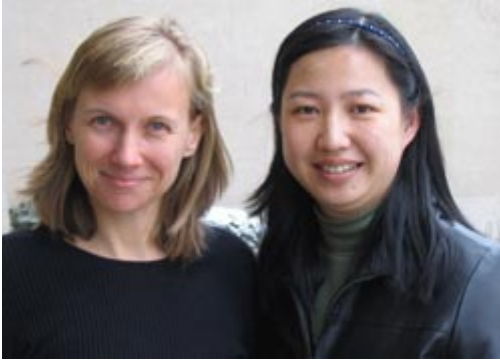# SLIS Faculty News

Research Grants Making an Impact

Katy Börner, **Weixia (Bonnie) Huang** and the members of Börner's *Information Visualization Lab* and *Cyberinfrastructure for Network Science Center* have been busy. Collectively they have conducted and implemented extensive research in "mapping science". Their research is supported by a number of **grants**, and the results of their research have been presented all over the world. The **Places & Spaces Exhibit** has been a popular way to showcase the science maps.

A new grant has been awarded by the National Science Foundation ($399,870., January 2008 - December 2009):

TLS: Towards a Macroscope for Science Policy Decision Making

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Summary

Today's world is flooded with scholarly data, information, knowledge, and expertise. Science policy and other decision makers need qualitatively novel tools to help them identify the publications, patents, technology claims, grant proposals, or other developments that are most important or potentially profitable and deserve their full attention. They also need a tool that lets them analyze and mine terabytes of relevant data and presents aggregated results in an easy to understand way, enabling them to increase the quality of their decisions. However, more than just a tool is needed. The design of tools that truly support science policy making requires a detailed characterization and prioritization of the information needs

of science policy makers, along with a conceptual framework that links the information needs of the policy maker to the available data, analysis and indicator types. Once these are in place, tool development that truly addresses the needs of today's science policy makers given the constraints of existing datasets as well as theoretical and algorithmic approaches can proceed.

This project aims to address these three challenges as follows: We propose to: (1) Conduct a detailed analysis of the information needs of a representative set of science policy makers (candidates include NSF, NIH, DOE, OSTP, congressional staff, foundations, etc.) including existing data, approaches, and tools.

(2) Develop a theoretic conceptualization of tasks relevant to science policy making that maps the needs of policy makers to theoretically grounded and practically valuable processing pipelines that transform data into actionable information. This conceptualization will be made available online in a wiki-like format for community review and consensus building.

(3) Design a prototypical tool, a *macroscope*, to visualize structure, patterns, trends, and outliers in science and technology (S&T) data sets that are too large and complex to be comprehensible to us through direct observation – just like microscopes and telescopes make it possible for us to see things that are too small or too far away. The prototypical macroscope will support a well defined set of information needs, e.g., identification of emerging research frontiers or correlation of funding with publications and patents in an area of research and exploration of results using graphs and geospatial and science maps. Macroscope tool development will benefit from the NSF funded Scholarly Database (SDB)) that provides access to more than 20 million scholarly records, and the Cyberinfrastructure Shell (CIShell), which supports the easy plug and play of datasets and algorithms and the design of stand-alone tools. Usability studies will be conducted to evaluate and optimize the macroscope. The macroscope as well as its support of advanced science mapping techniques will be introduced to a broader audience by means of the *Places & Spaces: Mapping Science* exhibit.

We will collaborate with researchers and science policy makers in Japan such as Prof. Ryutaro Ichise, National Institute of Informatics, Tokyo and Prof. Yuko Harayama, Management of Science and Technology (MOST) at Tohoku University and National Institute of Science and Technology Policy (NISTEP), Tokyo to benefit from a bi-directional flow of best theory and practice.

Intellectual Merit

The scientific study and management of S&T requires a shared terminology and conceptualization of how science works. It requires

shared data repositories that can be used to run benchmarks and comparisons of algorithms, to thoroughly validate the combination of algorithms, indicators, and evaluation procedures. The proposed theoretical work, as well as the extension of the SDB and the prototypical design of a macroscope, will create a basic shared understanding and a freely available cyberinfrastructure and tool for the science of science (policy) community.

Broader Impacts

The same capabilities that will make the macroscope a tool of choice for science policy makers will also make it attractive to other potential users. For instance, *students or members of the public* will be able to see the large scale structures of science, and find potential areas of interest for further study; researchers will be able to monitor and access research results, relevant funding opportunities, or find potential collaborators within and without their fields of inquiry. *Program managers and reviewers* will use it to meet their individual needs.

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