BEING THERE:

THE USE OF CYBERSPACE IN COMPUTER-MEDIATED COMMUNICATION

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Introduction

The library and information science community has, for a great many years, held one object as a common focus: the document. While approaches and emphasis employed may vary, all of the various domains comprising the professional LIS realm have in common the attempt to improve people's ability to obtain documents (widely-defined) containing the information they desire. In so doing, the LIS community has devoted itself to improving a particular communication flow within society, that mediated through documents, be they embodied in paper, CD-ROM, or Mme. Briet's antelope.[1]

However, it has not escaped the attention of many within the LIS community that the information held within society's store of documents is at best, only half the equation, and from most users' point of view the less important half at that. Various studies[2] have shown that for most, if not all, individuals, information which they obtain by direct contact with other people is considered more important and more valid than information which they obtain from documents. In the course of their lives, the majority of people consider those who live and work around them their first (and usually best) source of information on most topics. While the LIS world has

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[1] See Buckland (1995) for a discussion of the life and work of Suzanne Briet.

[2] See Childers (1976) and Lievrouw (1990) for examples.

known this fact for many years, it is one that has gone, if not without notice, at least without a significant degree of attention or remark.

This should not be considered terribly surprising, if for no other reason that most of these exchanges of information are *un*mediated; they occur at parties, random meetings in the corridor at work, in faculty lounges, wherever people directly encounter another individual whom they consider to be a possibly useful source of knowledge on an issue. The fact that these communications happen in a variety of times and locations, without any physical artifact involved in the communication process, would be enough to preclude any attempts to assist people in their efforts to locate and obtain information from other individuals, even if one chose to ignore such issues as the privacy of the individuals involved. And it is to the LIS community's credit that it does not, as a rule, ignore such issues as privacy and autonomy in people's efforts to obtain information. However, it has meant that the LIS community has generally considered efforts to improve communication outside the realm of documents as beyond its purview.

The growth in computer-mediated communication (CMC), however, may have begun to alter some of the fundamental aspects of interpersonal communication which have led those in the LIS world to consider that communication as outside its charge and concern. As Zuboff has pointed out in *In the Age of the Smart Machine* (Zuboff (1988)), one of the most significant aspects of computer-mediated communication systems is that they textualize and fix conversational exchanges that previously were oral and impermanent. As the increasing popularity of the Internet and other on-line services leads to a greater amount of personal

interaction occurring within computer-mediated forums, the LIS community may find opportunities to assist people in obtaining needed information that originates directly from other users of such forums, rather than from document collections.[3] While the previous mention of the LIS community's desire to preserve individual's rights to privacy and autonomy in seeking information should make it clear that entry into this new realm presents certain dangers, Zuboff's work demonstrates that allowing computer-mediated communication forums for the exchange of information to develop without clear planning and design, at both the technical and social level, is an equally perilous course of action. It may well be that the concern for individual rights which has marked parts of the LIS world specifically suits it for approaching the design of such systems.

Before LIS professionals can begin to address issues related to the design of computer-mediated forums, however, a framework for analyzing communications that might take place in such systems is needed. The remainder of this paper will be devoted to providing the beginnings of such a framework, with special attention devoted to the issue of space in computer-mediated communication.

A Framework for Typifying Communications

If a framework for typifying communications for the purpose of designing on-line forums is to be successful, it has to walk a rather narrow course between theoretical consistency and practical application. By preference, such a framework would be equally applicable to the

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[3] See Ackerman (1994).

exchange of information in face-to-face encounters as it would be to those exchanges occurring through some form of fixed (or even fluid) media. However, our most immediate concern is formulating a framework with which to approach the design of systems for exchange of information through on-line forums. The following list is an attempt to specify those elements which determine the nature of a communication which might be relevant to designers of such forums. While this list is perhaps not exhaustive, it at least provides something resembling the beginnings of a checklist of areas of concern that designers of computer-mediated communication systems should consider.

Time: There are several issues relevant to time and communications that designers need to consider, including whether communications need to be synchronous or asynchronous, whether transmission channels are adequate for conveying the relevant information in a timely fashion, whether the mechanisms for display of information allow for its apprehension in a timely fashion, etc.

Space: The location of the participants in a communication, both in real and/or any 'virtual' space, must be considered during CMC design.

Format: CMC systems need to provide the abilities to handle all formats of information relevant to the exchange of ideas within the current social context, potentially including text, still graphics, audio and video links, and impressions of tactility and motion (within more advanced virtual reality systems).

Medium: Issues surrounding the medium involved in a communication do not disappear within the digital realm, as is too often assumed. As Levy and Marshall (1994) have pointed out, digital libraries may not necessarily be restricted to digital content. Therefore, designers should try to maintain an awareness of what medium is most appropriate for the exchange of information they wish to support, be it paper, various digital forms (for some applications, a CD-ROM through the mail may make more sense than a network connection, however fast), or even the aforementioned antelope.

Content: The nature of the content being conveyed in users' communications may have a great deal of impact on the design of CMC systems. Systems designed for use within a relatively formalized process of communication such as educational settings may need to convey content very different from systems designed for informal exchange of information relevant to particular work arenas.

Social Context: One of the aspects of the growth of the Internet which has proven the source of a great deal of conflict is the introduction of large numbers of new users whose context for the use of Internet resources has been significantly different from those more established users from the traditional education/military/commercial domains. Achieving anything like a complete understanding of the social context in which users and/or potential users of a CMC system operate is obviously out of the question for most designers; however, at least some consideration must be made of the social issues defining the environment in which the system will be used, or designers risk implementing a system which may quite literally be worse than nothing at all.

Participants: The single most important issue for designers to consider in implementing CMC systems is, 'who will be using this system?' Perhaps equally relevant questions are 'who has been using pre-existing systems for exchanging information?' and 'who hasn't, and why not?'

The above criteria are obviously not mutually exclusive. One of the more painful aspects of the design of CMC systems may be the impossibility of reducing design issues to a set of neatly compartmentalized factors that can be addressed individually and without a great deal of regard for the larger whole. The factors affecting CMC systems design are instead tightly interwoven and interdependent, with a change in one element having immediate ramifications for other aspects of the design.

A great deal might be said (and has) in regards to each of the elements of the above list. At the moment, however, the issues surrounding 'space' as a design consideration in CMC systems

may be of particularly pressing concern for at least two reasons: 1) the application of spatial metaphors to computer-mediated communication systems is already wide-spread and growing daily, both in and out of the network systems design community. Major popular periodicals discuss the merits of "Cyberspace" on an almost weekly basis, and the business pages of most major newspapers have also leapt on the cyberspatial bandwagon, with technologies such as the Virtual Reality Modelling Language (VRML) being discussed for their potential profitability before they've even been fully implemented, let alone seen significant use; and 2) the application of spatial metaphors has, in fact, become so all pervasive that I believe there is a significant risk of designers becoming blinded to the issue of whether such metaphors *should* be applied in the first place. Alan Kay (1990) has argued that the application of metaphor within interface design itself is fundamentally limiting and counter-productive; while his argument may be an extreme one, we can at least acknowledge that there is a balance involved in the application of metaphors in design between easing users' comprehension and use of a system and imposing artificial constraints on the types of interactions the user is allowed to perform. The question for designers, then, is under what conditions does the use of various spatial metaphors within CMC systems provide the users with greater benefits than impairments?

Cyberspace Defined

A necessary first step in examining the use of spatial metaphors in computer-mediated communication is addressing the rather heavily-loaded term, Cyberspace. The term originated

within William Gibson's novel *Neuromancer*, in a paragraph which has been cited and copied in so many places as to warrant an entry in a bibliometrics Hall of Fame:

> Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts . . . A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light range in the nonspace of the mind, clusters and constellations of data. Like city lights, receding . . . .[4]

While Gibson was by no means the first person to envision a virtual space of this kind (that honor probably dates back at least to the military simulation researchers of the 1960s), he was the first to use the term 'cyberspace,' and his vision of how such a spatial representation of data would be implemented and used has been extraordinarily powerful within various parts of the software design community. Gibson's vision though, powerful and widespread as it may be, is obviously not something that currently exists. The term cyberspace, however, is used in a variety of discourses within our society referring to existing computer-mediated forums. How, then, is the idea of cyberspace being employed in discussions of contemporary communication systems?

A voice that has been heard very nearly as much as Gibson's in discussions of cyberspace and on-line forums is that of John Perry Barlow of the Electronic Frontier Foundation. Ignoring for the moment the connotations of place in virtual forums carried within the entire 'Electronic Frontier' language, Barlow has made several comments in public speeches regarding cyberspace that sum up his vision of what cyberspace is:

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[4] William Gibson, *Neuromancer*, New York: Ace Science Fiction Books, 1984: 51.

> "Cyberspace is where your money is. . . . It's where your phone conversations take place."[5]

Obviously this definition of cyberspace is far more inclusive than Gibson's notion of cyberspace, apparently encompassing the entirety of electronic data storage and transmission. While this approach has been useful as a convenient metaphor for dramatizing the impacts of political decisions regarding electronic data on people's lives, there are at least two significant problems with this definition for those whose primary interest is in the design of CMC systems. The first is that it *is* so all-encompassing a definition, encorporating even such items as financial transactions that occur with little or no direct human involvement, as to provide very little help or guidance to those considering the design of CMC forums; it fails to specify a concept of space at a level of detail sufficient for a designer to begin considering whether such a concept would be a useful metaphor for users in manipulating CMC systems. The second is that, to the degree that it *does* employ a concept of space, it doesn't make a great deal of intuitive sense. Very few people envision themselves as inhabiting an independent, virtual realm when they're talking with someone on the phone. If we are to begin discussing how and when to apply conventional notions of space to computer-mediated communication, it would be helpful if we could at least begin with a concept of a cyberspace more evocative of a sense of place than a telephone conversation would suggest.

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[5] John Perry Barlow, "Where Are We Going: Themes for the 21st Century." Plenary session presented at *Navigating the Networks: the ASIS Mid-Year Meeting, Portland Oregon, May 21-25, 1994.*

There are at least two other approaches to the idea of cyberspace that bear mention, both of them originating within the software design community which has attempted to come to grips with the design of virtual spaces. The first approach appears, at least at first glance, to be somewhat derivitive of Gibson's ideas of cyberspace, and finds probably its best expression in the work of Michael Benedikt:

> Cyberspace is a globally networked, computer-sustained, computer-accessed, and computer-generated, multidimensional, artificial, or "virtual" reality. In this reality, to which every computer is a window, seen or heard objects are neither physical nor, necessarily, representations of physical objects but are, rather, in form, character and action, made up of data, of pure information. This information derives in part from the operations of the natural, physical world, but for the most part it derives from the immense traffic of information that constitute human enterprise in science, art, business, and culture.[6]

Benedikt's approach definitely manages to more concretely raise the idea of space than Barlow's does. However, one possible problem with Benedikt's ideas regarding cyberspace for the designer of CMC systems is that Benedikt's endebtedness to Gibson manifests itself somewhat in his ideas concerning what cyberspace should be used *for*. Benedikt's presentation of cyberspace makes it appear that the primary use of these virtual spaces is data storage and retrieval; he does not dwell to any significant degree on the issues of how interactive, person-to-person communication should occur within this space. He does acknowledge that the cyberspaces he envisions will contain multiple participants who will interact with each other, but these participants' presence within the space appears to be motivated primarily by a desire to navigate and locate particular

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[6] Michael Benedikt. "Cyberspace: Some Proposals." *Cyberspace: First Steps*. Michael Benedikt, ed. Cambridge, MA: The MIT Press, 1992: 122-123.

data representations, not to communicate with the other participants. This approach seems, then, at least slightly at odds with our original purpose, finding a definition of cyberspace that seems particularly amenable to being applied to the development of CMC systems.

The second theme from the software design community that bears mentioning might best be referred to as the 'hard-line' approach to cyberspace. While it is probably a disservice to Robert Stone to associate him with this camp, he does provide an example of the definitive mark of this approach:

> . . . the aim of Virtual *Reality*, also referred to as Artificial Reality or "Cyberspace", is to generate, using computer graphics, realistic three-dimensional visual, audio and tactile worlds in which a human operator can be *immersed* and is free to interact naturally with computer generated objects . . . . Users are typically equipped with a head-mounted stereoscopic display, interactive gloves and even whole-body suits, and can explore and interact with virtual objects using near-natural actions — moving, pointing, grasping, talking and viewing from many different angles.[7]

The definitive mark of the hard-line approach to cyberspace is the insistence on the immersive aspect of the experience, a view which may be rather prejudicially characterized as, 'cyberspace is immersive, 3-D, real time virtual reality and *that's all, dammit!*' Proponents of this point of view have engaged in a series of running debates in various forums with others who do not have quite so restrictive a view as to the nature of either virtual reality or cyberspace. There have been some particularly heated discussions between those involved in the creation and design of text-based virtual realities, such as MUDs and MOOs, and the hard-line camp as to what constitutes a *true*

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[7] Robert J. Stone. "Virtual Reality and Cyberspace: from science fiction to science fact." *Information Services & Use*. Vol. 11 (1991): 284.

virtual reality. Without venturing into this debate, there is at least one observation that can be made regarding the hard-line approach to cyberspace: if cyberspace is indeed to be restricted to immersive, 3-D real time virtual reality, it is unlikely to see significant use by the majority of computer users now or in the near future. The hardware costs of such systems are still significant, and even if they were not, the problems of having to physically engage and disengage with the equipment would tend to preclude the use of such cyberspaces in any arena which requires interaction with the actual physical environment surrounding the user. This would generally preclude a large number of workplace and social forums from making use of such cyberspaces.

If the above discussion makes one thing clear, it is that there is an immense degree of confusion and disagreement about the exact meaning of the term, 'cyberspace.' At the clear risk of adding to this confusion, I would like to propose Yet Another Cyberspace Definition:

> Any forum for synchronous, interactive digital communication which deliberately employs and relies on a metaphor of shared spatial location in order to orient participants within the communication domain to each other and/or other entities/"objects" within the domain.

This definition is obviously not as restrictive as the hard-line approach presented above, and unlike Benedikt's conception of cyberspace, tends to emphasize the aspect of personal interaction over that of data navigation and retrieval. I believe the exact meaning of this definition may be made clearer by examining its implications in the design of two front-ends for a library service developing at the University of Michigan School of Information & Library Studies, the Internet Public Library.

Cyberspace In and Out of Practice: The Internet Public Library

The Internet Public Library is an on-line facility being developed under the auspices of the School of Information and Library Studies (SILS) at the University of Michigan. Under the direction of Prof. Joseph Janes of the SILS program, the Internet Public Library

> ". . . represents our vision (as of today!) of the useful roles played by libraries and librarians as they might be performed on the Internet. In so doing, we hope to challenge the notions of what libraries are and should be in a distributed world, but also to demonstrate the value of that perspective in a chaotic, dynamic, but exciting and liberating environment."
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> "We are not attempting simply to put a public library up on the Internet or mindlessly translate the functions of libraries to the Net environment. We are also not trying to replace existing libraries or supplant the valuable services they provide to their communities. Rather, we hope to complement their work in appropriate ways."[8]

The Internet Public Library (IPL) has been attempting to provide a variety of the functions available in more traditional library settings in an on-line environment, including access to collections, bibliographic searching, and reference service. As the IPL has not wanted to needlessly restrict itself to a particular technology, it has been exploring the use of various interactive programs for providing library services including both the World Wide Web and MOOs.[9]

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[8] Joseph Janes, *IPL Welcome from the Director*, available electronically as http://ipl.sils.umich.edu/about/message.html.

[9] MOO stands for MUD Object-Oriented and derives from the MUD adventure games developed by Richard Bartle and Roy Trubshaw. MOOs provide both a text-based, 'virtual reality' in which multiple participants can simultaneously interact with the program and each other, and a certain degree of user extensibility through a built-in programming language. See

Examining the WWW and MOO interfaces for reference service within the Internet Public Library helps to illustrate how such a service can be provided both using and not using a cyberspace (as previously defined). Figure 1 shows the Reference Center page which is seen by the user upon first accessing the Reference Area of the IPL from the WWW; Figures 2 through 4 (shown on the following page) show the HTTP form (obtained by clicking on the 'Ask A Question' sign visible in Figure 1) which is employed to allow users to send reference questions to the IPL staff using the WWW interface to the Internet Public Library. A transcript of the interaction with IPLive (the Internet Public Library MOO) necessary to connect with the service, move through the virtual space to the reference room, and take a number in order to 'queue up' for an interview with a reference librarian may be found in Appendix I. The WWW pages and MOO transcript shown, then, are covering similar areas of service within the IPL.

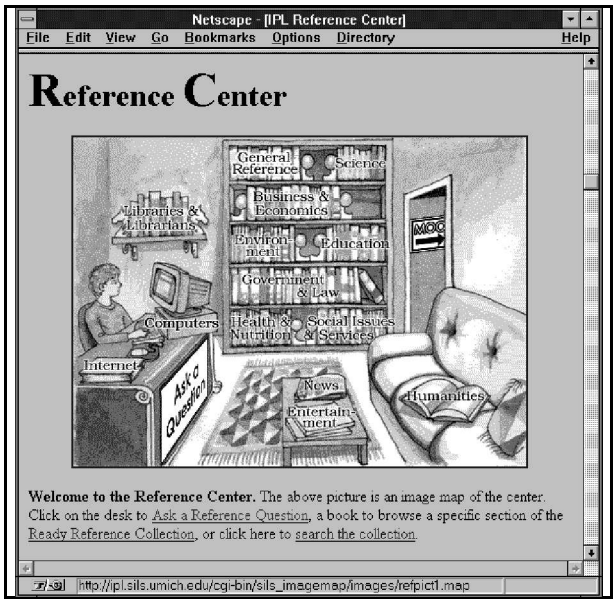

Figure 1

There are a few comments which may be made about the WWW front end to the IPL. While there is some effort made to apply spatial metaphors with the IPL WWW interface (note the reference room graphic used in Figure 1), this does not really qualify as a cyberspace under

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Curtis [1992?] and Curtis & Nichols for overviews of the technology.

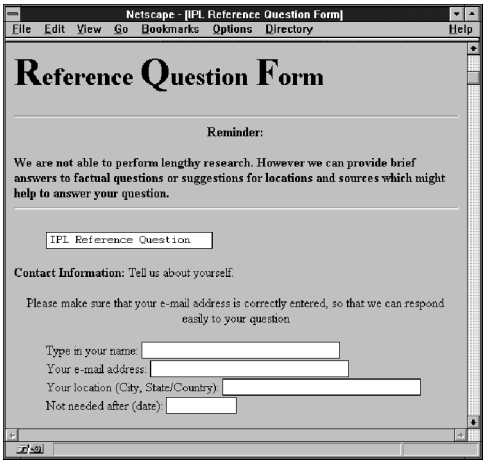

Figure 2

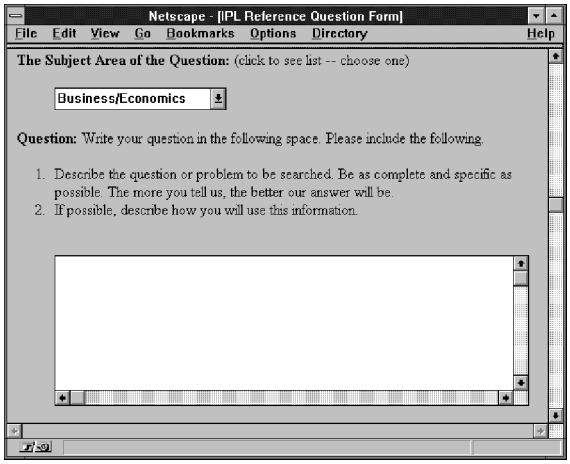

Figure 3

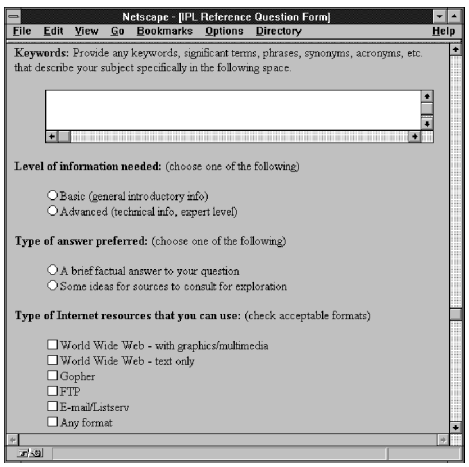

Figure 4

our preceding definition. While a spatial metaphor is loosely used here, it does nothing to provide a common frame of orientation for the participants, either to each other or to other aspects of the IPL. This is most apparent when examining the reference form show in Figures 2 through 4. Any attempt to maintain an impression of place is given up; what is left is a fairly straight-forward form

for specifying a reference request. I should note that this is not necessarily a criticism of the WWW interface to the IPL. The fact that this interface does not really provide a cyberspace in the sense we've defined (and what use of spatial metaphor is made could be given up without significantly impacting the service) does not mean that this front-end to the IPL does not provide an adequate means of providing reference service. Judgments regarding the success or failure of the WWW front-end to the IPL would have to be made based on a larger set of criteria than simply the presence or absence of a thorough implementation of a cyberspace.

While the WWW front-end to the IPL does not qualify as a cyberspace under our definition, I believe that the MOO interface does. As the log file reproduced in Appendix I makes clear, any and all interactions within the IPLive MOO occur within the context of the text-based, virtual reality which provides a 'place' for user interactions with staff. Such interactions are synchronous, and the virtual rooms place limits on who may interact with whom, as well as providing an environment in which various virtual objects (such as virtual gopher screens) may be manipulated and viewed by the participants. The question that needs to be asked at this point is, 'Though the IPLive MOO is definitely a cyberspace, is it a *necessary* cyberspace?'

I would tend to argue that at this point, the answer is 'no.' While the MOO provides a forum for synchronous interaction with library staffers, synchronous text-based interaction could be provided without resorting to MOO technology using a variety of other programs such as IRC. As the log file shown in Appendix I should also make clear, the use of a virtual space also imposes a certain degree of cognitive and interactive overhead on the system's users. To successfully

interact with reference staff on the IPLive MOO, users must understand the operation of a basic MOO client program such as TinyFugue (used in this example) or TKMoo; they must have an understanding of the basic commands for moving and interacting with other users within the MOO, and finally, must negotiate the virtual space of the MOO and interact with a MOO object (the Take-A-Number machine) before they even begin to engage in a reference interview with a IPL staff member. It should also be noted that the IPLive MOO imposes certain restrictions on the IPL staff; for reference service within the MOO to be successful, a staff member must be continuously present within the virtual space (as opposed to the asynchronous communication with the WWW interface, where staffers may take their time in handling interactions with patrons). If we compare the restrictions imposed by the MOO with the relative simplicity of use shown by the WWW forms-based interface, it would seem that the benefits of interactivity achieved by the use of MOO technology do not really seem to be worth the costs imposed on both users and staff.

This is not to suggest the IPLive MOO is a failure, or even that further development efforts in regards to the application of MUD/MOO technology to information service provision should be foregone. There is definite potential within such technology, particularly for the use of virtual objects such as gopher and WWW slates which may be simultaneously referred to by various MOO participants, and in the provision of virtual spaces for collaborative work and education. However, designers of computer-mediated forums for information service should also bear in mind that, as is demonstrated by the IPL WWW interface, cyberspace is not always

necessary to provide a useful information service forum. This obviously raises the question of 'when *is* cyberspace necessary?'

Cyberspace: Who Needs It?

Given the lessons to be learned from examining the Internet Public Library systems, I would suggest that very few people in fact really need cyberspace, at least for provision of information services. It may even be that the only people who truly need a cyberspace for interaction are those for whom the space itself forms a significant focus for the communications of the participants. Most people for whom this is true would tend to fall into the category of those who are performing various kinds of simulations, whether it is of architectural renderings for a virtual walk-through, or tank or aerial battle arenas within military training systems. One additional class of people who might need a cyberspace are those engaging in communications where the focus of their communications, while not actually *being* the space itself, requires a shared sense of space or frame of reference for mutual understanding.

An interesting example of this latter case is provided by the ClearBoard project undertaken by researchers at the NTT Human Interface Laboratories in Japan.[10] The ClearBoard provides a shared drawing space that allows for collaborative work between two remote sites. A mirror image of the remote participant is projected as a background image on the local participant's drawing screen, and audio conferencing is provided between the two sites. The total

[10] See Ishii et al. (1994).

effect for both users is that they are on opposing sides of a pane of glass upon which both may draw while conversing about a project. The reseachers who designed the ClearBoard specifically sought to produce a system which would allow the users to have a smooth shift of attention between the remote participant's image and the shared workspace in order to facilitate understanding of non-verbal aspects of the remote participant's communication; the researchers also sought to produce a system which enabled gaze awareness (a knowledge of upon what the other participant is focusing their attention).

I believe that the ClearBoard qualifies as a cyberspace under the definition above. It is certainly not immersive; there is no sense of leaving one's current physical reality to participate in a different, virtual one (in fact, the researchers had another goal of enabling seamless interactions with both the remote site and a local user's collection of tools, papers, etc.). However, the attention given to the details of the users' non-verbal interactions provide an environment in which there is a sufficiently shared concept of space to enable each of the users to comprehend the others' gestures, head movements, and focus of attention. This combined with other visual details of the system[11] give a sense of shared place that is essential to the ClearBoard's success in facilitating collaborative work.

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[11] As an example of this, it should be noted that the users of the system sit in front of a black background while at the ClearBoard. This removes any visual cue from the video image sent to the remote participant to indicate that the other user is operating in any space other than that of the shared ClearBoard.

As with the IPLive MOO, it should be noted that the success of the ClearBoard system is not without its own costs. The system as currently implemented would not scale at all well in terms of allowing interactions between more than two remote sites. However, within the limitations imposed, the ClearBoard ranks as an extremely successful use of a virtual space.

The ClearBoard example raises an issue with regards to the need for space in interactive communication that the LIS community will need to consider carefully in any design efforts it undertakes. Specifically, the cyberspace shared by the participants within the ClearBoard environment is necessary *because* of the shared physical/virtual object, the board itself. The cyberspace provides a common frame of reference for the participants to the board, and hence for their own interactions regarding the board and its contents. To the extent that the digitization of information resources removes information from the realm of physical artifacts, it may well be that a shared space for discussion of information artifacts will become less and less important. In regards to the primary question of this essay, the use of cyberspace in computer-mediated forums intended to facilitate direct exchange of information between individuals unmediated by documents, the examples of the ClearBoard and IPLive would tend to indicate that a cyberspace for interaction is only necessary when participants' communications must refer to a physical or virtual object which requires a shared frame of reference in order to be discussed.

Conclusion

The rise of digital networked communications is producing two effects that may be of particular concern to those within the LIS community. The first is that, increasingly, informal

communications are occuring within venues that textualize, and to varying degrees fix, exchanges that previously were oral and ephemeral. This may provide opportunities for the LIS community to assist in facilitating such exchanges in ways that were previously impossible. The second is that a great deal of the documentary record with which the LIS community has previously concerned itself is increasingly in digital form. The trend in this case, then, is nearly the mirror image of the first. Exchanges of information which were previously physically embodied in a variety of artifacts are now transmuted into digital forms which are far more malleable (and possibly transient) than their previous incarnations. For the LIS professional, this will doubtless necessitate a transformation of traditional work practices in order to assist users in locating digital artifacts whose presence is by no means as readily discernable as a book on a shelf.

For those in the LIS world, then, the advent of computer-mediated communications presents both new opportunities to assist the communities they server, and a transformative force to which LIS professionals must adjust in order to continue providing those services which they have given to their communities in the past. Both of these aspects of CMC have ramifications for the LIS professional's relation to concepts of space and place.

The idea of the 'library without walls' has, at this point, become so clichéd that it is perhaps more trouble to raise than it is worth. And as Levy's and Marshall's discussion of assumptions underlying digital libraries makes clear, those who are awaiting a vast evaporation of library services and resources into the ethereal realm of digitization may have a very long wait indeed. However, both the growing number of digital source materials and the opportunities

presented by computer-mediated communication have one clear message for the LIS community. The new digital technologies afford a new flexibility in the design of library and information services; most particularly, they allow us to consider the issue of space, in at least some circumstances, as an optional design parameter, rather than the essential component it was in an age of physical documents. While this means that those designing library and information services will have to confront an entirely new series of questions in regards to the needs for and use of space in information exchange, it also means that they will be able to better tailor existing services and offer new ones that were practical impossibilities before the development of network systems. By learning to operate in an information environment where space has ceased to be quite so significant an issue, they may be able to facilitate the ability of individuals in the wider community to directly exchange needed and useful information. The 'library without walls,' then, may not only be allowing documents to flow out more freely to the surrounding community. It may also enable the wider community to enter and participate in the library as each other's most valuable source of information.

APPENDIX I

```
lucien.Berkeley.EDU> tf

TinyFugue version 3.3 beta 16, Copyright (C) 1993, 1994 Ken Keys
Regexp package is Copyright (c) 1986 by University of Toronto.
Type `/help', `/help topics', or `/help intro' for help.
% Loading commands from /share6/lucien/local/lib/tf.33b16.lib/stdlib.tf.

---- No world ----

/world ipl.sils.umich.edu 8888

---- World (unnamed2) ----

           Welcome to the Internet Public Library MOO!

            This MOO lives a ipl.sils.umich.edu 8888

A MOO is a text-based, multi-user virtual reality environment.  We are
developing this MOO as a public library for the Internet community,
the live, real-time extension of the Internet Public Library Website,
http://ipl.sils.umich.edu/.  This MOO is intended as a model and
laboratory for librarians and MOO folk to explore the possibilities of
library services in MOO and virtual reality environments.

Please join us, and feel free to contribute your ideas to the library!

You may:

   connect guest                        to connect as a guest
   connect <mooname> <moopassword>      to connect as a particular member
   @quit                                to disconnect from this moo

The lag is low; there are 2 connected.

connect Jerome
*** Connected ***

The Foyer

The entryway into the Internet Public Library Moo. You can see the
Main Atrium ahead of you through a wide open archway to the north.
Behind you are the rotating glass doors you just walked through.

    To leave the moo, type: doors or type: @quit
    To Talk to people on the moo, type: say (your words)
    For Help, type: help

Welcome!
```

Obvious exits: north to The Main Atrium and DOORS to leave the library.
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north

The Main Atrium

A wide, open space in the middle of the building reaching up past
the many balconies to the skylight roof of the building. There
is a Map on an easel, many low benches and tables for chatting
and reading.
Obvious exits: south to The Foyer, east to The Reference Department, north to
The Courtyard, and west to The Auditorium

east

The Reference Department

You see a Take-A-Number-Machine here.
Obvious exits: west to The Main Atrium, north to First Floor Stacks, northeast
to The Reading Room, and interview to Reference Interview Room

look Take-A-Number-Machine

You see a tall slim blue metal box, this is a ticket machine.
 If you want to wait for a reference interview, you can get a
 ticket by typing: get ticket from machine (short: get from machine).
 If you take a ticket, remember that you can see where you are in
 the line by looking at the ticket.
 Currently 2 people are waiting.

get ticket from machine

You get a ticket from the machine!
You are now waiting for a reference interview. You are the 3rd in line.

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