Preprint: paper to appear in ACM Transactions on CHI. Special issue on social aspects of technology, 2005.

Social Empowerment and Exclusion: A case study on Digital Libraries

ANNE ADAMS AND ANN BLANDFORD
UCL Interaction Centre,
University College London
and
PETER LUNT
Psychology Dept,
University College London

This paper reports on work studying how technology can empower or exclude its users due to interactions between social context, system design and implementation. The analysis is based around the introduction and use of digital libraries in four different settings, three clinical and one academic. Across the four settings, in-depth interview and focus group data was collected from 144 users, and analyzed with reference to 'communities of practice'. The four settings represent three different approaches to digital library implementation: making digital library resources available from existing computer systems in people's offices and the library (a traditional approach); making computer systems – and hence digital libraries – available in shared spaces (in this case, hospital wards); and employing information intermediaries to work with staff and library resources. These different approaches engendered different perceptions of the technology. The traditional approach produced perceptions of technology as being irrelevant for current needs and community practices. Making technology available within shared physical space – but with poor design, support and implementation procedures – was widely perceived as a threat to current organizational structures. In contrast, technology implemented within the community which could adapt to and change practices according to individual and group needs, supported by an information intermediary, was seen as empowering to both the community and the individual. We relate the findings to a discussion of evolutionary and revolutionary approaches to design, and to the concept of 'communities of practice'.

Categories and Subject Descriptors: H1.2: User/machine systems (human factors); H3.7: Digital Libraries (user issues); H5.3: Group and organization interfaces (organizational design); K4.3: organizational impacts (reengineering).
General Terms: Human Factors; Design; Management.
Additional Key Words and Phrases: social exclusion; social empowerment; communities of practice; digital libraries; grounded theory.

---

1. INTRODUCTION

Computer technology and the 'knowledge society' frequently inspire speculation about their effects on society and its organizations. Within organizational contexts, technology has been recognized as not only improving the efficiency of work processes, but also

This research was supported by the ESRC ESociety programme under grant RES-335-25-0032 with added support from the London Library and Information Development Unit.
Authors' addresses: Anne Adams, UCL Interaction Center, University College London, WC1E 7DP. UK.; Ann Blandford, UCL Interaction Center, University College London, WC1E 7DP. UK.; Peter Lunt, Department of Psychology , University College London, WC1H OAP. UK.

radically redesigning those processes through improved communication and coordination [Gallivan, 2000]. One important aspect is that technology can empower or exclude people by determining their access to knowledge; for example, improved information access that results in process redesign can empower employees previously trapped in their decision making processes by poor knowledge management [Sia *et al*, 2002]. However, increased accessibility does not follow directly from improved availability: many users are excluded from technology access by their IT literacy, previous experience, age, gender or disabilities. Organizational and social structures can also play a part in perceived exclusion from technology through the acceptability of certain users accessing technology and the information it conveys [Adams & Blandford, 2002a].

Communities of practice have been recognized as an important factor in the use of technology [Wenger, 1999]. Communities of practice are therefore a useful tool for reviewing technology's ability to empower or exclude an organization's users. However, the impact of social structures on these communities, and consequently on technology uptake, is frequently underestimated. This paper reviews the interplay between organizational social structures and communities of practice, and how they affect the impact of technology and its utilization, using digital libraries as a case study.

Information and knowledge accessibility can have social and political repercussions within an organization. Information does not necessarily have to include personal data to be sensitive; even non-personal information can be interpreted so as to produce negative judgments about individuals or groups [Adams, 2000]. Digital libraries are an exemplar type of system that does not normally retain personally sensitive information and, as such, is useful as an object of study to interpret the impact of technology on communities of practice without privacy issues overshadowing the findings.

Digital libraries (DLs) are used in a wide variety of ways and to support a multitude of needs across different domains (e.g. academic, clinical and business). The social context and needs of these various domains are different, yet DL design varies very little to support those differences. Academic and clinical contexts are two contrasting domains that provide insight into the use of technology within contrasting social structures, task and knowledge goals and communities of practice. Within academia, the importance of DLs as a learning resource is highlighted, while within the clinical domain their role in decision support is paramount.

Elsewhere [Adams & Blandford, 2004] we discuss the implications of digital libraries for librarians' and DL designers' roles, and identify changes needed to ensure the acceptable and effective implementation of these resources. In contrast, this paper reviews how technology can interact with communities of practice and social structures to empower or exclude its users. Four case studies of the introduction of digital libraries within two contrasting domains (academia and health) are used to explore two issues:

1. The ability of technology to empower or exclude its users; and
2. The interplay between social structures and communities of practice, and their effects on the use of DL resources.

2. BACKGROUND

As Borgman [2000] observes, 'social informatics' is an important new area of research. Social contexts and work practices can have a significant impact on a community's engagement with new technology systems [Duncker, 2002; Kling, 1999; Theng, 2002; Cunningham, 2002]. Lave and Wenger [1991] argue that social practices shape how we learn and, in turn, who we become. However, those social practices grow from and interlink with organizational structures. Technology often traverses organizational structures and knowledge domains, and supports communication and collaboration through the use of 'boundary objects' – items that act as an interface between boundaries of domain knowledge [Star & Griesemer, 1989]. From this perspective, it is the social and economic system in which technology is embedded, not the technical artifact itself, which is important. Winner [1985] argues that technology develops with certain social and organizational structures in force. Chandler [1977] goes further to argue that the construction and effective daily operation of many systems requires the development of centralized, hierarchical organizational and social structures, without which they will collapse. It is important, therefore, to review the impact technologies such as digital libraries have on the inter-play between communities of practice and organizational structures.

2.1 Communities of Practice

Supporting communities of practice can assist the development of effective ways to share knowledge across organizational boundaries, thus promoting collaboration and coordination while also increasing productivity and organizational performance [Millen *et al*, 2002; Mojta, 2002]. The concept of 'communities of practice' emerged from a learning theory developed by Lave and Wenger [1991] called 'legitimate peripheral participation'. According to this theory, learning within any domain is more than a formal acquisition of

knowledge or information: it has a social element which is often ignored. Learning, it is argued, should be through a process of participation in '*communities of practice'*. The theory details how new members are brought into knowledge communities, and how knowledge communities both transform and reproduce themselves. This participation is at first peripheral, but gradually increases in both engagement and complexity. They go on to argue that the emphasis within learning should be on the whole person, and that learning equally involves the agent, activity and world. Wenger [1999] extends this to a framework in which the two basic streams are *Practice* (from collective social norms of practice to accounts of meanings) and *Identity* (from impacts of organizational power and social structures to those of personal subjectivity).

2.2 Communities of Practice and Digital Libraries

Within the digital library domain there is an increasing focus on user practices and their social interactions with regard to learning and digital library usage. Reviews of digital library communities of practice vary from the abstract concepts of trust and credibility [Van House, 2002] to those of searching practices [Crabtree *et al,* 1997; Reddy & Dourish, 2002]. Crabtree *et al* [1997] identify problems with the use of digital libraries by studying physical academic library interaction patterns, focusing on information searching strategies. They identify two key contributors to effective search in the physical library:

1. The collaboration between the librarian and the user in the searching activity.
2. The social context.

The role of the librarian is also highlighted by Theng [2002] as being paramount in the service provided by the library. She suggests that the librarian 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. Her review of digital libraries highlights their limitations in this respect. Taking a broader perspective, Covi and Kling [1997] argue that understanding the wider context of technology is essential to understanding digital library use and its implementation in different social worlds.

Reddy and Dourish [2002] review information seeking behaviors in a clinical setting, and identify two important points:

1. Colleagues are the first information reference point for clinicians.
2. Clinical and organizational issues are intertwined.

They found that clinical staff provide the contextual information that cannot usually be provided in a hardcopy format. Schneider and Wagner [1993] also highlight the importance, within a clinical setting, of local knowledge, informal collaboration and

technology to support the sharing of information. Similarly, Cicourel [1990] notes that team members on medical ward rounds provide contextualizing information to each other.

There is a striking similarity in the findings of Crabtree *et al* [1997] and Reddy and Dourish [2002] despite the different domains of study. The crucial difference is that the collaboration highlighted in the academic domain is that between librarian and user, while colleagues take on this role within the clinical domain. This difference in work practices may reflect the different social structures within these two domains.

2.3 Communities of Practice and Organizational Structures

The interaction between organizational structures and communities of practice is an important source of clashes between technology implementation and acceptable work practices. Communities of practice differ from the designed organization in that they are more self directed and organic in their construction, goals and boundaries [Wenger, 1999]. However, those communities can respond to and accommodate institutional directives, events and boundaries. Gallivan [2000] argues that traditional business models governing proposed technology usage, whereby system usage is determined by IT training, its quality and the perceived support, are inappropriate; rather, he argues that a 'community of practice' perspective is more accurate, with system usage being determined by work group usage and specific capabilities. Wenger [1999] also points out that organizational directives can produce barriers to users' ability to establish an identity which is conducive to participation in their community of practice.

Technological developments, specifically those involving digital libraries, are increasingly focusing on the importance of directing design towards the work practices and communities they support [Covi & Kling, 1997; Marchionini *et al*, 1997]. Both formal and informal work practices help to develop rich and varied social interactions in the modern workplace [Millen *et al*, 2002]. It is therefore important to establish the differences between formal and informal work practices, and the impact of social structures within those communities. Formal practices relay the official, formalized way to conduct the work, but do not allow for organizational dynamics, changing situations, evolution of task definitions, or social and political aspects (e.g. staff motivation, hierarchies) [Grudin, 1994]. Informal practices are organic, and evolve with the community through negotiation and engagement. Communities of practice are directly linked to informal practices, as their boundaries of practice are constantly renegotiated. Ultimately, systems designed to support only formal work practices can be too inflexible. Adams and Sasse [1999] found that systems which do not take into account informal work practices, and are perceived to restrict those practices, will be circumvented. Wenger [1999] notes that communities of practice are neither independent of nor reducible to organizational structures, and it is the

interplay between the two that may have the greatest impact on technology acceptance and use.

An organization's culture has a direct impact on the informal practices that can develop into social and organizational norms [Schein, 1990]. The distinction between formal and informal work practices is generally clear, but can be even more important for health care systems than most others. 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, on whom new demands were being placed [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; Heathfield *et al*, 1998]. Heathfield [1999] suggests that this is due to the complex, autonomous nature of the medical discipline and the specialized (clinician or software engineer) approach to system development. 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; Richman, 1987; Turner, 1987]. Symon *et al* [1996] found conflicts within a clinical setting relating to social status and information practices. For example, higher status professionals were found to be more concerned with keeping their social status as an expert within the organization than adhering to formal organizational norms. It is organizational norms, particularly regarding status and expertise, which can lead to technologies producing perceived empowerment or exclusion by changing work practices.

2.4 Technology Empowering or Excluding Users

How well technology design and implementation supports current communities of practice can relate to its perceived ability to empower or exclude. Symon *et al* [1996] have found, within a hospital, that established social structures and work practices can be disrupted by technology implementation that excludes some users. As noted above, although digital libraries do not deal with sensitive, personal information, apparently innocuous data can also be perceived as a threat to social and political structures [Adams & Blandford, 2002a; 2002b; 2004].

The information management literature presents empowerment as an important concept when assessing the impact of technology within organizations [Clement, 1994; Frans, 1993; Spreitzer, 1995]. Sia *et al* [2002] argue that technology increases flexibility in work practices and empowers local communities of practice, getting away from the hierarchical decision making that is often caused by lack of knowledge. However, technology can also be a controlling tool, empowering some users while excluding others. They argue that

empowerment should rule out deliberate control over the behavior of others, since true empowerment requires a degree of trust through the hierarchy. Krull [1995] suggests that the appropriate use of authority is in direction, not control, since explicit, inflexible rules undermine trust.

The 'community of practice' approach highlights how technologies that support information use can produce a richer knowledge which can be empowering [Wenger, 1999]. Participation in a community of practice involves the whole person, including the emotional drives which direct our endeavors and are controlled by them. Our identities are partially defined, not only by what is familiar and what we participate in, but also by what we do not participate in. In other words, to choose to exclude ourselves from participation can define us and a community of practice. Wenger [1999] makes the distinction between peripheral and marginal participation: in the former participation is dominant and in the latter non-participation is dominant. However, he goes further to point out that when non-participation is mediated by organizational structures and directives, it can lead to marginalization (e.g. due to users' perceptions of low job status and role issues).

Poor technology design and implementation interacting with organizational structures may cause users to perceive themselves as being excluded in some way [Adams & Blandford, 2001; 2002a; 2002b]. Poor system design can provide information that is in principle available, but in practice inaccessible, producing perceptions of disempowerment and exclusion. Wenger [1999] gives the example of a technical article which is full of indecipherable formulae, producing a lack of negotiability that excludes many users. Digital libraries can be exclusive in this way; they can also exclude by not adapting to practice needs or constraints. Todd *et al* [2003] highlight the fact that nurses' current work practices (e.g. shift patterns, ward-bound duties) restrict their access to libraries and the internet. The difficulty some professionals experience in accessing the physical library, and the push for evidenced based medicine[1], have resulted in different approaches to implementing DL technology – such as remote DL access, computers on the wards and outreach information intermediaries. However, as discussed below, these different approaches, when interacting with work practices and social structures, can produce both perceived exclusion and empowerment for different communities of practice within the organization.

3. RESEARCH METHOD

[1] A UK government push for healthcare professionals to use current best evidence in every-day clinical decision-making.

This study covered four different contexts of use, based in two domains: academia and healthcare. The two domains were studied over a 4-year period, and results from 144 users – end-users, librarians, designers and management – were gathered, compared and contrasted, to identify socially relevant issues, both specific to each domain and generic. Current work practices were identified and the impact of digital resources on those practices was assessed. A pre-defined concept of a 'Digital Library' was not employed, so that users could explore what they perceived as comprising a digital library.

3.1 Study 1. An academic institute

The findings within the academic domain are based on data 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 and Professor). Of the 13 librarians interviewed, the majority were subject librarians with responsibility for acquiring and supporting digital resources for their disciplines. All of the respondents had reasonably high degree of computer literacy and had used digital libraries at some point. Although various electronic resources were mentioned by participants, three main DLs were discussed: the ACM DL, PROQUEST and LEXIS.

3.2 Study 2. Inner London Hospital:

The first clinical setting studied was a London teaching hospital. In this hospital, computers have been placed on the wards, with web-accessible digital libraries. Focus groups and in-depth interviews were used to gather data from 73 hospital clinicians. 50% of the respondents were nurses while the other 50% were junior doctors, consultants, surgeons, Allied Health Professionals (AHPs; e.g. occupational therapists), managers and IT department members. In this and the other two hospital-based studies (3 & 4), there was a wide spread of computer abilities and digital library experience amongst those interviewed. In all three cases, although a wide variety of digital resources were mentioned, the three main DLs discussed were Medline, the Cochrane library and the UK National electronic Library of Health (NeLH).

3.3 Study 3. Provincial Hospital:

A further study within the clinical domain was conducted in a provincial teaching hospital. In this hospital, although all computers allowed access to web-accessible digital libraries,

they were not placed on the wards, but within specified offices and the library. 20 in-depth interviews were used to gather data from management, library, IT, consultant and nursing employees.

3.4 Study 4. Outer London Hospital:

Finally, an evaluation of an information intermediary's role within clinical communities of practice was undertaken. 26 in-depth interviews were conducted across 8 different clinical teams over a 6 month period, as well as an observational study of one team and information intermediary collaborating during a drop-in session.

3.5 Data Collection and Analysis:

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

- Perceptions of their role within the organisation, and their information requirements.
- Perceptions of current information practices, social structures and organisational norms.
- The impact of current practices, structures and norms on information resource awareness, acceptance and use.
- Technology perceptions (specifically of DLs) and how these affect other issues already identified

An in-depth analysis of respondents' 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 analyzed 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 more 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 the 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 'Pre-registration nurse' are not necessarily from the same individual).

4. RESULTS

Studies 1 and 3 feature similar deployment of technology, and the findings from these two situations share many features in common, even though one is an academic and the other a

clinical setting. We therefore present the findings from those two studies together. For each type of situation, we consider how people work with information (their 'information practices') and their perceptions of digital libraries.

4.1 Studies 1 & 3: Library based interactions

The traditional implementation of technology, and thus access to digital libraries, requires the individual to initiate interactions for their own needs. A user goes to the computer in *its* context (i.e. in the library, office, at home), and support is provided directly or remotely by the librarians. With this approach the computer is not a communal tool, but caters for individual needs.

4.1.1 Information Practices. We consider first the academic perspective (study 1), then the clinical one (study 3).

Across different disciplines within the academic domain, information dissemination has traditionally been via hard copies. Lecturers perceive their main information intermediaries, librarians, to be tied to hard copy resources and library-bound. Some academics also view librarians as hoarding information: focusing on, and being possessive of, resources rather than supporting and understanding users' needs.

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

It was reported that interactions with librarians occur primarily within the physical boundaries of the library on an informal, ad-hoc basis – either by 'bumping into' each other or by direct instigation from the lecturers or students themselves. Conversely, librarians held the view that lecturers rarely visit the library. Library instigated interactions are largely email based, usually regarding course-based hard-copy resource acquisitions or discontinuation:

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

> "And they don't really use it [the library] themselves [lecturers]. Because they use the same journal articles every year. So in that sense there is no, very little connection between academics and us." **(Humanities librarian)**

The subject librarians, when detailing their practices, always mentioned student resource acquisition as the first priority, and then training. Few highlighted supporting lecturers' needs or the marketing and on-going support required for electronic resources. The librarians argued that they focus on student training because lecturers are notoriously bad at attending these sessions. In the librarians' view, the social status of lecturers reduces

the effectiveness of general training sessions, as lecturers are embarrassed to disclose their poor electronic resource skills.

> "So if you're running one on medieval studies - the medieval lecturer will come and sit at the back of the class and you know that they're not trying to keep an eye on their class, they're trying to actually learn without appearing not to know." **(Humanities librarian)**

Lecturers admitted their poor DL knowledge, explaining that library services and training are not focused on their specific needs. As library services tend to focus on student and course requirements, lecturers perceive themselves (as both teachers and researchers) as being marginalised and excluded:

> "no like advice, certainly no tailoring of information from the library service" **(Humanities senior lecturer).**

Librarians, conversely, believe that they are overlooked and disregarded by academics.

> "There is also that whole professional thing as well that you have to be wary of that we're not seen as maybe their equal in knowledge or whatever and that maybe they feel that they're not going to learn anything gainful from us" **(CS librarian)**

Turning to study 3, it was found that, within the traditional clinical model, information dissemination is predominantly either via hard copies or verbal.

> "They reach for a book … or they go and ask somebody, they don't reach for a digital resource at the moment, it's not yet a natural part of their everyday clinical lives. And that's one of the main hurdles to be got across, I think." **(Consultant)**

Due to work pressures and organisational structure, verbal dissemination is also inhibited by crisis management practices (i.e. information is released as and when a crisis occurs or is imminent):

> "you don't have the time to stand back and look at what's happening and do things pro-actively" **(Nurse).**

The rigid hierarchical structure within the clinical domain has often resulted in juniors being excluded from information by senior staff. Senior clinicians were frequently referred to as a type of information gate-keeper for junior clinicians.

> "she'll say – this is what I found and this is what I feel." **(Specialist nurse)**

Many senior clinicians were found to have poor computer literacy but, as with lecturers, social issues (e.g. perceived relevance of the technology to work practices, social pressures

of revealing poor abilities to junior clinicians) inhibit their participation in group training sessions.

> "And there are all kind of issues around training, many of which are more to do with cultural and philosophical change than they are to do with the technology per se and the difficulty one can have in persuading senior people that the change is going to happen." **(Consultant)**

Training sessions designed to counteract these problems by concentrating on 'consultant only' support are perceived by some junior clinicians as reinforcing old hierarchies and status barriers.

> "he said that they are not prepared to train alongside the others and I think that is a big barrier because they need to do that … say like in my area I think its important for the consultants to be there, to be part of the team, not to be separate." **(Specialist nurse)**

4.1.2 Digital Library perceptions. In the academic domain, it was found that digital libraries are regarded as being primarily for students and researchers and not as a resource to support the practical aspects of teaching. Some considered these resources to be over-rated and were happier using the 'Web', viewing that as a more flexible resource to support teaching. The CS lecturers, in particular, highlighted the importance of the web as supplementing core books. Web resources are regarded as being easy to work with, and giving access to large quantities of information for relatively little effort.

> "I just think about the fantasy when one gets into that hyperlink type thing. It is very much about some sort of consumption … It is so strange it's a weird fantasy of sort of wanting it all everything in terms of knowledge and yet not really knowing what it is that you're getting" **(Humanities senior lecturer)**

> "Some people when they use search engines they type in a question and if they don't get the answer that they are looking for they type in another one. Just like prayers" **(CS lecturer)**

Both lecturers and librarians perceive students to have very poor skills in searching and identification of reputable sources and both are seeking to address these inadequacies through training.

The poor usability of digital libraries within academia and their transient interfaces were highlighted by both lecturers and librarians:

> "You have to keep training every year, every 6 months. It's not static" **(CS librarian).**

Some mismatches between users' and interface terminology were identified within the departments which could lead to the perceived exclusion of certain user groups. Computer science and business lecturers referred to the use of 'digital libraries' while humanities lecturers talked about 'archives'. However, the librarians invariably referred to the same resources as 'databases'. The library web site (see Figure 1) reflects the librarians' database terminology without any reference to digital libraries or archives. Several of the digital libraries discussed within the interviews are located under the headings 'databases' or 'journals' without any indication of how these grouping are made. In contrast the ACM Digital library (see Figure 2), used by most of the CS lecturers, uses the digital library terminology, conforming with their perceptions.

Fig. 1. University library portal.

Fig. 2. ACM digital library.

Within the clinical domain, although management and junior clinicians recognize the potential of technology, it is still far from being an everyday resource with practical applications:

> "I've seen the advantages as technology has grown but we are still growing with it aren't we" **(Specialist nurse).**

Technology was sometimes referred to as distracting from and obstructing current working practices:

> "I think it's driving it from the top it's a whole concept of how we integrate as people, how we interrelate as human beings and they're not allowing that normal process." **(Nurse).**

Within the clinical domain the 'National Electronic Library for Health' (NeLH – see Figure 3) provides a portal to a wide variety of resources from guidelines and standards to decision support tools, full text and abbreviated journal libraries (e.g. Medline, Cochrane). Although many clinicians (especially junior clinicians) proposed a need for this type of resource, many were unaware of its existence or that it would contain anything other than journals. The NeLH portal also alludes to supporting communities of practice regardless of individuals' position in the organizational hierarchy. There are links through to specialized virtual libraries for nurses, librarians etc. However, while these links take users through to a further portal which uses terminology appropriate to each profession, the actual resources (i.e. digital libraries) accessible from these pages are those originally developed for and directed towards doctors (Medline, Cochrane, etc.).

Fig. 3. National electronic library for health.

The terminology and information grouping within resources such as Cochrane (see Figure 4) was reported by many of the non-doctors as being incompatible with their perspective. Cochrane, like the academic library, refers to all the resources as 'databases' even though this terminology is alienating and confusing for most of the clinicians who use it. The term 'library' is associated, for most clinicians, with academic theoretical knowledge. Digital libraries are not considered practical information resources, for day-to-day decision making and therefore are only used for research and educational development. Using clinical terminology might aid a clearer understanding and acceptance of the technology – for example, using terms such as evidence based digital handbooks or resources.

Fig. 4. The Cochrane library.

4.1.3 Traditional libraries: Summary. As we have seen, in this setting, the information users and librarians have few points of contact. Most users feel disempowered, and alienated by the ways information is made available to them. Some feel marginalized within their organizational contexts. Traditional digital library design and implementation produce perceptions of technology excluding community needs. Current digital library systems are perceived by many users as having poor design and support and as being complex, inappropriate and inflexible for their changing needs.

4.2 Studies 2: Library access within the workplace

Recognizing that the location of technology could create difficulties of access, the second organization studied brought computers, and thus digital libraries, into the working context (e.g. the wards). The user still initiates computer interactions but these are within the normal place of work. The technology is implemented as a communal tool for multiple users.

4.2.1 Information Practices. The attempt to change working practices through the introduction of computers onto the ward had little apparent effect except for the polarization of perceptions. Dissemination of information is again hampered by poor accessibility to hard copy (e.g. via paper guidelines and books) due to priority access for those of higher status, thus marginalizing those of lower status. Computers on the wards

have reportedly not improved information access, for reasons such as information hoarding, technology hoarding and inadequate training, as discussed below

Many nurses and AHPs expressed the view that information accessibility problems are associated with senior staff's information hoarding behaviours. Some senior staff confirmed that they saw technology, and specifically digital libraries, as a benefit of status:

> "People lower down. Well they would resort to the actual standard text" **(Nursing manager).**

Many senior staff members expressed a desire to retain their expert status by continuing to control information dissemination procedures. For example, some would rather access digital libraries on behalf of junior staff:

> "… if they want something on this or that then I'm around to do it for them" **(Nursing manager).**

These approaches to controlling technology and information access are perceived as exclusion mechanisms by those of a lower status:

> "Why shouldn't we have anything that they are hiding from us?" **(Post-reg nurse)**

A major source of problems within this study was found to be the location of the technology. Although computers were formally accessible by all, nurses' and AHPs' access within the hospital was often limited by either physical or social restrictions (e.g. passwords, computer locks, location of computers). Computers on the wards increased friction between different user groups (e.g. doctors and nurses, senior and junior staff) trying to access them.

> "I know there is some friction between the junior doctors and the nurses about who the computers are there for … sometimes the computer has been put in a place where it is very obviously in one territory" **(Doctor)**
>
> "I know that there is one computer on the ward which is supposed to be for everyone to use it but because it's in the doctor's office they don't want people in there in a certain time because they could be putting something on tape, doing their notes. So it ain't (is not) for everyone is it." **(Post-reg nurse)**

Computers on the wards are also perceived as a threat to existing information dissemination procedures since higher status staff regard nurses as requiring practical rather than theoretical knowledge. Web-accessible digital libraries, in particular, disrupt these processes by increasing knowledge for those of lower status:

> "they're going to be quoting text books at us and quoting policy notes but they need to go out there nursing patients." **(Nursing manager)**

The placement of computers on the wards has also highlighted further the disparity in clinicians' computer abilities. Many senior clinicians, although able to navigate the web, do not perceive themselves as computer literate, especially with regard to digital library use. Rather, senior clinicians perceive recently qualified staff members as being far more computer literate. The poor usability of digital libraries was identified as a crucial factor in the difficulties senior clinicians encounter. Of particular importance is the consequent friction developing between recently qualified members of staff and those classed as 'old school professionals'. A generation gap was identified as a key factor in producing senior staff's perceptions of computers as a threat to their status as experts. All the respondents noted the lack of support and training available with digital libraries.

> "…a lot of people feel 'well I should know about it but I don't and I feel silly going to somebody that is much younger than I am saying explain it to me'." **(Surgeon)**

4.2.2 Digital library perceptions. The location of computers on the wards accentuated the poor design of the digital resources. It also highlighted organizational divides and changing work practices. As in the earlier studies, digital libraries are considered as mainly academic and not relating to practical or locally relevant information

The Internet is perceived as an important aid in accessing reputable up-to-date information sources (e.g. digital libraries, academic sites, professional colleges). However, computers on the wards have made staff develop a strong distinction between Internet and Intranet resources. Many senior staff members perceive information stored on an intranet and accessed by junior staff as less politically sensitive than web-accessible information. The Internet is seen as a threat to their status by providing open access to varied information sources while providing the potential for abuse (i.e. access for non-professional purposes). In addition, senior clinicians expressed the view that junior staff members would not be able to interpret the quality of all the information available to them on web sites and in digital libraries.

> "… there may be stuff in this country that is of a reasonable quality but it requires some skill to some extent to be able to discriminate. I don't have difficulty with this. I don't know how much the nurses or the junior doctors would be able to discriminate." **(Consultant)**

Some senior staff went further and expressed a concern that junior staff would not be able to fully understand some complex information sources:

"… you find that people will just go off and they will misunderstand the national guidelines because they come out in long documents which interpretation requires further study. So I think for junior doctors they can be misleading, harmful, damaging." **(Consultant)**

Intranet information provision, in contrast, was perceived as being controlled by higher status staff members and therefore more applicable to juniors' needs and abilities; it is also adaptable to local requirements.

Journals were mentioned as being the major kind of documents available from digital libraries. International journals were highlighted as being particularly important for obtaining up-to-date information on specialist areas of research:

"At a consultant level one tends to go less to text books and more and more to journals." **(Consultant).**

The type of knowledge provided within a digital resource (i.e. theoretical and practical) was used by senior staff as an argument for access rights as:

- Higher status staff require more theoretical knowledge
- Lower status staff require more practical knowledge

In contrast, all the junior staff members (i.e. nurses, AHPs and doctors) who were interviewed recognised the potential for digital libraries to support them in completing their jobs effectively. Nursing staff (especially student nurses) and AHPs perceived them as an 'empowering tool', providing them with up-to-date information and knowledge. However, these junior staff members were often excluded from access to these resources, not just by intentional access restrictions as discussed above, but also because of their working practices (e.g. shift patterns, short breaks) and the multiple uses made of computers (e.g. also used for patient administration).

The immediate benefits of updated, locally relevant, day-to-day clinical information (e.g. policies, procedures, induction data, guidelines, and protocols), electronically stored and quickly retrievable, were recognized. Clinicians, however, require more than simple electronic representations of documents. These information sources would be invaluable if, subject to appropriate authentication, they could fulfil specific user needs and provide local knowledge.

"… how to care for a wound point 6 ohhh yes I have to use this type of dressing and where are they kept ohhhh right they're kept under there" **(Nursing manager)**

Users also detailed the need for flexible libraries of organizational information (e.g. job title, role, contact details, schedules and diaries) that would then link into communication media such as email and, ultimately, the electronic patient record.

4.2.2 DLs on the wards: summary. Although technology physically placed within the workplace has the apparent potential to improve timely access to information, in practice it has been found to increase clashes over practices and status structures. A polarisation of existing perceptions occurred, with poor design, support and implementation procedures producing negative reactions from specific users groups who perceived threats to current organizational structures and practices.

The support provided for information access is remote, with more likelihood of misinterpretation and miscommunication, both between users and providers and between different user groups.

4.3 Studies 4: Team based interactions

The final study focused on a project in which two information intermediaries had been placed within the community to facilitate and support agreed changes in information use due to digital library implementation. In this context, interactions are instigated by the user, the group and the intermediary. These interactions take place both online and offline, supporting both individual and group needs. The technology is located primarily in individual offices with a small number of communal computers, but the intermediaries move around, working with clinicians in their normal places of work. Support and training are provided by the intermediaries.

4.3.1 Information Practices. One key finding from this study was that technology can be positively empowering if implemented with reference to the communities of practice. In this study technology requirements and use, by both individuals and the group, were found to develop with changes to work practices and as the relationship of the intermediaries within the community evolved.

Clinicians reported that prior to the information intermediaries' support they had had difficulties in implementing 'evidence based medicine' due to a lack of time, inadequate IT facilities and their own limited searching skills. These problems resulted in clinicians adopting informal evidence verification methods (e.g. asking colleagues or inviting patients to search for information) or avoiding evidenced based medicine altogether – e.g.:

> "I think what would happen is that it would get shelved for quite a time."
>
> **(Psychologist)**

The information intermediaries' presence had a great impact on perceptions of evidence based medicine. Clinicians stressed that they now had an increased awareness of digital resources and had changed their working practices to use such resources. Working practices were adapted to accommodate the use of technology to support clinical decision making; this was led by the intermediaries (separately) attending team meetings and ward rounds, recording queries and searches *in situ* or actively proposing searches.

> "(The information intermediary) 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)**

Ultimately the flexibility of the information intermediaries meant that their roles in teams became integral to working practices.

> "So she's been quite thorough, she's highly respected in the team." **(Doctor).**

It was this trusting relationship, built up with the team as a whole as well as with individuals, that facilitated an in-depth understanding of their information needs.

> "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)**

Although facilitating access to information was a major role for the intermediaries, they also sought to implement training procedures with the clinicians.

> "There was a theoretical danger though that here would be this wonderful resource … we would all completely rely on without perhaps developing any skills ourselves… BUT my impression is that overall, just by having been here, just for this limited time there was a knock on effect that we learned some IT skills ourselves and managed to use those in such a way to develop our own EBM approach." **(Consultant)**

Established relationships enabled more specific tailoring of these training sessions for both teams and individuals and greatly increased motivation for users to attend. Intermediary support allowed all users with varying abilities to feel more able to utilise the resources.

> "It increases the sense that you think 'I can find out the answer to this question'" **(Consultant)**

> "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)**

While individuals' abilities and use of the technology increased (depending on interaction time with the intermediary and computer access) the most striking finding from this study was the impact on the team as a whole. Increased team cohesion was found to result from the information intermediary's interventions, especially with regard to joint goals and knowledge acquisition. The result was an increased sense of job satisfaction for the team as a whole.

> "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 (the information intermediary) it will just collapse." **(Doctor)**

4.3.2 Digital library perceptions. The placement of an intermediary within a clinical team did not change perceptions of digital libraries' poor usability, information structures and quality. The information intermediary did, however, increase users' awareness of resources that were applicable to their needs while supporting their changing work practices to accommodate the use of digital resources. One aspect of digital library usage that worried users was their ability to quickly identify applicable information from the resource. An information intermediary ensured that they received a high level of appropriate information within a reasonable time-frame:

> "… you knew that she, through her training and knowledge, was accessing everything that there was available." **(Social Worker)**

Users also noted that the information intermediary trained them in these skills so they could be applied by themselves for information that was not safety or time critical:

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

> "Also last year she came twice I think and did specific input in terms of how to formulate a question all of that and we practice that. And also what best evidence means and if you do your own searches how to organise them." **(Consultant)**

During the information intermediary's time with the team the number of types of information sourced greatly increased. Originally, information was restricted to that supporting 'evidence based medicine', covering issues such as medication, diagnosis, therapies, procedures and services. This was then extended to include information relevant for patients and carers. However, over time the clinicians realised that the information

intermediary could source a wider spectrum of knowledge (e.g. financial, legal and management information), and utilised this resource:

> "What we managed to do with (the information intermediary's) help was actually address the financial implications of the patient remaining on our ward … because she knew exactly who to access for that information" **(Consultant)**.

The team as a whole was encouraged to develop new approaches to information (e.g. team specific collections, journal clubs).

> "We've got a whole shelf of searches that we've requested over the year … available as a sort of library for the team otherwise people come along a year later and say would you look at this and it's already been done." **(Doctor)**

> "We give over one of the Journal clubs for (the information intermediary) to come and talk about the 'focus project', which is the government's 'finding the evidence'." **(Doctor)**

The teams felt empowered, due to the intermediaries' support, to seek out alternative work practices that exploited the availability of these resources:

> "we wanted to look into certain things about sleep, what was the literature around. You know what else could we do besides medication" **(Nurse)**.

Users also noted that, with the flexible team based support given by the intermediary, they felt able to exploit the many online support mechanisms available.

> "She was showing me a web-site which is now put onto my favourites so that I don't have to remember what it is and it's got all sorts of literature, journals and there's one site and you can go onto that and it'll email you the contents of every journal." **(Physiotherapist)**

The information intermediaries themselves noted the empowerment encountered by users when they realised the ways in which the systems could support and enhance their daily working practices.

4.2.2 Information intermediary: summary. In the context of this final study, it was not the technology, but an information intermediary who was physically located within the workplace. This was found to result in co-evolving relationships between team members and uses of information resources. This approach, which made it possible to adapt to and change practices according to individual and group needs, was seen as empowering to both the community and the individual.

5. DISCUSSION

The findings of this paper illustrate how information and technology are utilised within communities of practice, and how social structures can interact to exclude users while communities of practice can be used to develop empowering technologies. In the four case studies, three different configurations have emerged, as discussed above (see Figure 5).

Within both domains (study 1: academia and study 3: clinical) traditional information practices and social structures together with poor technology design resulted in excluded and marginalized user groups. Seeking to correct community exclusion, studies 2 and 4 took alternative courses of action. Within study 2, the problem was identified as communities' poor access to technology, especially with regard to team and ward based information needs. The solution adopted was to locate computers within the community, in this case the wards. However, as discussed above, the study found that poorly designed technology, placed within communities without local and flexible support, polarized traditional information and technology exclusion patterns. Within study 4 the problem was identified as a need for local and flexible support to overcome poor design and to support changing work practices. This study found an increased empowerment in information and technology usage for both the users and the community as a whole.

Fig. 5. Digital library and librarian interaction patterns for different community of practice implementation procedures.

Within the clinical setting, to improve collaboration between librarians and clinicians, many projects have sought to place the librarians within the clinical community of practice, namely on the wards and within clinical teams. Within the UK these are usually referred to as 'outreach librarians' whilst in America they are termed 'clinical medical librarians'; a similar role that is emerging is that of the 'informationist', an information specialist who mediates between different information users and resources. This mediating approach is not new to librarianship, having emerged in the 1970's [Lamb, 1976]; however, it has only ever been adopted within specialised communities. The reason behind this may lie in a simple cost-benefit analysis. On the surface, the costs outweigh the benefits: there is a need for increased manpower, training and support to introduce information specialists throughout an organisation, whilst the benefits are vague and intangible. In addition, there are social barriers that inhibit the full take-up of this model [Guise, 1997]. This set of studies has shown that there are quantifiable as well as qualitative benefits from this approach. They have highlighted the importance of verbal communication for information dissemination, but also showed that in time-pressured situations this can result in costly

crisis management. Study 4 identified both the great savings made in clinicians' time by information specialists and the sourcing of information that they would not usually seek. As reported above, one consultant gave an example of how the information intermediary sourced information which led to timely release of a patient, thus saving costs on their current budget.

The ever changing nature of digital libraries and users' needs means that there will always be a role for information intermediaries to support effective information usage. However, the more effective and usable the system design, the less input and support is required from intermediaries until the next change in system design or user needs. Intermediaries can also potentially act as advocates for the users within the organisation (e.g. when making purchasing decisions) and to suppliers (e.g. informing design decisions). While the first, obvious, attribute of intermediaries is their cost, this may indicate a benefit of a broader rethinking of information roles within organisations.

In all of the studies presented in this paper, users stressed the importance of the technology supporting practical aspects of their jobs (teaching students or caring for patients). However, many users consider digital libraries to be irrelevant to current practices, being full of theoretical information that is only relevant for researchers. Of the groups interviewed, junior clinicians were the only exception, as they perceived digital libraries as a potentially empowering tool, supporting the development of change to knowledge bases and practices. Although many had not yet witnessed this, their optimism for the technology's potential was evident. An important question is what determines whether the technology is perceived as empowering or excluding. Wenger [1999] proposes that when non-participation is mediated by institutional arrangements it can lead to marginalisation or exclusion. This was identified through all the digital library studies. The marginalisation identified by Wenger, however, related to users' perceptions of job status and role issues. This research highlights the interaction between technologies and organisational norms as a greater factor in users being marginalised and excluded from technology. Poor technology design, training and support produced a knowledge gap between those who could and could not use the technology. Users of a higher status within the organisational structure perceived their poor technical abilities as a threat to their status as experts. User groups were found to be further marginalised by the terminology used within the digital library interfaces, producing misunderstandings and alienation from the technology.

Traditionally, the IS literature has related technology adoption to the amount of user training and support provided [Gallivan, 2000]. The communities of practice perspective

has been used to consider various technology design and implementation concerns – for example, identifying the potential costs and benefits of supporting communities [Millen *et al*, 2002] and taking account of the importance of trust, credibility and user-group diversity in digital library design [Van House, 2002]. Gallivan [2000], in particular, proposes that other group members' usage and technology capabilities will determine individual usage patterns; however, he does not discuss how this model can be translated into effective technology implementation. This paper, in contrast, has reviewed three different approaches to digital library implementation which produced different perceptions of the technology and its excluding and empowering qualities. Traditional design and implementation procedures (see Figure 5, CoP1) produced digital libraries that were seen as being irrelevant for current needs and community practices, while technology with poor design and support simply located appropriately for communities (CoP2) was perceived as a threat to current organizational structures. Technology implemented within the community which could adapt to and change practices according to individual and group needs (CoP3) was seen as empowering to both the community and the individual. Although the community would have benefited greatly from a more appropriate design for their needs, the information intermediary enabled users to appreciate the potential of the technology while circumventing the design flaws.

The findings from these studies suggest that an approach to technology design and implementation should be taken which supports and complements, yet advances, each community of practice. Within the design community, one important idea is that there are two principal ways of viewing the design process and products: as evolutionary or revolutionary. Evolutionary design involves incremental steps of design change, each of which is typically in response to a recognised need. Fundamental design concepts remain stable over many generations of product, and the ways in which people work with such products evolve over time in line with new products. However, such evolution does not normally create radically new possibilities. Design revolutions occur more rarely, and involve the development of conceptually new designs. These create fundamentally new possibilities, and often impose radically different ways of working. Successful design revolutions can create exciting changes, but many are not accepted and sink into oblivion. Technological progress consists of a well balanced mix of evolutionary and revolutionary developments. In considering the social and organisational contexts within which we have studied the introduction of digital libraries, we see a combination of internal forces and external pressures (deliberate forces for change) that are together creating sometimes revolutionary changes in the ways people work, both individually and collectively. Some of these revolutions will be successful, creating new long-term interaction possibilities,

while others will be rejected. Design and implementation processes that support the need for both of these approaches within communities of practice have a greater potential to realise the empowering qualities of technology while decreasing its excluding elements. The studies reported here illustrate successful and struggling design revolutions, highlighting the need to work with and evolve, rather than confront and undermine, existing communities of practice.

6. CONCLUSION

In conclusion, the findings from the digital library studies reveal how technology can be perceived as an empowering tool that not only supports current communities of practice, but also develops and changes practices. However, inappropriate technology design and organisational structures can interact to marginalise or exclude some users. The findings from the three approaches to digital library implementation show a movement towards technology empowering its users:

- Traditional design and implementation approaches, isolated from communities, produced users who were either unaware of the technology or perceived it as complex and inappropriate for their needs.
- Deployment of technology within the communities, yet with poor design and support, was perceived by many as a complex technology, inappropriate for their needs and a threat to current organizational structures and practices.
- Integrating technology with communities and their practices, through an information intermediary, produced increased perceptions of user and group empowerment.

Wenger [1999] notes *designed organizations'* directives cannot make things happen: this is down to practice and the communities that drive those practices. This view has been supported and extended by the findings presented in this paper. Government and organizational directives are pushing digital library implementation and usage within both the academic and clinical domains. At the same time organizational drives within the clinical domain are pushing changes in work practices driven by the demands of evidence based medicine. The assumption is that the digital library technology will intervene to enable this desired process change. However, despite this climate, without the aid of information intermediaries, users' adoption is still slow, and over-shadowed by the web. This has not been found to be due to individual abilities or the hierarchical nature of the domain. Study one (an academic institution) revealed that despite users having a high-level of familiarity with computers and web searching, and a relatively non-hierarchical culture, users were still not readily able to see the value of digital libraries due to their poor design

and usability. Furthermore, external pushes to speed technology adoption are causing friction within some communities, as current practices are disrupted and perceived threats to social structures uncovered. The result is that, although some perceive and utilize the empowering potential of technology, other user groups are marginalized and excluded.

Ultimately, digital libraries, like many technologies, are often designed and implemented on the basis of assumptions which can result in users being excluded. Digital libraries assume individual usage and search patterns, whereas these studies highlight community aspects of information use. The information contained within DLs, and the ways it is structured and presented, has been driven by theoretical rather than practical considerations, thus restricting potential user groups. A flexible intermediary who can work with practitioners to identify relevant information can support the empowering elements of DLs. However, it is the element of trust in the information and the technology itself which is the most important factor identified here.

Because this work reports on a case study, we cannot be sure how far the results generalise to different contexts of use; the fact that Wenger's [1999] work on Communities of Practice has provided good explanatory power, despite that work being based within a very different domain, suggests that the findings will generalise well. We look forward to complementary studies of other technologies being introduced into other domains. This paper proposes an approach to technology design and implementation which supports communities of practice through evolutionary design, but allows for revolutionary design through community rather than individual prototype piloting. With the digital library technology, an information intermediary compensated for the inevitable gaps between design and users' ability, awareness and motivation. The information intermediary acted as a flexible catalyst for producing an empowering technology within the community of practice. The key issue is to understand the relationships between organisational structures and communities of practice, and to ensure that new developments strengthen the latter while working within necessary constraints of the former.

ACKNOWLEDGMENTS

This project is funded by ESRC within the e-Society programme, under grant RES-335-25-0032. Some of the data analyzed within this study was collected during earlier projects funded by Middlesex University and the London Library and Information Development Unit. We are also grateful for the help and support of the hospitals and university studied, and of all individual participants, and to anonymous reviewers who gave constructive feedback on earlier versions of this paper.

REFERENCES

ADAMS, A. 2000. Multimedia information changes the whole privacy ballgame. In *Proc. Computers freedom and privacy'00: challenging the assumptions*, Toronto, Canada, Feb 2000 ACM Press. 25 – 32.

ADAMS, A & BLANDFORD, A. 2004. The unseen and unacceptable face of digital libraries. *Journal of Digital Libraries*. Springer-Verlag, Heidelberg. 4 (2) 71-81.

ADAMS, A. & BLANDFORD, A. 2002a. Acceptability of medical digital libraries. *Health Informatics Journal*. 8 (2) 58 – 66.

ADAMS, A & BLANDFORD, A. 2002b. Digital libraries in academia: Challenges and changes. In *Proceedings of ICADL'02, Digital Libraries : People, Knowledge and Technology*. Singapore, Sept 2002 E. Lim , S. Foo, C. Khoo, H. Chen, E. Fox S. Urs and T. Costantino, Eds. Heidelberg: Springer. 392 - 403.

ADAMS, A & BLANDFORD, A. 2001. Digital libraries in a clinical setting: friend or foe. In *Proceedings of ECDL'0: Research and Advanced Technology for Digital Libraries*. Darmstadt, Germany, September 2001. Heidelberg: Springer. 231-224.

ADAMS, A. & SASSE, M. A. 1999. The user is not the enemy. In *Communications of ACM*. (Dec. 1999) 40 – 46

BORGMAN, C.L. 2000. *From Gutenberg to the global information infrastructure: Access to information in the networked World*. Cambridge, MA: The MIT Press.

CHANDLER, A.D. JR. 1977. *The Invisible Hand: The Managerial Revolution in American Business*. Harvard University Press. Cambridge, Mass.

CICOUREL, A.V. 1990. The Integration of Distributed Knowledge in Collaborative Medical diagnosis. In J. Galegher, R.E. Draut and C. Egido (Editors) *Intellectual Teamwork*. Hillsdale, NJ: Lawrence Erlbaum Associates. 221-242.

CLEMENT, A. 1994. Computing at work: Empowering action by low level users. In, ACM Press, Vol. 37 No. 1. 52 – 65.

COVI, L. & KLING, R. 1997. Organisational dimensions of effective digital library use: Closed rational and open natural systems model. In Kiesler, S (Ed.) *Culture of the Internet*. Lawrence Erlbaum Associates, New Jersey. 343-360.

CRABTREE, A., TWIDALE, M., O'BRIEN, J. AND NICHOLS, M. 1997. Talking in the library: Implications for the design of digital libraries. In *Proceedings of DL'97*, ACM Press. 221-228.

CUNNINGHAM, S. J. 2002. Building a digital library form the ground up: An examination of emergent information resources in the Machine learning community. In *Proceedings of ICADL'02, Digital Libraries : People, Knowledge and technology*. Heidelberg: Springer. 301-302.

DUNKER, E. 2002. Cross-cultural usability of the library metaphor. In *Proceedings of JCDL'02*, ACM Press. 223-230.

FRANS, D. J. 1993. Computer diffusion and worker empowerment. In *Computers in human service*, Vol. 10 No. 1 15 – 34.

GALLIVAN, M. 2000. Examining workgroup influence on technology usage: A community of practice perspective. In *Proceedings of SIGCPR'00*, ACM Press. 54-66.

GREMY, F. AND BONNIN, M. 1995. Evaluation of automatic health information systems: what and how: Assessment and evaluation of information technologies. In Gennip, E. and Talmon, J.L. (eds.) *medicine van*. Amsterdam, IOS Press. 9-20.

GRUDIN, J. 1994. Groupware and social dynamics: Eight challengers for developers. *Communications of the ACM*, 85, 437-438.

GUISE, N. 1997. Advancing the practice of clinical medical librarianship. *Bull Med Libr Assoc*, 37, 73-105.

HARRISON, G. S. 1991. The Winchester experience with the TDS hospital information system. *British Journal of Urology*, 67.5, 532-535.

HEATHFIELD, H. 1999. The rise and fall of expert systems in medicine. *Expert Systems*, Vol. 16, No.3. 183 – 188.

HEATHFIELD, H., PITTY, D. AND HANKA, R. 1998. Evaluating information technology in health care: barriers and challenges. *BMJ*, 316, 1959 –1961.

KLING, R. 1999. What is social informatics and why does it matter? *D-lib Magazine*, 5(1), January. *www.dliborg/dlib/january99/k/ing/01/<lmg.hgml*

KRULL, A. 1995. Controls in the next millennium: Anticipating the IT-enabled future. Elsevier Science Ltd.

LAMB, G. 1976. Bridging the information gap. *Hospital Librarian*. Nov 15, 1:(10): 2-4.

LAVE, J. & WENGER, E. 1991. *Situated learning: legitimate peripheral participation*. Cambridge: Cambridge University Press.
MARCHIONINI, G., NOLET, V. WILLIAMS, H. DING, W. BEALE JR., J. ROSE, A. GORDON, A. ENOMOTO, E. AND HARBINSON, L. 1997. Content + Connectivity => Community: Digital Resources for a learning community. In *Proceedings of ACM Digital Libraries (DL'97),* Philadelphia, ACM Press. 212-220.
MILLEN, D. R., FONTAINE, M. A & MULLER, M. J. 2002. Understanding the benefit and costs of communities of practice. In *Communications of the ACM*. Vol. 45 (4), 69-73.
MOJTA, D. 2002. Building a community of practice at the help desk. In *Proceedings of SIG UCCS'02*. ACM Press. 204- 205.
MORGAN, G. 1991. *Images of organization*. London: Sage.
REDDY, M. & DOURISH, P. 2002. A finger on the Pulse: Temporal Rhythms and information seeking in medical work. In *Proceedings of ACM CSCW'02*. ACM Press. 344-353.
RICHMAN, J. 1987. *Medicine and Health*. London: Longman.
SCHEIN, E. 1990. Organizational culture. *American Psychologist*, 45, 109-119.
SCHNEIDER, K. & WAGNER, I. 1993. Constructing the 'Dossier Representatif': Computer-based information sharing in French hospitals. *Computer Supported Cooperative Work*, 1, 229-253.
SIA, K. S., TANG, M., SON, C. & BOH, W. F. 2002. Electronic resource planning (ERP) systems as a technology of power: Empowerment or panoptic control? In *The DATA BASE for advances in information systems*. ACM Press. Winter, 2002 Vol. 33, No.1. 23 – 36.
SPREITZER, G. M. 1995. Psychological empowerment in the workplace: Dimensions, measurements and validation. In *Academy of Management Journal*, Vol. 38 No. 5, 1442 - 1465.
STAR, S. L., & GRIESEMER, J. R. 1989. Institutional Ecology, 'Translations' and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-1930. *Social studies of science* (19), 119-128.
STRAUSS, A. & CORBIN, J. 1990. *Basics of qualitative research: grounded theory procedures and techniques*. Sage, Newbury Park.
SYMON, G., LONG, K & ELLIS, J. 1996. The Coordination of work activities: co-operation and conflict in a hospital context. *Computer supported cooperative work*, 5,1. 1-31.
THENG, Y.L. 2002. Information Therapy in Digital Libraries. In *Proceedings of ICADL'02, Digital Libraries : People, Knowledge and technology*. Heidelberg: Springer. 452-464.
TODD, A. M., HARRISON, J., MORRIS DOCKER, S., BLACK, R. & WOLSTENHOLME, D. 2003. Access to the internet in an acute care area: experiences of nurses. In *British journal of nursing*. Vol. 12, No. 7. 425- 434.
TURNER, B. 1987. *Medical Power and Social Knowledge*. London: Sage.
VAN HOUSE, N. A. 2002. Trust and epistemic communities in biodiversity data sharing. In *Proceedings of JCDL'02*, ACM Press. 231-238.
WENGER, E. 1999. *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.
WINNER, L. 1985. Do artifacts have politics. In Mackenzie, D. & Wajcman, J. eds *The social shaping of technology*. Open University Press, Milton Keynes.