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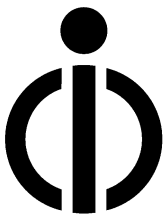
Creating Digital Libraries Together —Collaboration, Multimodality, and Plurality

Anders Hedman



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Creating Digital Libraries Together— Collaboration, multimodality, and plurality

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ABSTRACT

Many have tried to answer the question of what a digital library is and how such libraries should be built. But, in a sense the question of how to construct digital libraries as well defined entities is misguided from the beginning. There are many approaches to building digital libraries [7, 18, 4] and each approach must be understood from within a context. Some contexts such as information retrieval and digitizing of existing materials have received much attention [12, 22, 18, 17], while other contexts have been more or less ignored [19]. One such context is that of networking from a higher level of abstraction [8, 11]. Since traditional libraries have long since existed in elaborate and large-scale physical networks it is only natural that we should see such structures mirrored in the world of digital abstract networks. The Universal Simulator [10] application builds on the idea that research in digital libraries need not necessarily focus on micro level infrastructures, but that we may also find interesting possibilities on the macro level of digital library infrastructures. Moreover, at such a macro level we may find important new ways of collaborating and building digital libraries in educational settings.

Keywords

Digital libraries, collaboration, multimodality, infrastructure

1. DIGITAL LIBRARIES

The concept of a library from the very beginning presupposes cooperation. Without at least the cooperation of content producers (writers and other media producers), libraries could not exist. Indeed, what could be more fundamental to a library than it in essence being a cooperative effort? It is people that create libraries together although they may not know each other, or even think about where their works end up. How exactly does this cooperation take place? In the world of print the process is largely determined by authors and publishers, but in the electronic world, the situation need not be the same. In the electronic world anyone can be both an author and a publisher (as evidenced by the World Wide Web). This is the starting point for many debates about media control. But, also for debates about the very process of creating communal resources through cooperation, which is what libraries are most fundamentally about. As with traditional libraries this cooperation takes place through networking, but electronic networking with respect to the idea of a library opens up different possibilities.

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1.1 Infrastructures

One way to approach the field of digital libraries is from the viewpoint of networking as a general concept. In a physical library setting networking means that we concentrate on how materials pass physically between main libraries, sub-libraries, interlibrary lending facilities, storage facilities, binderies, publishers, patrons, and other entities. Such physical networks for the transfer of resources have developed over the years, and are expressions of what we may think of as traditional library culture.

In facing the era of digital libraries we can only speculate and experiment in order to arrive at what will one day be part of our future library culture. Whatever that culture will be like, we can be sure of that networking will be prevalent. One possible networking infrastructure is hypermedia and the World Wide Web [9, 2].

1.2 Substrates

While both traditional libraries and digital libraries can be seen as networked information storage facilities, only the digital library houses the possibility of being both an information storage facility and tools of production. Although this latter possibility has been largely ignored, there is no technical or practical reason why digital libraries should not work as information *substrates*–entites allowing for the dynamic generation of content. Such an approach would enable the creation of digital libraries from the grassroots level [20] and can be seen as influenced by the Scandinavian School of participatory design [3, 5, 15, 6]. Since a digital library has the quality of being a *software artifact* (however complex it may be), we can also think of it as an artifact capable of letting patrons generate their own catalog items. A digital library could in principle perform a wide range of software authoring functions. Putting the three ideas together, i.e. collaboration, infrastructure and substrate artifacts, we arrive at one particular view of digital libraries–the view of digital libraries as collectively constructed through networking infrastructures.

2. THE UNIVERSAL SIMULATOR

The World Wide Web has two of the qualities brought forth: it is a collective effort and it depends on a common infrastructure, but

it is not a substrate. It does not allow for its patrons to author their own content as they visit parts of this giant, unstructured digital library. The Universal Simulator is an effort to show how such authoring is possible. It is a substrate technology, and an authoring tool allowing its patrons to generate their own information structures, and to create or add existing content to those structures. It is built with standard Internet technologies and can be used by anyone with a web browser.

2.1 Digital library visions

Collaborative digital libraries can be used for constructing communal repositories of knowledge resources. The universal simulator was constructed with this aim in mind. It is possible to let students and teachers cooperate to build their own multimedia digital libraries. Such digital libraries could serve as backdrops for regular courses. They can also fulfill three important learning objectives: multimodality, collaboration and plurality.

2.1.1 Collaboration

Collaborating to construct digital libraries is not simply a matter of building learning resources. Inherent within the possibility of dynamic generation of digital libraries using substrate technologies, is also the possibility of learning through the very act of collaboration. Students using digital libraries on the Internet learn about IT and Internet-technologies at the same time. Moreover, we hope that students deploying the Universal Simulator will also learn about the subjects they are studying through creating their own parts of the digital library.

2.1.2 Multimodality

The Universal Simulator can harbor any multimedia content on the Internet. Using multimedia elements such as Java-applets, Shockwave and dynamic HTML allows for concepts to be visualized and portrayed in a variety of ways. A student can, for example, watch how Newton's law of gravity work or see how mathematical equations appear when plotted. The content is in many cases readily available on the Internet and the Universal Simulator can then be used as a meta-library, i.e., the content is accessed through the Universal Simulator, but resides elsewhere.

2.1.3 Plurality

In an ordinary school setting, the learning materials are limited. Although it would in many cases be better for students to have more extensive course materials, economics does often not allow this. However, in the setting of digital libraries, several different versions of the same learning materials could be used since publishing and distribution costs are small. Another way to put this is to say that digital libraries are well suited for parallel publishing. Parallel publishing possibilities could in turn aid various target groups based on qualities such as gender, age or learning abilities.

2.2 Building digital libraries

The universal simulator server is a web server, but it is also an authoring tool. What is authored is both structure and content. The structure is a scaffolding of HTML pages with links and the content can be any content compatible with HTML, i.e. any content that we may find on the Internet. The universal simulator enables visitors to write their own HTML-documents in real time.

Where the content resides is largely irrelevant and the Universal Simulator can build libraries which are free from local content. It is transparent to library patrons where the content comes from, just like it is on the World Wide Web at large.

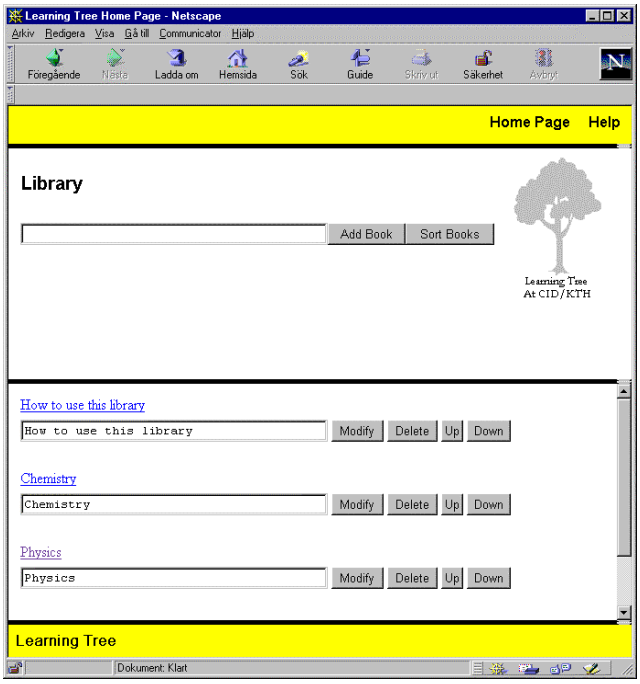

Figure 1 – Universal Simulator

Creating digital libraries and adding content requires no special technical skills other than being able to click on links and fill in forms. The structure is hierarchical and provides a high level of predictability.

Figure 2 – Hierarchical structure of the Universal Simulator

In order to aid the user further the location within the library is always shown. This information is shown as path, and the visitor can click on different parts of the path to navigate within the library.

2.2.1 High level infrastructure analysis

The Universal Simulator application can run on almost any machine connected to an intranet or the Internet.

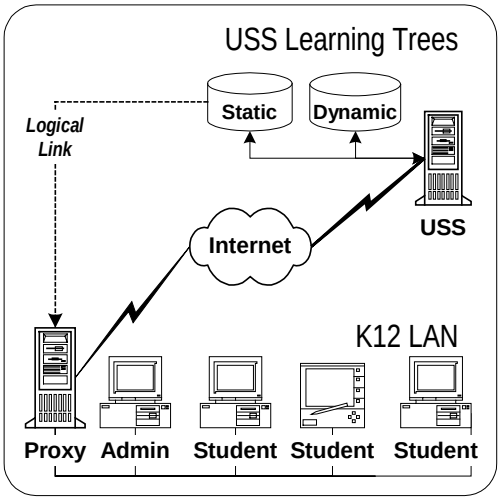

Figure 3 – Infrastructure of the Universal Simulator

In brief the Universal Simulator server generates two distinct, but isomorphic web sites: a *dynamic site* and a *static site*. One of these sites is dynamic and this site houses the authoring tools. The other is static and functions more like a traditional library in the sense that visitors are not allowed to make any content changes. The dynamic site provides an interface to the substrate functions of the universal simulator server. New structures and pages are generated transparently by Java-programs as the users work with library production.

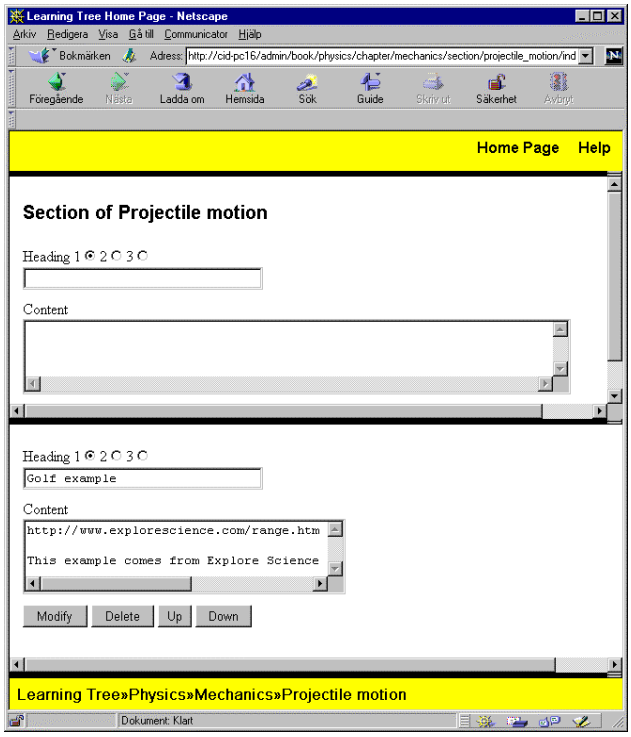

Figure 4 – Dynamic Site

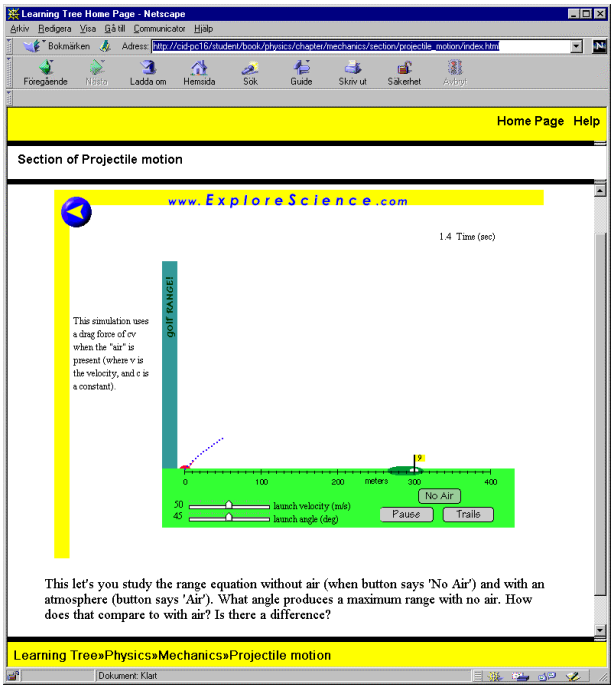

Figure 5 – Student view[1]

2.2.2 *Level of infrastructure analysis*

The universal simulator provides an infrastructure inspired by traditional library systems.

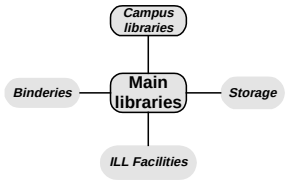

Figure 5 – Library infrastructure elements

The higher level infrastructures applicable to digital libraries can naturally be conceived of in a variety of ways. The one explored here is based on sites that are used to build libraries and those that provide access. Since the sites that merely provide access are self-contained they can be copied to local area networks.

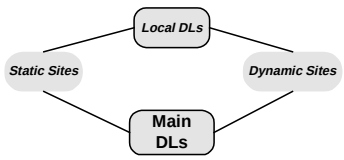

Figure 6 – Infrastructure elements of The Universal Simulator

Another possibility with this infrastructure is to link different libraries together in higher level indexes.

[1] Shockwave application by courtesy of Raman Pfaff.

3. CURRENT USE SCENARIOS

This paper has focused on digital libraries as information tools, but in order for them to work we also need to consider the cultural and social spaces [1, 24, 13, 23] in which they have their life. By building a VRML entrance to the Universal Simulator and placing it in a digital worlds project[i] we hope to provide a social setting which allow us to better study the digital library from a digital community perspective. Another line of investigation is taking place at a Swedish university[ii], where our focus is on implementing and evaluating cognitive apprentice–ship [16]. In this latter case teachers at the University of Stockholm will use the dynamic server to generate the digital library and the students will use the static server for accessing multimedia demonstrations and course materials

4. REERENCES

[1] Ackerman M. S. (1994) Providing Social Interaction in the Digital Library Paper *Proceedings of the First Annual Conference on the Theory and Practice of Digital Libraries* June 19-21 College Station, Texas, *USA*.

[2] Akscyn R.,McCracken D. (1993) PLEXUS: A Hypermedia Architecture for Large-scale Digital Libraries *Proceedings of SIGDOC '93, ACM SIGDOC* Oct 1993, Kitchener, Ontario

[3] Bodker S, Gronbaek K, Kyng M (1995) Cooperative Design: Techniques and Experiences from the Scandinavian Scene in Baeker R M, Grundin J, Buxton W A S and Greenberg S, Readings in HCI: Toward the year 2000, Morgan Kaufman, California.

[4] Buckland M. (1992) *Redesigning Library Services: A Manifesto.* Chicago: American Library Association Press.

[5] Greenberg E.S (1986) *Workplace Democracy* New York: Cornell University Press.

[6] Ehn P, Kyng M. (1987) The collective resource approach to systems design in *Computers and Democracy-a Scandinavian Challenge*, Bjerknes G, Ehn P. Kyng M. (eds) pp 17-57 Aldershot, UK: Averbury.

[7] Fox, E. A., R. Akscyn, R. Furuta, J. Leggett. (1995) Introduction to Digital Libraries. *Communications of the ACM* 38:22-28.

[8] Fox E.A. et al (1993) *Interactive Learning with a Digital Library in Computer Science Education* Infrastructure Proposal to the NSF for 1993-96.

[9] Fox E.A. (1993b) *Source Book On Digital Libraries Fox* (ed) Prepared for the National Science Foundation, Directorate for Computer and Information Science and Engineering (CISE), Division of Information, Robotics and Intelligent Systems (IRIS)

[10] Hedman A, Jacobsson, E. (1998) The Universal Simulator Technical Demonstration at *the 6th ACM International Multimedia Conference* September 98 Bristol UK.

[11] Maurer H., Williams M. R. (1991) Hypermedia systems and other computer support as infrastructure for museums 14:117-137 *Journal of Microcomputer Applications*

[12] Kenney A.R., Personius L.K. (1992) Joint Study in Digital Preservation: Report Phase I: Digital Capture, Paper Facsimiles, and Network Access. The Cornell/Xerox/Commission on Preservation and Access, Project Managers: Anne R. Kenney and Lynne K. Personius, Cornell University.

[13] Kling, R, Elliot M. (1994) Proceedings of the First Annual Conference on the Theory and Practice of Digital Libraries June 19-21 College Station Texas USA

[14] Kling R., Lamb R. (1996) Analyzing Visions of Electronic Publishing and digital Libraries *Scholarly Publishing:The Electronic Frontier* Gregory B. Newby and Robin M. Peek (eds) Cambridge Ma: The MIT Press.

[15] Kyng, M (1991) Designing For Cooperation: Cooperation in Design *Communications of the ACM*, 34(12) 65-73.

[16] Lave J.,Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Pea R., and Brown, J. S. (eds), Cambridge: Cambridge University Press.

[17] Lesk M. *Practical Digital Libraries: Books, Bytes & Bucks* San Francisco: Morgan Kaufmann 1997.

[18] Levy D.M., Marshall, C.C. (1995) Going digital: A look at assumptions underlying digital libraries. *Communications of the ACM,* 38:4, 77-84.

[19] Peters P.E. (1995) Digital Libraries Are Much More than Digitized Collections. *EDUCOM Review* 4:14-15.

[20] Sandusky R.J., Powell K.R (1998) Design for Collaboration in Networked Information Retrieval, AAAS-98, Digital Libraries Session, Philadelphia, February 1998.

[21] Schatz B.R. (1993) Building an electronic community system in *Readings in Groupware and Computer-Supported Cooperative Work: Assisting Human-Human Collaboration*. Baecker, R.M. (Ed.). Morgan Kaufmann Publishers, New York, pp 550-560.

[22] Schatz B.R. (1997) Information Retrieval in Digital Libraries: Bringing Search to the Net. *Science*. 275:327-335.

[23] Star S.L., Bishop A. (1996) Social informatics of digital library use and infrastructure. In Martha E. Williams (ed) *Annual Review of Information Science and Technology* 31:301-401.

[24] McClure C. et al. (1987) Planning and Role Setting for Public Libraries. Chicago, American Library Association Press.

[i] Digital Worlds on the World Wide Web – Centre for user oriented desing at the Royal Technical Institute http://cid.nada.kth.se

[ii] The project is sponsored by Graduate School for Human Computer Interaction in Sweden. http://www.hmi.kth.se/