LTER The Network News

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Strategies for Building Scientific Cyberinfrastructure

Continuing an ethnographic approach begun in 2002...

In 2004 the National Science Foundation's cross-cutting Human and Social Dynamics theme awarded Geoffrey Bowker and Karen Baker a three-year grant to study the dynamics of building scientific *cyberinfrastructure*—the connective elements needed to hold together communities of scientists working in multiple locations who want to share data and knowledge (see the Atkins Report, 2003, *http://www.communitytechnology.org/nsf_ci_report/*).

Work on the grant project, entitled *"Interoperability Strategies for Scientific Cyberinfrastructure: A Comparative Study,"* began in September 2004 with the arrival at University of California, San Diego, of Florence Millerand, a postgraduate researcher trained in Human-Computer Interface studies, and David Ribes, a graduate student in sociology working with distributed communities that incorporate technical infrastructure. The project's goal is to understand how to simultaneously mobilize community, organizational, and technical resources in support of data integration—that is, enabling the movement of data and ensuring it can be used across and within different disciplines.

A lot is at stake in the development of these new cyberinfrastructures. Often viewed as mere "technical" development efforts, we take an approach to cyberinfrastructures as being as much about the sociotechnical, the interplay of the conceptual and organizational with technical, as about the technology itself. Cyberinfrastructure has human dimensions: they include changing ways in which organizations recognize and support scientific work and how the ramifications of science are tended and individual careers are viewed.

The Comparative Study builds on work begun in 2002 with an earlier NSF grant, *"Designing an Infrastructure for Heterogeneity of Ecosystem Data, Collaborators, and Organization"* (see Network News Vol. 14 No. 2, Fall 2001), which opened up dialogue on 'data ecology'; supported postdoctoral researcher Helena Karasti; and initiated a cross-domain dialogue between LTER ecologists, information managers, and science studies researchers (Baker & Bowker, 2001).

Building from the salient features of infrastructure and collaboration, we are studying community characteristics in general and coordination mechanisms in particular. We are using a qualitative research approach, building from grounded theory using ethnographic and theoretical sampling approaches (Strauss, 1987).

Our initial work focuses on three projects with technical infrastructures:

- GEON, a distributed geosciences project based at the San Diego Supercomputer Center that is using ontologies as a shared community approach (Keller, 2003);
- Ocean Informatics, an oceanographic team at Scripps Institution of Oceanography that is developing a conceptual framework as a community building strategy to initiate dialogue on informatics as a design environment (Baker et al., 2005);
- The LTER community, a distributed network that is working to establish very long term baselines of ecological data (Hobbie et al., 2003).

Human dimension efforts within the LTER network recognize humans, in their individual capacities and as community members, as participants in designing their environment as well as in perceiving it (Kinzig et al., 2001; Redman 1999; Redman et al., 2004; LTER white paper).

LTER sites can draw from potentially synergistic fields within social science, ranging from political and economic ecology to history and anthropology, as well as sociology and sociotechnical informatics. For instance, local LTER sites focus on built communities (e.g., urban or education communities); on anthropological studies, (e.g., historical land use); or on data ecologies (e.g., information systems). We are working today within a context of multiple perspectives transitioning to include realistic approaches to science. For our work with data, technology, and communities we draw specifically upon science studies, information science, sociotechnical, and organizational informatics (e.g. Zimmerman, 2003; Bowker, 2001).

The realization that data, databases, and information systems are not socially or culturally neutral, changes our approach to designing scientific infrastructures. With a need for coordinated databases, we focus on strategies that enable interoperability.

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For more information and a fuller list of references, see the online version at www.lternet.edu.