Proposal to the Lab for New Media Strategy and Design

From the Center for LifeLong Learning and Design (L^3D)

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NEW MEDIA TO SUPPORT COLLABORATIVE KNOWLEDGE-BUILDING:

BEYOND CONSUMPTION AND CHAT

Project Principal Investigator:

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NEW MEDIA TO SUPPORT COLLABORATIVE KNOWLEDGE-BUILDING: BEYOND CONSUMPTION AND CHAT

Executive Summary

The Center for LifeLong Learning and Design (L^3D), directed by Gerhard Fischer, is an interdisciplinary research and teaching center within the Department of Computer Science and the Institute for Cognitive Science. It has long focused on developing theoretical frameworks and prototype technologies for supporting high-functionality, collaborative, creative tasks with computational media. In recent years, it has explored models of Web-based communication that foster interaction and the collaborative construction of shared knowledge.

The proposed project is situated within an advanced interdisciplinary seminar that brings together faculty and graduate students to research the role of computational cognitive artifacts and innovative Web-based media in collaborative learning and education. Much of the seminar activity takes place through WEBGUIDE, a knowledge-building environment being developed by Gerry Stahl, the project Principal Investigator. WEBGUIDE is an experiment in dynamically structuring hypertext communication according to group and personal perspectives.

The requested seed grant will allow the further development and evaluation of WEBGUIDE during the duration of the seminar. WEBGUIDE will become a central theme of the seminar as an example of a computational artifact that seminar members learn to use. New functionality will be added to WEBGUIDE incrementally as suggested by its use. The adoption, usability, benefits and limitations of the technology will be evaluated and reported.

L^3D has always pursued interaction with industry. WEBGUIDE and related models and technologies developed at L^3D have been used in a number of classroom settings, and will soon be ready for exploration in commercial settings.

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Technical Description

The L[3]D Center

The Center for LifeLong Learning and Design (L[3]D) emerged from Gerhard Fischer's research group on Human-Computer Communication. That research group established a reputation for developing ideas and systems to support high-functionality, collaborative, creative tasks with computational media. A central theme in the late 1980's and early 1990's was computational design environments to support designers in various fields (e.g., design of kitchens, voice-dialog systems, LANs, habitats in outer space. Most current L[3]D faculty were involved in these efforts, and approaches from it influence on-going research.

An important focus in the early work was on supporting "lifelong learning," "just-in-time learning," or "learning-on-demand". The design environments were always "domain-oriented," that is, they were built around knowledge-bases of domain knowledge. A distinctive feature of L[3]D's research was a concern with the evolution of these knowledge-bases through use. It was seen as critical that designers not only have access to domain knowledge as they work, but that they can grow the knowledge-base by contributing to it and reorganizing it. This concern broadened the research interests from HCI (human-computer interaction) and AI (artificial intelligence) to CSCW (computer supported cooperative work) and CSCL (computer supported collaborative learning) (Arias et al., 1999; 2000; Fischer, 1994; 1998).

With the advent of the Web, L[3]D research shifted to exploiting the promise of the Web as an infrastructure for sharing knowledge and collaborating on design. Here it was important to distinguish distinct models of Web use: (model 1) the Web as a read-only repository of information; (model 2) the Web as a place where information may be submitted to webmasters who mediate its dissemination; (model 3) the Web as a communication medium in which users interactively grow shared knowledge. Of course, each of these models is appropriate for certain classes of use and model 3 raises a variety of special issues which we are currently investigating.

Much of L[3]D's work recently has tried to identify limitations of popular models of the Web and to explore ways of overcoming these limitations. To allow users to move from the role of passive consumers of information to active producers of shared knowledge, we developed a number of prototypes and then deployed them in courses. For instance, a series of interlocking dynamic websites were created in which users could interactively build glossaries of technical terms, bibliographies of literature sources and threaded discussion of topics (see DYNAGLOSS, DYNASOURCE, DYNACLASS: http://www.cs.colorado.edu/~ostwald/dynasites.html).

We observed through analysis of entries in threaded discussions that these media, though interactive, were generally limited to relatively superficial chat or exchange of personal opinions. WEBGUIDE was developed to explore support for activities of knowledge-building that go beyond both consumption and chat to dialog, merging of perspectives, clarification of meanings, theory building, shared knowledge, crystallization of ideas in cultural artifacts, etc. (Stahl, 1999b; 1999c; 2000b).

Other L[3]D projects address the limitations of purely digital communication by allowing interaction with physical objects that have computational implications. Another major concern is that today's technology excludes both people without access to equipment and also many people with physical or mental disabilities. L[3]D has begun a major effort – in association with industry – to develop technologies that address the special needs of these populations.

The Project Environment: Teaching & Research

The proposed project is situated within an advanced interdisciplinary seminar on "Perspectives in Computer Supported Collaborative Learning" (http://www.cs.colorado.edu/~gerry/readings/). The seminar brings together faculty and graduate students from Computer Science, Communication, Education, Psychology and Philosophy to research the role of computational cognitive artifacts and innovative Web-based media in collaborative learning and education. A variety of theoretical approaches are reviewed through discussion of seminal texts and collaborative micro-ethnographic analysis of videos from a middle school classroom. Video clips, log and transcripts are available through WEBGUIDE, which also provides the medium for communication and group theory building. Several seminar participants interact solely through WEBGUIDE from other universities and even from other countries.

WEBGUIDE is an experiment in structuring hypertext communication according to group and personal perspectives. Seminar participants each have their personal "perspective" or digital workspace in which they have complete control over editing, arranging and managing their own mix of shared and private notes (short texts, graphics, Web links). There is also an official class perspective with topic headings, class minutes and agreed upon notes. Contents of the class perspective are automatically inherited (included, subject to editing) in each personal perspective. Further, it is possible to create subgroup perspectives that reflect the work of teams or topics within the class. For instance, participants from a particular other university, from a specific academic discipline or those especially interested in one of the authors being read could set up a workspace reflecting their joint perspective on the seminar. Again, contents would be inherited from class to subgroup to selected personal perspectives. What appears in a Web browser at any given moment is a dynamic, personalized selection from the shared, interactive knowledge base (Stahl, 1999a; 2000a; Stahl & Herrmann, 1999).

WebGuide has been piloted in a middle school and a graduate school course. The results of these trials have been presented and well received at the major related conferences (see http://www.cs.colorado.edu/~gerry/webguide/publications.html). Many of the problems and limitations of previous trials will be addressed in the current semester, where a substantially revised version (WEBGUIDE 2000) will be used for the first time. This seminar is likely to produce much more meaningful data, particularly if several known problems can be addressed through the proposed project.

Description of the Project

The requested seed grant will allow the further development and evaluation of WEBGUIDE during the duration of the Fall 2000 seminar. By providing 50% funding for the PI, the grant will allow system development work, addition of new utilities, rapid fixes of bugs, evaluation of patterns of use, and timely assessment and reporting of successes and limitations. In addition to freeing up the PI to work on the software directly, the seed grant will let him supervise student projects related to WEBGUIDE, coordinate explicit reflection on the software by seminar participants, and prepare funding proposals to continue this research.

One major planned component of WEBGUIDE has not yet been implemented, although the technical infrastructure for it is mainly in place. That is a negotiation process whereby the group of users decide what notes should be promoted to the class perspective (or to a subgroup). A student project last semester designed this component, but it has not yet been implemented.

A major improvement to the WEBGUIDE architecture would be to convert the client/sever interface to communicate using XML data rather than Java objects. This would greatly improve the ease of developing alternative interfaces to WEBGUIDE, for instance simple HTML or Perl displays and forms. It is possible to involve a student project from an XML course this semester in working on this. The PI also has an undergraduate research apprentice who could work on this, given grant funding.

L^3D is increasingly developing expertise in evaluating the success and character of online interaction. In part this is through developing methods of analyzing the structure and semantic or interaction content of

discussion threads. In part it is by practicing micro-ethnographic methods of human-computer interaction analysis using digitized video recordings and computer logs. With seed grant funding, these approaches will be applied to assessing the use of WEBGUIDE and related materials in the seminar. The findings will be published and will also be used as the basis for funding proposals to the ROLE, CSS and ITR programs at NSF to continue this research. Collaboration with industry would also be appropriate and welcome at this point.

Relation to New Media Lab Mission

L^3D has always pursued interaction with related industry, including NYNEX, US West, IBM, Johnson Engineering, Athenaeum International, BEA, PFU, SRA. L^3D's philosophy has been to address real-world problems and to test its ideas in real-world settings. This distinguishes it from alternative approaches oriented to abstract theory or to laboratory research.

L^3D is focused on innovative research and teaching concerned with human interaction within the increasingly digital environment, whereby that environment is seen as a potential with both advantages and limitations – a future that is in the throes of being invented, and whose invention we can influence.

L^3D strives to integrate teaching and research, with a strong project-based orientation in its classes and a dominant involvement of undergraduate and graduate students in its research. Vertical integration is a way of life here. Relations between L^3D and industry have historically included both long-term placement of students on site and substantial visits by industry scientists on campus, in order to build lasting, meaningful relationships and deep shared understanding.

The proposed project fits nicely within the Lab for New Media's theme of "Perception and Persona in the Digitally-Mediated Environment." The perspectives mechanism in WEBGUIDE is designed to represent the intellectual persona of participants and to allow these persona to be perceived dynamically.

The project falls under Technology Research, involving directly the design, implementation, use and assessment of middleware in support of collaborative interaction. At the same time, in the seminar setting it is used to explore the strategic integration of face-to-face and computer-mediated interaction. Finally, within the tradition of work at L^3D and by the PI, it involves the dynamic configuration of text and graphics from a shared, interactive knowledge base into a hypertext narrative structure personalized to the user's changing interests.

References

Arias, E., Eden, H., Fischer, G., Gorman, A., & Scharff, E. (1999) Beyond access: Informed participation and empowerment, In: Proceedings of *Computer Supported Collaborative Learning (CSCL '99)*, pp. 20-32.

Arias, E., Eden, H., Fischer, G., Gorman, A., & Scharff, E. (2000) Transcending the individual human mind: Creating shared understanding through collaborative design, *ACM Transactions on Computer-Human Interaction,* 7 (1), pp. 84-113. Available at: http://www/cs/colorado.edu/~gerhard/papers/tochi99.pdf.

Fischer, G. (1994) Domain-oriented design environments, *Automated Software Engineering,* 1 (2), pp. 177-203.

Fischer, G. (1998) Seeding, evolutionary growth and reseeding: Constructing, capturing and evolving knowledge in domain-oriented design environments, *Automated Software Engineering,* 5 (4), pp. 447-464. Available at: http://www.cs.colorado.edu/~gerhard/papers/final-journal-sept30-97.pdf.

Stahl, G. (1999a) POW! Perspectives on the Web, In: Proceedings of *WebNet World Conference on the WWW and Internet (WebNet '99)*, Honolulu, HA. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/1999/webnet99/webnet99.html.

Stahl, G. (1999b) Reflections on WebGuide: Seven issues for the next generation of collaborative knowledge-building environments, In: Proceedings of *Computer Supported Collaborative Learning (CSCL '99)*, Palo Alto, CA, pp. 600-610. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/1999/cscl99/ -- and -- http://kn.cilt.org/cscl99/A73/A73.HTM.

Stahl, G. (1999c) WebGuide: Guiding collaborative learning on the Web with perspectives, In: Proceedings of *Annual Conference of the American Educational Research Association (AERA '99)*, Montreal, Canada. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/1999/aera99/ -- and -- http://www-jime.open.ac.uk/00/stahl/stahl-t.html.

Stahl, G. (2000a) Collaborative information environments to support knowledge construction by communities, *AI & Society,* 14 , pp. 1-27. Available at: http://www.cs.colorado.edu/~gerry/publications/journals/ai&society/.

Stahl, G. (2000b) A model of collaborative knowledge-building, In: Proceedings of *Fourth International Conference of the Learning Sciences (ICLS 2000)*, Ann Arbor, MI, pp. 70-77. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/2000/icls/ -- and -- http://www.umich.edu/~icls/proceedings/abstracts/ab70.html.

Stahl, G. & Herrmann, T. (1999) Intertwining perspectives and negotiation, In: Proceedings of *International Conference on Supporting Group Work (Group '99)*, Phoenix, AZ. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/1999/group99/.

Project Budget

New Media to Support Collaborative Knowledge-Building: Beyond Consumption and Chat

Principal Investigator: Gerry Stahl

Duration: 9/15/00 - 1/15/01

A.	**Salaries and Wages**		
	Principal Investigator: Gerry Stahl		
		50% time, 4 months calendar	14,306
B.	**Fringe Benefits**		
	PI: 19.22% + $348.42/mo.		3,446
C.	**Travel**		
	Project personnel to attend professional meeting		
		Airfare: $350; Per diem: 4 days @ $125/day;	
		Registration: $100; Ground transp.: $50	1,000
D.	**Other Direct Costs**		
	1)	Materials and Supplies	1,000
E.	**Total Direct Costs**		19,752
F.	**Indirect Costs**		
	Waived for seed grant		0
G.	**Total Costs**		$19,752

Biographical Sketch of Gerry Stahl, Principal Investigator

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Professional Appointments

Research Professor
1999-present Department of Computer Science and
Institute of Cognitive Science, Boulder, CO

Post Doctoral Research Fellow
1996-99 Center for LifeLong Learning and Design, Boulder, CO

Education

University of Colorado
1993 Ph.D. in Computer Science
1990 M.S. in Computer Science

Northwestern University
1975 Ph.D. in Philosophy
1971 M.A. in Philosophy

University of Frankfurt
1973 Graduate study in critical social theory

University of Heidelberg
1968 Graduate study in continental philosophy

Massachusetts Institute of Technology (MIT)
1967 B.S. in Humanities & Science (Math & Philosophy)

Research Interests

Theory of collaborative knowledge-building, educational technology, computer supported collaborative learning, knowledge-building environments on the Web, digital external memories for groups, situated cognition, social theory, mediation of cognition by cultural artifacts and technology, new forms of computer-mediated collaborative cognition.

Related Publications

Stahl, G. (2000) Collaborative information environments to support knowledge construction by communities, *AI & Society*, 14, pp. 1-27. Available at: http://www.cs.colorado.edu/~gerry/publications/journals/ai&society/.

Stahl, G. (2000) A model of collaborative knowledge-building, In: *Proceedings of International Conference of the Learning Sciences* (ICLS 2000), Ann Arbor, MI. http://www.cs.colorado.edu/~gerry/publications/conferences/2000/icls/

Stahl, G. (1999) Reflections on WebGuide: Seven issues for the next generation of collaborative knowledge-building environments, In: *Proceedings of Computer Supported Collaborative Learning* (CSCL '99), Palo Alto, CA, pp. 600-610. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/1999/cscl99 .

Stahl, G. (1999) WebGuide: Guiding collaborative learning on the Web with perspectives, *Annual Conference of the American Educational Research Association* (AERA '99), Montreal, Canada. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/1999/aera99 .

Stahl, G. & Herrmann, T. (1999) Intertwining perspectives and negotiation, In: *Proceedings of International Conference on Supporting Group Work* (Group '99), Phoenix, AZ. Available at: http://www.cs.colorado.edu/~gerry/publications/conferences/1999/group99 .

Stahl, G., Sumner, T., & Owen, R. (1995) Share globally, adapt locally: Software to create and distribute student-centered curriculum, *Computers and Education*. Special Issue on Education and the Internet, 24 (3), pp. 237-246. Available at: http://www.cs.colorado.edu/~gerry/publications/journals/c&e/.