporting digital resources for their disciplines. Some of the librarians

interviewed were involved in an outreach project similar to that described in study one. Although various electronic resources were mentioned, the three main digital libraries discussed were the ACM Digital Library, PROQUEST and Lexis Nexis.

Data collection

Four issues guided the focus of questions within all three studies:

- Perceptions of their role within the setting, and their information requirements.
- Perceptions of how information is currently accessed, and how these processes accommodate or inhibit working practices.
- The impact of organisational social structures and patterns of interaction on information resource awareness, acceptance and use.
- Technology perceptions (specifically of digital libraries) and how these affect other issues already identified.

An in-depth analysis of respondents' information and technology perceptions was conducted using the Grounded Theory method. Grounded Theory (Strauss & Corbin, 1990) is a social science approach to data collection and analysis that combines systematic levels of abstraction into a framework about a phenomenon which is verified and expanded throughout the study. Once the data is collected it is analysed in a standard Grounded Theory format (i.e. open, axial and selective coding and identification of process effects). Compared to other social science methodologies, Grounded Theory provides a focused, structured approach to qualitative research. The methodology's flexibility can cope with complex data, and its continual cross-referencing allows for grounding of theory in the data, thus uncovering previously unknown issues.

In the results discussed below, many points are illustrated with verbatim extracts from interviews and focus groups. In these quotations, the speaker is identified by role, but not as an individual (so, for instance, multiple excerpts from a 'nurse' may be from different individuals).

Results

A comparison between the three studies highlights the valuable but contrasting roles information intermediaries play within different settings, and for different users. Analysis of the data identified 8 different intermediary roles across the different study settings. Four of these relate to information itself (mediating between users and the information) and the other four to the information repositories (i.e. digital libraries); the roles were similar across information and resources:

- Initiating needs: raising awareness of the need for information or of the possibility of obtaining it (or, in the case of digital libraries, raising awareness of the existence and utility of a library).
- Providing access: making information (or the digital library) available to the users.
- Making usable: In the case of information, this means interpreting it in the context of the user's immediate needs. In the case of the digital library, this means training and providing on-going support for users to work more effectively.
- Quality assurance: providing assurance about the trustworthiness of the information, or of the digital library and its contents as a whole.

We consider in more detail each of these four roles, and relate them to the specific studies in which each role was identified. As noted, above, not all roles were apparent in all studies.

Initiating needs

Raising awareness of information

The intermediary role of 'information initiator' in information requirements was only identified within study one (hospital study). The role was found to be taken on both actively and passively. The clinicians and librarians noted that once a relationship had been built between the two, the intermediary, when appropriate, was able to actively propose potential searches for the group.

“(The CL) would sort of raise the flag and she became very good also at predicting and anticipating when a clinical discussion was leading towards asking a clinical question that could then be addressed by her help.” (Consultant)

Clinicians also noted that simply having the librarian there passively stimulated an awareness of information and its usage in day to day decision making.

“Because she was there the team ... would be saying well I wonder what the latest research has been showing.” (Doctor)

The active role of Information requirement initiation was found to be important in all the studies; however, in the other two situations (i.e. patient call centre & university), this role was not taken by an information professional, but by the person themselves or by others such as peers, family or tutors.

Raising awareness of information resources

One of the roles for intermediaries in all three studies was also to make information users aware of what resources were available to them. In the hospital study (study 1) the intermediary guided the clinicians towards a variety of appropriate digital libraries and web-sites, thus raising resource awareness. An interesting additional aspect to this role was the end-users also being made aware of on-line tools that would continue to support their resource awareness and usage (e.g. setting up alerting mechanisms, book-marking functions):

“She was showing me a web-site ... it'll email you the contents every time that journal comes out.” (Physiotherapist)

Results from the patient call centre (study 2) revealed that intermediaries raised callers' awareness of information resources and how information was classified within those resources (e.g. benefits & social services information, schools public health information). Patients call up asking for specific or general information and the intermediaries then guide them towards the classifications and

“We sign-post people to the right place.” (Health information officer)

Health information officers noted that they were surprised how often they were required to take on this role.

Within the university setting, many academics noted their own poor awareness of digital library resources and those currently subscribed to by their institution.

"It's an area of enormous ignorance for me. If I knew more, I would know better how to advise people." **(Humanities senior lecturer)**

However, although, digital resource awareness and education was frequently noted by the librarians as important they tended to center this role on students, the physical library and its resources. However, many lecturers stated that they rarely visited the physical library, producing a barrier in the lecturer / librarian relationship and development of this role.

"... the librarians are not user-centred they're information resource centred ... they want to protect their resources not to gain access to them." **(CS lecturer)**

In contrast to the clinical intermediaries, the poor support for this role caused problems in lecturers' (and in-turn students') resource awareness. Several of the humanities lecturers, for example, suggested that a useful digital resource would be an online newspaper archive so that the students did not have to travel to the physical newspaper library to complete their research. However, all the librarians noted the successful acquisition of this same resource a year earlier. This example highlights the importance of not only acquiring the right resources but also adequately marketing them. The main library approach to raising awareness of these resources was by links on the library web-page, induction courses, word of mouth or handouts within the library:

"...we have sheets at the desk that we give out." **(Humanities librarian)**

All of these approaches, however, require users to access local library resources rather than accessing the web and digital libraries directly.

Providing access

Making information available

The intermediaries' skills in making information available was identified as a key role in study 1 (Hospital). The expertise, speed and accuracy of the intermediary were greatly valued by the clinicians:

“... you knew that she, through her training and knowledge, was accessing everything that there was available.” (Social Worker)

*“It’s saved us so much time ... so out of my research hours I actually read the articles.”
(Consultant)*

The results from study 2 (patient call centre) showed that the intermediaries’ primary role was restricted to increasing information availability. The intermediaries facilitated access to a spread of reputable, high quality information (see quality assurance roles below) but did not help to interpret that information (see making information and resources usable below).

“What we are saying is it may well be upsetting information but nevertheless people have a right to have it... we felt that otherwise we could be, there could be pressure to push us towards a more traditional clinical approach to this of restricting information for people’s own good.” (Information manager)

Within the academic domain, the intermediary librarian role of student information trainer takes precedence over that of facilitator (i.e. providing access). However, within the humanities department, librarian intermediaries and lecturers were eager to change this balance but unsure how to proceed.

“So he [the librarian] would like to be a little bit more hands on with them and he would like to help them with research ... I haven’t yet found out a way that I can use his enthusiasm without actually killing it when he has ninety students knocking on his door saying can you find me this stuff.” (Humanities senior lecturer)

One solution was to introduce the librarian into smaller courses as support for projects. However, due to librarian role stereotyping (i.e. only student support) and social barriers (i.e. maintaining perceived expertise), intermediation for lecturers did not occur.

“there is an astonishing separation between the library and us. It’s very weird the way in which they’re both sort of satellites and very little interaction” (Humanities Lecturer)

Advances were being made in breaking down these social barriers by introducing an outreach librarian project (termed an 'electronic resource librarian') similar to that in Study 1 (Hospital). In this project the intermediaries took on a more proactive role in lecturer information facilitation and training, participating in research group meetings and supporting research activities (e.g. workshops) within the department. However, although this was found to be working successfully within the business dept the project ceased within the computing department where role definitions appeared more entrenched.

Making information resources available

A key and obvious role for librarians is that of making information resources available for users. This was evident in studies 1 and 3. Although this role was not directly undertaken in study 2 (the patient call centre: NHS Direct) a sister organisation (NHS Direct Online) provides online health information for patients. Many of the patient health intermediaries noted that they not only directed callers towards these sites but also provide information to resource developers to improve resource availability for callers (e.g. links from other sites noted by callers).

Within the hospital study (Study 1) the intermediaries supported the clinicians in developing and tailoring their own resources both online and offline (e.g. an archive of previous search results). The intermediaries also provided feedback to hospital digital library portal developers on the clinicians' work-practices (e.g. support required with authentication procedures).

Within the university study this role was taken on far more proactively, with the librarians continually negotiating resource acquisitions with lecturers.

"Provision of materials which involves book selection, journal selection and I suppose even online resource selection" (CS Librarian)

Many of the academics noted that this was the only communication that they had with the librarian:

"But I haven't spoken to a librarian directly for at least 3 years." (CS lecturer)

“I filled in an email two days ago if that counts saying what was good and bad journals. But no, not on the whole. We send in our requests for books.” (CS lecturer)

As already noted, an outreach librarian was being used to break-down these communication barriers within the business department of the university (study 3). The intermediary regularly identified and communicated user needs directly to resource developers to support new developments, tailoring of systems and appropriate training sessions. It was noted by the intermediary that as the library acquired these resources they were able to use their purchaser status to convince developers to meet their end-user needs.

Making usable

Interpreting information

The role of supporting information interpretation is traditionally adopted by colleagues, peers and domain experts. In study 1 (hospital) colleagues were used to assist in information interpretation as well as support for locating information.

“If I really wanted to know something I would do something that I still do now which is to ask a colleague.” (Consultant)

However, in this study it was revealed how the role of expert information intermediary could be expanded to one of mediator, as well as facilitator, through the building of trusted relationships:

“So she's been quite thorough, she's highly respected in the team.” (Doctor).

The trusted relationship with individuals and groups helped intermediaries to develop a deeper understanding of users' needs and how to support information interpretation. This in turn increased the likelihood of serendipitous information facilitation.

“What I find very valuable is that she comes to some of the team meetings so she really does have an understanding of the topic and an empathy with it.” (Psychologist)

As previously mentioned, the call-centre staff (study 2) noted that, for political reasons (i.e. because this is a clinicians' role), they avoided this role in patient interactions. The information intermediaries were monitored, by senior staff, to ensure that they provided information but did not support its analysis or interpretation. It was proposed, by the intermediaries, that patients should seek the expertise of doctors and nurses for analysing and interpreting the information in relation to their own specific needs.

"They call up and say which is the best one, like operation, or do you think I should have this operation, and we can't tell them that. We say no! You have to discuss it with your consultant, what is the best one for you." **(Information handler)**

Within the academic domain (study 3), the mediating role was taken on by lecturers. However, some lecturers and librarians built strong trust relationships and were trying to increase the facilitating and mediating aspects of the intermediaries' role for students.

*"Information searching techniques and if it's just the odd group I'd go and tell them to go talk to *** and *** would help them to work out their research proposals and give them some different ideas about things to look at."* **(Humanities senior lecturer)**

Resource training and ongoing support

Study three (university) highlighted the importance of library and more specifically digital library training:

"A major part of our work is on library education." **(CS librarian)**

It was also reported that continually changing digital library design and the fact that most users access them infrequently meant that users were playing catch-up with the digital library tools.

"So if you don't go into it for a couple of weeks you've lost it." **(Humanities librarian)**

This raised the importance of regular training sessions and the value of the intermediaries' own expertise. However, social issues (e.g. perceived status, poor lecturer / librarian relationships) lowered the acceptability of attending digital library training for academics. In contrast, study one (hospital)

highlighted how social and organizational barriers were overcome by building trusted relationships, which then led to increased confidence in the use of digital libraries and IT more generally.

“I think it encourages me to begin to do more myself because she’s there and because she can just say, well we can start and do something. The whole technology side doesn’t become so overwhelming and daunting.” (Psychologist)

The intermediary developed training sessions that were tailored to each team’s and individual’s needs, from the use of specific resources to generic searching skills.

“She trained us up though, she showed us how to look up for relevant information, how to word questions.” (Social worker)

The call-centre staff provided no support for training or ongoing support for patients’ information and resource usage. They considered that this was not a role they should take on but were unaware of any other body within the health service that provided this support.

Quality assurance

Ensuring quality of information

In both the health studies (1 and 2), a very important role of the intermediary was to ensure quality of the information obtained. Clinicians in the hospital study (study 1) noted fears that their own searches would not ensure that they would retrieve all the high quality resources that were, in principle, available:

“... you knew that she through her training and knowledge was accessing everything that there was available...For example, she got this information for us – it’s about giving patients medication without them knowing it and she checked it out. It’s an up and coming issue and we wanted to know the legality issues as much as anything else.” (Social Worker)

The intermediaries’ speed in obtaining and verifying a spread of high quality information was noted by the clinicians as a strong advantage to this support.

“So if I think of the hours that I spent and the cost effectiveness of doing it in that way.”

(Consultant)

“... she could do it in a fraction of the time that it would take me to do it, because she's got the knowledge.” **(Physiotherapist)**

Within study 2 (patient call centre), ensuring information quality was a major goal for the intermediaries. Patients were always provided with information from three different digital sources (i.e. self-help web sites, pamphlets, digital libraries) to ensure a spread of high quality information perspectives – from those clinically based to those related more directly to every day life experiences.

“We are presenting a range of information for people, we are saying this is good quality information and we are saying why it is good quality information” **(Information manager)**

The spread of information types was noted as important to increase patients' knowledge. It was understood that high quality information from different sources did not ensure consistency in the information given.

“And it doesn't matter if they contradict each other as long as we sent out 3 we've given them the whole range of opinion in that area.” **(Health information officer)**

Within the university study (study 3) the lecturers highlighted that they would source and ensure the quality of information for students. The librarian intermediary role was then considered one of administration, managing and re-affirming the relevance of this information (e.g. books, articles etc.)

“They would keep the list of the recommended books with them; if there was Internet URL's then they would print them out and put those in the library as well.” **(CS lecturer)**

The intermediaries would then only have an indirect impact on information quality, both online and offline.

Ensuring information resource quality

Within the hospital study (Study 1) a clear point of concern was the quality and reliability of the information resources used. Hospital or local trust portals to resources authorised as reliable were the usually means by which resource quality was maintained. The intermediaries, however, only indirectly had an input into ensuring resource quality or its maintenance.

NHS Direct intermediaries (study 2) noted that they only gave callers details from information resources that have been authorised as reliable by their organisation. To this end, the organization maintains an expert-appraised database of reputable, high quality information resources from which the advisors source information. This quality check on information sources is formally reviewed and updated on a regular basis by a panel of information experts to maintain the trusted quality of the information.

“And we have the approved web-sites ... they have been checked out by health information and the information is okay to use.” (Call handler / Nursing advisor)

Within the academic study (study 3), however, a poor awareness of digital resources was identified as impacting upon the type and quality of information obtained. Many academics were relying on broad Google searching for information and then using vague assessments of its quality (e.g. non-academic reviews):

“I mainly use Amazon for books a lot. I find the books and download and print off the summaries for the students” (CS Professor)

Discussion: the appropriation of roles within settings

In many information settings, some workers serve as unofficial information consultants to their colleagues in both providing and interpreting information (Brewer *et al*, 1996; Reddy & Dourish, 2002; Adams, Blandford & Lunt 2005). Colleagues as information intermediaries often cannot and should not be replaced, but with the ever increasing amount of information available, there is a need to supplement them with other forms of information expertise. Across all the studies, users frequently

required input and support from both formal and informal intermediaries. Informal roles were invariably taken on by colleagues and, in the case of patients, by friends and family. Formal roles were supported by librarians and domain information specialists. All of the studies identified distinctly different roles undertaken by both types of intermediaries (see table 1). However, it is the distinction between information and resource intermediation which is the most interesting. This may explain some of the ambiguity in intermediaries' roles as they support changes in not only information provision but also resource utilisation.

Four digital library intermediary roles, were identified that related to both information and information resources; these were found in either all or only specific domain studies. Some intermediary roles did not occur within all studies (see table 1), but were taken on by people other than the information specialists. Within the patient call centre, the role of information initiator is usually taken by the patient, their peers and relatives or the public press. Patients were advised by the call centre staff to seek support in interpreting the information (making it usable) from their doctor, while seeking training in information resource usage was left to the patient to pursue. Within the academic domain, the information initiator and intermediation roles were provided by the lecturer, the students themselves and their peers. The students were noted, by library staff, as having some guidance and support from them in information interpretation.

Table 1. Information expert intermediary roles in each study.

Study / role	Initiating needs		Providing access		Making usable		Quality assurance	
	information	resource	information	resource	Information interpretation	resource training & support	information	resource
Hospital	Y	Y	Y	Y	Y	Y	Y	Indirectly
Call centre	-	Y	Y	Indirectly	-	-	Y	Y
Academic	-	Y	Students (to some extent)	Y	Students (to some extent)	For Students	Indirectly	Y

Both human and software intermediaries can play a major role in initiating searches, helping people locate and interpret information. The challenge is to identify the capabilities, expertise and roles those intermediaries can provide in supporting users along their *'information journey'* (Adams & Blandford, 2005). By defining these roles, we can better develop online and human intermediary support. One clear distinction is between the support required at the information and resource level. Making a clear distinction between these two levels can highlight developments designers need to make. Do end-users need online support to help raise awareness about new information or resources? Although the former is frequently supported by digital library alerting mechanisms the latter is often left unsupported. The findings from study one (hospital) revealed how important the intermediaries' tacit knowledge of changing resources was. However, within study three (University) librarians noted that they were not themselves supported in gaining this awareness.

Belkin (1980) reports that users' system usage is driven by a gap in their knowledge. However, it is important to identify when users realise that a gap exists, who highlights it, and in what context it is highlighted, as this may determine where and how they look for information and their motivation in retrieving it. Bishop's (1999) study into digital library users found that they can easily be deterred from its usage and that poor awareness of library coverage prevents a full understanding of its potential. The intermediary role of *'information initiator'* was only actively supported in one study. Here, the intermediary also took on the role of making users aware of resources, their potential and their applicability for the clinicians' day to day activities. The value of this intermediary role should not be under-estimated as it related to users' motivation in information behaviours so that they changed working practices to incorporate day to day digital library usage. Within the academic domain, the *'information initiator'* role is taken over by the lecturer. However, as their digital library awareness and expertise can vary greatly they require greater support in this role, which for many social reasons have been left largely unsupported by libraries (Adams & Blandford 2002). Within other domains this role is

also driven by personal needs, peers and the press, with the latter often exploiting fear motivators which direct later searches (Adams & Blandford, 2005).

Much of the research into intermediary roles has concentrated on users' information searching patterns and needs through the pre-search interviews and search sessions (Taylor, 1968; White, 1998; Bates, 1981; Borgman, 1984; Harter & Hert, 1997; Drenth et al, 1991). Within study 2 (patient call centre), the intermediary's role concentrated on 'making information available', with an emphasis on providing a spread of high quality information to a patient who maybe on the wrong side of the 'digital divide'. Ultimately, these intermediaries are increasing the impact that digital library information can have on the public as a whole. Gristock and Mansell (1998) have argued that digital library intermediaries of the future will need to not only help users 'negotiate the sea of data' but also manage the third party redistribution of creative works.

The three studies presented in this paper highlight the fast changing roles that intermediaries are playing across domains and user types in the utilization of digital libraries. Wu and Liu's (2003) analysis of a librarian's main role and elicitation style being one to support training may be true for a traditional academic library; however, digital libraries are changing the information landscape and, rather than librarians disappearing, their roles are changing and the need for their expertise is increasing. A more traditional account of a digital library intermediary role was identified in study 3 (university) as increasing 'information and resource availability' as well as making resources more usable through 'training and support'. However, even here there were indications that these roles were expanding to become more pro-active to accommodate users' need for intermediaries' expertise in supporting information interpretation.

Gristock and Mansell (1998) highlight the importance in future digital library developments of intermediaries who will add value to resources and information. The findings from the studies relate this to the role of 'making resources and information usable'. One vital part of this is in the support for information interpretation. The findings from study 2 (patient call centre) reveal the importance for

patients of personally contextualising information and what it means for them. It is interesting to note, however, that despite callers asking call centre staff for information interpretation, this role was clearly seen as that of other health professionals (e.g. doctors, support helpers), and callers were advised of this. Gristock and Mansell (1998) argue that digital library intermediation of the future will require increased interpretation of information. As digital resources become essential in global daily practices, problems with information literacy will increase. The role of intermediaries in counterbalancing these limitations with effective support may become paramount in counteracting the digital divide. The findings presented here also highlight that although this role was supported by human intermediaries in study 1 (hospital), and to some extent by librarians for students in study 3 (university), it was not supported by online resources. However, some more recent digital library developments making the link with elearning initiatives have developed mechanisms to support student information interpretation. For example, Zhang & Quintana (2005) describe the initial development of a system that supports middle school students in their information sense making processes.

Several other authors have reviewed the need for information interpretation, although these have tended to concentrate on reducing information overload via quality filtering (Hopkins, 1995; Twidale and Nichols, 1996). Although this is a key intermediary function, the findings presented in this paper highlight it is a separate role. Borgman (2001) highlights the often invisible but vital role of library intermediaries in resources and information quality assurance. Gristock and Mansell (1998) go further and state that future digital library developments will require intermediaries to be 'trusted third parties' in security, protecting and providing confidence in information and resource usefulness. Within study 1 (hospital) and study 2 (patient call centre), the information and resource quality was central to clinicians' acceptance of the information and resources. Relationships were built whereby clinicians and patients trusted the intermediaries' judgements of their needs and abilities, and the quality of resources and information. This relationship meant that clinician, in particular, trusted intermediaries' assessments of whether a resource and information would be worth the time invested to utilise it.

As described above, in most domains, digital libraries intermediaries took on only a few of the roles shown in table. 1. However, the findings from study 1 (hospital) reveal a digital library intermediary taking on the broadest variety of roles. The intermediary provided all four roles for the clinicians, with an emphasis on building relationships both within the team and with its individuals. This approach was required by the users to support the varying abilities, facilities and preconceptions that inhibited attempts to use clinical information in everyday decision making. The findings from study 1, where all 4 intermediary roles were flexibly and appropriately supported, were that these barriers were greatly reduced. The impact of the intermediary also had a profound impact on the groups' interactions with regard to team cohesion, goals, knowledge management and patient interactions. This, in turn, provided higher job satisfaction, as the clinicians perceived professional and knowledge development for both themselves and the team.

“It feels as though there has been an ethos of shared endeavour to get a more pro-active relationship to evidence-based practice and I think without this it will just collapse.” (Doctor)

Ultimately, the intermediaries revealed the potential power of these digital resources. Users had previously avoided these resources for fear of inaccurately predicting overheads (e.g. time) and benefit (e.g. increased efficiency in work practices).

Conclusion

Digital libraries and their content are constantly changing. One library which may not have anything of use for a specific subject today may have just the right paper tomorrow. A constant review of these libraries and their structure and content is required. However, potential digital library users from domains outside academia are rarely regular users of any particular resource. This is because few jobs entail only information retrieval: they also require analysis and dissemination, and the parameters of what information they require are continually changing. Most occupations, as identified in study one (hospital) and three (university), also have a practical element to them. Clinicians need to see,

diagnose and treat patients as well as, on occasion, retrieve specific information for a wide variety of reasons. Lecturers and students also need specific information but their needs and usage patterns vary according to subjects, assignments, and schedules (e.g. breaks, exam times). Potential digital library users also have disparate IT skills and access to computers, sometimes leading to a 'digital divide'. There is a long way to go in implementing effective digital libraries that support users' varied needs, abilities and behaviours throughout their 'information journeys' (Adams & Blandford, 2005). Within many domains, and for the public en masse, only information specialists have the required knowledge to use many digital libraries to their full potential, or even realize what that potential is. Intermediaries, as well as end-users, need support in their tasks, which change for different domains and the working practices of communities, and also for users' individual needs. However, these studies have also shown the influence that digital libraries can and will have on organizations as day to day resources in every-day decision making.

Borgman (2001) argues that digital libraries will supplement, not supplant, real world libraries and librarians. From these studies, we would go a step further and say that real world libraries and librarians are symbiotically changing the way we interact with them, digital resources and information. Previously, librarians were bound to the library by the sheer weight of the books they utilized. However, with the implementation of digital libraries, accessible anywhere within an organization, librarians have been empowered to change their roles. Libraries and librarians need a centre to work from and for clients to visit, but they are also becoming more mobile and proactive, and beginning to communicate in a variety of different ways (e.g. email, online chat-rooms and call centres). Librarians can take their expertise in information support and training to the clients, maintain their many traditional roles (e.g. information classification, quality control and intellectual property rights) while tailoring information and resources to clients needs (initiating needs, providing access, making usable and quality assurance). However, digital library intermediaries require system designs that accommodate their domain specific interaction capabilities and roles. If these roles are not supported by the technology or information

experts they will be taken up by others (e.g. colleagues, IT support and specialist information organizations), who may not value the qualities provided by digital libraries.

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