Annual Report for Period: 09/2004 - 09/2005 **Submitted on:** 08/17/2005

Principal Investigator: Bowker, Geoffrey C. **Award ID:** 0433369

Organization: Santa Clara University

Title:

Interoperability Strategies for Scientific Cyberinfrastructure: A Comparative Study

Project Participants

Senior Personnel

Name: Bowker, Geoffrey

Worked for more than 160 Hours: Yes

Contribution to Project:

Bowker has co-directed the project with Karen Baker; has organized weekly video conferences and three trips to San Diego to meet with the project team. He has completed a book (Memory Practices in the Sciences) which speaks to issues raised in the grant. He has represented the research team at workshops/lectures at MIT Sloan, Irvine Computer Science, Oxford e-science group inter alia.

Name: Baker, Karen

Worked for more than 160 Hours: Yes

Contribution to Project:

Baker has co-directed the project with Bowker. In addition to coordinating the weekly project conference meetings, she has with Millerand and Ribes organized a reading group for information managers at Scripps as well as a joint science studies/environmental science read group, which has introduced information managers to STS and social informatics literature, the social informatics participants to environmental field science, and the two fields jointly to concept of shared language. She has represented the project extensively within multiple arenas at Scripps and the LTER federated network and has opened up opportunities for science studies participants to work collaboratively at a design level with LTER and Ocean Informatics community participants. She has also overseen shared data collection practices as well as the creation of the project website.

Post-doc

Name: Millerand, Florence

Worked for more than 160 Hours: Yes

Contribution to Project:

We funded her to carry out an extensive series of interviews of members of the LTER network and Ocean Informatics. This has also included data organization and analysis, and collaboration on publications and outreach.

Graduate Student

Name: Ribes, David

Worked for more than 160 Hours: Yes

Contribution to Project:

We funded him to carry out an ethnographic study and a series of interviews of members of the GEON project. This has also included data organization and analysis, and collaboration on publications and outreach.

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

GEON
Geosciences Network

Long-Term Ecological Research Network

Other Collaborators or Contacts

We held a one day meeting in LA to discuss with Sharon Traweek (UCLA History), Charlotte Linde (NASA) and Jean-Francois Blanchette (UCLA, GSEIS) the possibility of using ethnographic data (interviews, observations) as a way of providing enhanced, contextual metadata for scientific projects. We intend to pursue this line of inquiry.

Activities and Findings

Research and Education Activities:

The 2004-2005 NSF/SBE/HSD agents of change grant 'Interoperability Strategies for Scientific Cyberinfrastructure: A Comparative Study' supported an interdisciplinary collaboration between Bowker and Baker. Post Graduate Researcher Florence Millerand, from the Universite de Quebec a Montreal (UQAM), joined the project bringing an expertise in human-computer interfaces as well as qualitative methods. Graduate Student Researcher David Ribes, at the University of California San Diego joined the project bringing an expertise in sociotechnical systems, qualitative research methods and science & technology studies û Ribes has also been a researcher on the GEON project for several years. A series of publications summarize the initial work: framing an understanding of the strategies of interoperability as configurations of community, technology and organization.

Findings:

Although nascent, we highlight four emergent findings:

-Configurations of technology: A broader understanding of what constitutes 'configurations of technology' informs both the development and the enactment of technologies. The rapid contemporary scaling of communities and practices frequently masks the iterative nature of human agency creating environments that in turn act on humans. Such views are only now unfolding and beginning to be articulated. (Ribes et al, 2005; Baker et al, 2005)

-Community roles and engagement:Positions within cross-domain projects are evolving dynamically and benefit from re-examination of both existing organizational frameworks and of domain perspectives that shape actions. Engagement with scientists and community science at multiple levels produces wider opportunities for interface and dialogue, augmenting traditional notions of intervention. In terms of social engineering, this means considering a range of strategies with social science performed in new ways, eg IT participants or cross-domain teams engaged with and tending to social informatics dimensions of work. (Karasti and Baker, 2004; Baker, 2004; Ribes, 2005)

-Cognitive Division of Labor:The interdependent aspects of and relations between organizational, technology, and social lead to establishment of diverse methods of division of cognitive labor. For instance, cognition may be born or carried by specific standards, group representatives, and objects including ontologies. This opens up the 'notion of leviathan' beyond a single person to include communities, artifacts, and ideas. (Millerand et al, 2005; Bowker and Baker, 2005; Ribes, 2005)

-Discursive Resources:The development of a full suite of contemporary discursive resources and approaches is critical. Infusing science studies into existing community practices is time consuming and qualitative but helps to jointly develop and document strategic interdisciplinary communication mechanisms. Further, the comparative analysis approach is affording unique opportunities that reveal interdependencies and new ways to ask questions as to what is intercomparable. Such an approach may provide alternative understandings by expanding beyond the static limitations of defining communities by more traditional characteristics or notions of success. (see Outreach Activities section)

Training and Development:

Baker, Millerand and Ribes have received training in grounded theory, a methodology for qualitative analysis. All have learned nVivo - a software program that supports such analysis. Bowker has used the experience in a number of workshops to teach about the structuring of cyberscience - notably in Oxford in 2004 to an e-science group.

Outreach Activities:

Our main outreach has been, through presentations and reports in progress, to communicate our findings back to the communities with which and within which we are working. Workshops such as that organized by Bowker (2005) on Digital Commons synergize with our efforts to articulate information practices as a dimension of knowledge sharing. The project is interfacing with UCSD communities through informal presentations such as to the Laboratory for Comparative Human Cognition (Millerand, 2005) and the UCSD System Administrators (Baker et al, 2005)

Our within group training: Karen Baker gained experience in interdisciplinary studies as well as participatory design and ethnographic field work. Geoffrey Bowker gained experience in working with information systems managers, ethnographic data analysis, and distributed practices. Florence Millerand has gained experience with ethnographic research, theory, and methods of science studies as well as the details of ecological and information systems practice. David Ribes has gained experience working with information systems managers and a collaborative team in addition to gaining a comparative perspective on his previous research with the single case study GEON.

Contribution to LTER Information Manager community development has been significant. It includes publication of two good reads highlighting sociotechnical dimensions in the LTER Databits Newsletter (Baker and Wanetick, 2005; Millerand, 2005). After several months of periodic Dictionary Process Design Team conference calls involving participants from five LTER research sites and the LTER Network Office, Baker and Millerand colead (in collaboration with the chair of the LTER Information Management Committee and the IT lead of the Ecological Metadata Language development team) a working group entitled Community Process: Standards Implementation' held in AUgust at this yar's annual LTER Information Management Meeting.

An article summarizing the project for the wider LTER community appeared in the Community Newsletter (Baker et al, 2005); Emerging from the LTER Information Manager work on metadata, Baker is leading a process focused Baker is participating on two of the LTER Planning Grant Committees as part of the LTER efforts to develop new approaches for its next decade of federated network science. The Human Dimensions Committe is explicitly considering the relationships of environmental and human systems; Baker foregrounds the addition of information systems to this discussion.

A presentation to the Integrative Oceanography Division (IOD) introduced our project to the SIO community (Wanetick, Baker, et al., 2004). Two reading groups have provided a forum for interdisciplinary discussion between science studies participants (Information Studies Reading Group) and between information managers across SIO departments (Ocean Informatics Reading Group). These informal groups represent an important mechanism both for better understanding the community perspectives with which we are working (in-reach) and to share across disciplinary boundaries (out-reach).

Over the years Ribes has conducted various formal 'feedback sessions' to GEON and the surrounding infrastructure (i.e. the San Diego Supercomputer Center). During the last yearû the period of the grantû this has included presenting in a formal capacity to the GEON NSF site review team on the 'social dynamics' of the GEON project, cultural integration and various facets of organizational development. In addition the forthcoming publications which directly mention GEON based research have also been made available to GEON participants and has promoted discussion: these include the Ribes&Bowker paper

A Trajectory for Ontology Development and the Ribes paper Organizing for Interdisciplinary Collaboration. The first paper focuses on the three year learning curve of GEON participants as they have encountered the technology of ontology, learned to use its techniques, and then begun deploying it within the earth-science community. The second focuses on the particular organizational strategies that GEON has undertaken in order to align the diverging interests of computer science and earth science participants.

Journal Publications

KSBaker and GBowker, "Information Ecology: Open System Environment for Data, Memories and Knowing.", Journal of Intelligent Information Systems. BDEI Special Series, (accepted), p. , vol. , ( ). Accepted

KSBaker, DRibes, FMillerand, GCBowker, "05ASIST Interoperability Strategies for Scientific Cyberinfrastruture: Research and Practice.", American Society for Information Systems and Technology (accepted 05), p. , vol. , ( ). Accepted

D.Ribes, "A Learning Trajectory for Ontology Building", Journal of the Association of Information Systems, p. , vol. , ( ). Accepted

MKhoo and DRibes, "Studying Digital Library Users in the WIld: Theories, Methods, and Analytical ApproachesD", D-Lib Magazine, p. 1, vol. 11(7/8), (2005). Published

Books or Other One-time Publications

KSBaker, SJJackson, and JRWanetick, "Strategies Supporting Heterogeneous Data and Interdisciplinary Collaboration: Towards an Ocean Informatics Environment.", (2005). Academic paper, Published
Collection: Proceedings of the 38th Hawaii International Conference on System Sciences. HICSS38, IEEE Computer Society
Bibliography: 2-6 January 2005, Big Island, Hawaii, 2005 (nominated best paper)

DRibes, KSBaker, FMillerand, GCBowker, "05JCDL Comparative Interoperability Project: Configurations of Community, Technology, Organization.", (2005). academic paper, Accepted
Collection: Proceedings of the second ACM/IEEE-CS Joint Conference on Digital Libraries
Bibliography: New York, ACM Press: (accepted 2/ 05)

KSBaker, GCBowker, FMillerand, DRibes, "Continuing an Ethnographic Approach - Interoperability Strategies for Scientific Cyberinfrastructure: A Comparative Study", (2005). newsletter, Published
Collection: LTER Network Newsletter
Bibliography: Spring 2005 http://interoperability.ucsd.edu/documents/05LTER_NetworkNews_Spring

KBaker and JWanetick, "Revolutionizing Science and Engineering through Cyberinfrastructure", (2005). newsletter article, Published
Collection: LTER DataBits Newsletter, Good Read
Bibliography: 2005. http://intranet.lternet.edu/archives/documents/Newsletters/DataBits/05spring/#2gr

F.Millerand, "Building the Virtual State: IT and Institutional Change.", (2005). newsletter article, Published
Collection: LTER DataBits Newsletter, Good Read.
Bibliography: 2005. http://intranet.lternet.edu/archives/documents/Newsletters/DataBits/05spring/#3gr

KBaker, LYarmey, LPowell, Wsheldon, "Designing a Dictionary Process: Site and Community Dictionaries.", (2005). newsletter article, Published
Collection: LTER DataBits Newsletter.
Bibliography: 2005. http://intranet.lternet.edu/archives/documents/Newsletters/DataBits/05spring/#8fa

Geoffrey C. Bowker, "Memory Practices in the Sciences", (2005). Book, Accepted
Collection: Book, Accepted

Collection: Inside Technology
Bibliography: Bibliography: Cambridge, MIT: MIT Press

DRibes, "The Positions of the Social Scientist: Social and Technical Act of Intervention.", (2005). Proceedings, Published
Editor(s): JCDL
Collection: Studying Digital LIbrary Users in the Wild
Bibliography: June 7-11, 2005; Denver, Colorado, USA

Web/Internet Site

URL(s):
http://interoperability.ucsd.edu
Description:

Other Specific Products

Product Type:

poster

Product Description:

This poster was used during the Artifacts and Collectives Workshop in Lyon, France to help explain the current project. The poster focuses on the means by which a division of cognitive labor is achieved in the three projects studied: the possible means include human organization, delegation to technological automation, and conceptual elaboration.

Sharing Information:

We will share this at other conferences and colleagues including the LTER Information Manager Meeting (August 2005) in coordination with a Working Group and the Palmer LTER Science Steering Committee Meeting(August 2005) in coordination with Naomi Oreskes, chair UCSD Science Studies Program.

Contributions

Contributions within Discipline:

We attempted to open a space within the world of Computer Supported Collaborative Work (CSCW) to generate discussion of the importance of cyberinfrastructure development and interoperability strategies for that community. Here we were highly successful - our workshop at the CSCW conference led to several researchers inflecting their careers around these sets of issues.

We are attempting within the Science Studies community, through a future double-panel presentation at the Society for Social Studies of Science (Ribes and Bowker, 2005; Millerand and Baker, 2005) to open questions regarding interoperability and models of engaged research, and the importance and difficulties of highly-interdisciplinary collaborations.

Finally, we are working with the informatics community within LTER and Ocean Informatics (OI) to help develop discursive resources for discussing social and organizational issues within the development of information systems. By developing reading groups which systematically tie technical enactments to organizational considerations and larger view images of changes in scientific practice both communities have begun to engage with the substantive concerns of the comparative interoperability project. By infusing science studies understanding of collaborative practices and participatory design approaches into ongoing OI design efforts, an awareness of language and of process is being made available to the work of data managers.

Our methods and the particular data collected has varied according to the specific field site, although all data is primarily qualitative and gathered via ethnography, interview and document collection. Within GEON the primary data collection method has been ethnographic observation. LTER has consisted of some ethnography but primarily interviews, and because Baker is a member of LTER this has also contributed substantially to the data collection. Finally, within OI the line between data collection and participation is substantially blurred, and record keeping of events serves the double purpose of gathering data for future analysis and creating organizational memory.

An analysis and reflection upon the differing positions of the social science researcher in each of the three projects involved in this study is summarized in Ribes' position paper published in D-Lib magazine (see Khoo and Ribes article): this piece outlines the kinds of relationship established between technology/information projects and social science participants. While serving as a kind of reflective piece for understanding our own project, this position paper serves as a starting point for a practical guide for designing information infrastructure projects with social scientific involvement. In the future this paper will be developed as a methodological guide.

Additional Contributions:

GCBowker, 2005. International Conference Digital Divide or Digital Commons: Toward Global Knowledge Sharing (organizer). Center for Science, Technology and Society (CSTS); 21April2005. http://www.scu.edu/sts/2005-International-Conference.cfm

DRibes, 2005. Graduate Student Workshop:Values in Computer and Information System Design (Participant). Santa Clara University. August 1-12. http://epl.scu.edu/~stvalues
- -Ribes has focused on which technologies come to be considered contentious by scientists themselves; noting that visualization technologies are often received with enthusiasm, while the technologies of knowledge mediation (i.e. ontologies) are often received with skepticism, Ribes asks, why do some information technologies incite inquiry while others are received at face value.

DRibes and GBowker, 2005. Society for Social Studies of Science. Panel Organizers: Interoperability: Beyond Standards.
-This panel has been organized but not yet taken place: it has a dual focus on case studies of interoperability and the possibility of 'interventions,' or participation by social scientists in information technology projects, including the implications of such participation.

FMillerand and KSBaker, 2005. Standardization in Action: From the Adoption of the Ecological Metadata Language to its Enactment. Intervention Panel Contribution: Interoperability: Beyond Standards.

DRibes. 2005. GEON. Science of Collaboratories Workshop. June 2005.
-Presented the analysis of the organizational solutions developed within GEON for managing large scale interdisciplinary collaboration: the presentation focused on enacting a vision from a proposal, on creating organizational structure to distribute IT resources for scientifically driven questions, and on the facilitating role of the new technologies of interoperability.

DRibes. 2004. GEON PI Meeting Presentation
-This presentation, during the NSF site review of GEON, focused in particular on communication and organizational practices within GEON. In turn this presentation elicited substantial discussion about the 'social and cultural' aspects of building an infrastructure for the geo-science community, creating a venue for discussion which was otherwise unavailable in the technically dominated site review.

FMillerand, 2005. Comparative Interoperability Project. UCSD, LCHC, Laboratory of Comparative Human Cognition

D.Ribes, Gbowker CSCW/Distributed Collaborative Practices û Chicago, October 2004.
-In this conference we presented an analysis of the standardization of communicative practices within distributed projects. The CSCW community has focused on particular means for communication across distances in collaborative projects, however we noted that experiments with particular means (i.e. video conferencing) is stabilizing around an entire suite of communicative practices and technologies.

Contributions to Other Disciplines:

Because we are a multidiscplinary team, we have described our contributions to multiple disciplines above.

Contributions to Human Resource Development:

Contributions to Resources for Research and Education:

Support for two reading groups (Information Studies and Ocean Informatics) and design teams provides to the informatics community a forum for engagement and cross-fertilization.

Contributions Beyond Science and Engineering:

Organizational Partners
Any Web/Internet Site

Any Product
Contributions: To Any Human Resource Development
Contributions Beyond Science and Engineering

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Unobligated funds: less than 20 percent of current funds
Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Contributions: To Any Human Resource Development