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Using studies of collaborative activity in physical environments to inform the design of digital libraries

Michael B. Twidale¹ and David M. Nichols²

twidale@uiuc.edu | dmn@comp.lancs.ac.uk

¹Graduate School of Library and Information Science,
University of Illinois at Urbana-Champaign, Champaign, IL 61820, USA

²Computing Department, Lancaster University, Lancaster LA1 4YR, UK

Cooperative Systems Engineering Group

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ABSTRACT

This paper considers how studies of collaborative activities in the real world can be used to aid in the design of digital libraries. We describe two studies of collaboration in physical environments. The first study examines behaviour at the enquiry desk in an academic library. The second study examines collaboration in an office environment - concentrating on 'over the shoulder learning'. The natural characteristics, or affordances, of these physical environments suggest that digital libraries should be designed to utilise the specific characteristics of digital environments.

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to inform the design of digital libraries**

Michael B. Twidale¹ and David M. Nichols²

twidale@uiuc.edu | dmn@comp.lancs.ac.uk

CSEG, Computing Department, Lancaster University, Lancaster, LA1 4YR, UK

Tel: +44-1524-65201 Ext 93799; Fax: +44-1524-593608; E-Mail: paula@comp.lancs.ac.uk

<http://www.comp.lancs.ac.uk/computing/research/cseg/>

¹*Graduate School of Library and Information Science,
University of Illinois at Urbana-Champaign, Champaign, IL 61820, USA*
²*Computing Department, Lancaster University, Lancaster LA1 4YR, UK*

Introduction

There are two classes of collaborative activities that can be supported in digital environments: those based on, or inspired by, physical activities and those glitzy new technologies which only make sense in a digital environment. This paper is concerned the former: with what we can learn from studying collaborative information seeking in the physical world. We discuss two studies of collaboration in physical environments and consider how key features of these physical interactions may apply to the design of digital information environments.

The first study consists of ethnographic fieldwork in a University library, where users collaborate with both staff and other users in their information seeking. The second study is of office work – where the workers collaborate in an informal manner to help each other overcome particular impasses. From these studies we attempt to generalise about the affordances of physical environments and how these may be reflected in designing digital libraries, and digital information environments in general.

Ethnographic observations of library activities

We have undertaken a series of ethnographic observations of library activities as part of a larger project on collaboration in libraries - these are reported in full elsewhere (Crabtree *et al.*, 1997; Twidale *et al.*, 1997). The ethnographic fieldwork consisted of forty hours of observation distributed over a period of two months during term-time at the Service Desk in a UK University Library.

Staff are members of other work specific teams (e.g. registration, reservations, cataloguing etc.) to which they return in-between Service Desk work. Most of these staff are not expert subject librarians - rather they are library assistants, having a good general education, substantial experience of library procedures and a working knowledge of the library catalogue. Part of their work is to filter particularly complex problems to the subject specialists who are qualified chartered librarians.

The service desk itself comprises computers for 'household management' (specifically regarding borrower details) and access to the library's in-house online public access catalogue (OPAC), as well as various hard-copy reference documents, organisational forms etc.

Our initial implications for design from these studies were reported in (Crabtree *et al.*, 1997) and can be summarised as:

- collaboration is a significant mechanism through which users achieve their goals.
- even when faced with well-designed library systems users can still have significant difficulties in determining how their information needs can be satisfied.
- users can be helped by library staff who are not experts in the domain of the user's information need.
- a computer interface to a library system can serve as a conversational resource between information seekers and those who try to help them.
- context is extremely important in help-giving. This is evident in the frequent 'snatching' (by staff) of any paper that a user is holding as they seek help.

We will expand on these initial points after we have considered a separate study in a different setting.

'Over the Shoulder' Learning

A small scale study (Twidale, Nichols and Paice, 1997) in a University library confirmed the (unsurprising) finding that many students learned how to use the OPAC system from interacting with friends and peers around terminals. A group of students would cluster round a single screen or individuals working at adjacent terminals would learn across to offer or ask for help. This form of learning seems to be important and yet has been little studied as an interaction that merits the active

support of systems designers. It clearly has significant differences from the conventional views of how people learn information systems. These can be categorised as formal and designated, (e.g. timetabled classes, workshops, etc.) and personal study – by any combination of: reading manuals, training materials, online help, demos and trial and error in exploring the system. By contrast to these two, the learning from peers is informal, brief (interactions can be very short although they may be part of a larger ongoing dialogue continuing over days or weeks), interleaved with genuine tasks, and are seemingly relatively successful. It is however reliant on the happenstance of personal contact and geography. We have since extended our study of this form of learning to the office environment and there use the phrase 'Over the Shoulder' Learning (OTSL) to describe it. This work has parallels with a number of studies undertaken by Bonnie Nardi (Nardi and Miller, 1991).

Informal collaboration in an office environment

The study was undertaken in an open plan office with five people working in designated areas. The office is an administration centre and so other members of the organisation are frequently walking through and stopping to interact as part of the numerous work activities being undertaken. Instances of OTSL were videotaped and are currently being analysed. Some of the findings to emerge are described below.

Again, context is vital. If the help giver knows what the user wants to do and why, it is easier to provide explanations at the appropriate level of detail. That seems to be one reason why people will choose help from a colleague (even if that person is not necessarily regarded as the 'guru') who will better understand the work-need underlying the technological request for help, as well as appreciating the questioner's general level of systems understanding, which determines how best to phrase the help given. This is as opposed to asking someone more expert in the domain, such as the organisation's systems expert who is more remote from the work context. The systems expert may answer the technical question raised but not thereby solve, in the most efficient way, the underlying work problem that is its ultimate cause. That is, the better answer to the question "how do I do X?", may be, "I think you would be better off doing Y". The relative inexperience of the chosen colleague may also actually be regarded as an asset, meaning that they are more likely to speak the learner's language and not 'blind them with science'.

The over the shoulder help-giver often gives a running commentary, switching rapidly between several levels of analysis, including what to do, how to do it, how all this fits into the overall set of systems functionalities and how those functionalities fit with the tasks undertaken in that office and the needs of the person being helped. Not surprisingly, the help receiver can become overwhelmed with the volume of information being received so that a recording of the context of the help interaction (what is said and what was done) would help in ensuring that the help receiver will be able to reconstruct the concepts and actions later. This we can see as another manifestation of the context issue; that preserving the context of the OTSL episode will help the learner (and also the helper in that the likelihood of need for a repeat explanation is reduced).

Design Implications: during OTSL every system is a CSCW system

If our initial findings are confirmed it seems clear that systems designers should at least have an awareness that their systems will on occasion be used collaboratively whether or not they design them with this in mind. So much of the broader context of work is collaborative, and as we are discovering from our growing understanding of OTSL, the same is true of how many people approach the learning of systems, both initially and subsequently as part of incremental improvement of their understanding.

If it is true that information systems will be used collaboratively to work and learn, then it would make sense to design features that at least do not disrupt and ideally actually support this process. Note that this approach is different from, although complementary to, the ideas of providing additional features to a computerised information system or digital library. The latter is addressing the problem "how can we use the technologies now available to enable people to work in quite new, more powerful ways, such as by using CSCW features to encourage new forms of collaboration?" Our approach is to say; "people have always used libraries in collaborative ways to some extent, and often seem to collaborate to cope with the complexity of learning how to use complex information systems (including but not limited to computerised systems). How can we design systems to support this existing spontaneous collaborative working?"

CSEG, Computing Department, Lancaster University, Lancaster, LA1 4YR, UK
Tel: +44-1524-65201 Ext 93799; Fax: +44-1524-593608; E-Mail: paula@comp.lancs.ac.uk

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Briefly, some of the themes that are emerging are:

- A re-emphasis of the point that people use information systems as just a part of their work. Clearly this is an unsurprising finding, but one that needs to be continually re-emphasised for systems developers who can focus exclusively on the use of their system both as an end in itself and divorced from the context in which it will be used and with which it must mesh.
- On a related point, people switch between many different media; databases, information resources, systems etc. to achieve their task. No single system is likely to be used exclusively, but rather used in conjunction with others. We would add people to the media list - the embodied expertise of colleagues and specialists such as librarians is at least as valuable a resource as a database.
- As well as information systems use being a sub-part of a broader set of activities, the search needs etc. may be an ongoing activity that recurs both over time (continuing the search at a later date, refining it, undertaking a variant of it in the light of changing knowledge and interests) and space (at the office, in the library, in a different library, in a colleague's office)

The central conclusion is that it is the shared context that is the key aspect of the collaborative activities we have observed – which has various aspects:

- the history, or other similar indicator, of what one participant has been doing before the help-giver/collaborator joins in. In the physical world this is usually poorly represented (e.g. the pieces of paper 'snatched at' by library staff at the help desk); however the digital environment is much better at the recording of activities so may be better at providing this form of contextual support.
- even a lone user can take advantage of a preserved context to facilitate the ongoing use of information across space, time and media.
- the co-incidence of representations. When some aspect of context is recorded for one purpose it may well be trivial to re-use it for another: when a search history is stored for communication it can just as easily be used for reflection by a user.

Affordances of Different Environments

One approach to analysing the different environments that collaboration can occur within is to consider the different affordances that they support (Gaver, 1992):

- Digital environments afford:
 - copying, transmission, recording, comparison, storage (and consequently asynchronicity)
- Physical environments afford:
 - familiarity, reciprocal vision, richer data (higher sensory bandwidth), proximity

The observations of collaborative activities in physical environments suggest that they rely on these affordances. Proximity involves being able to gather round an OPAC terminal, point at the screen, take conversational turns, to look over someone else's shoulder etc. Reciprocal vision allows us to see (and be seen) in a particular part of a library and our proximity to familiar shelving areas provides an indicator of our interests. From such basic properties of our physical environment we can observe and learn from the activity of strangers as well as (serendipitously) meet others and initiate collaborative partnerships.

The nature of the environment delineates both aspects of collaborative information searching: the identification of someone to collaborate with and the nature of the collaboration itself. At the service desk in a physical library the position of the desk allows easy location of help yet by walking to the desk a user destroys the context of their interaction. We can use such considerations to begin to consider how to build features that support context back into a digital environment.

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Conclusions

We are advocating authentic real-world studies of information search activities, as they occur as a part of users' broader work activities. This will serve to inform our research agendas for requirements for effective digital libraries. We predict that a sensitivity to the collaborative aspects of existing use of both paper and digital media will reveal useful insights. From this analysis we should look to both preserving, or providing, equivalent mechanisms to the functionalities which the physical environment naturally affords - and consequently which we take for granted. Equally, we should take advantage of the new digital functionality to change and improve the nature of collaborations. Our initial work in this area has revealed the crucial importance of context in supporting both work and the learning of the systems to enable that work to occur. This leads to a consideration of the possibilities of the development of different functionalities to preserve, manipulate and represent that context in usable and useful ways.

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