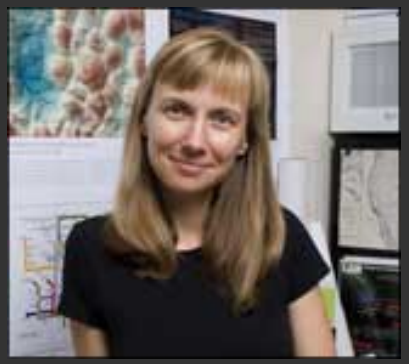
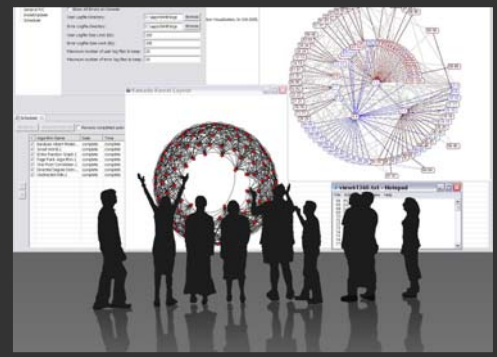
Computational Scientometrics

Studying science by scientific means





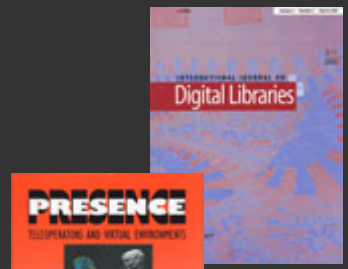
Dr. Katy Börner
Cyberinfrastructure for Network Science Center, Director
Information Visualization Laboratory, Director
School of Library and Information Science
Indiana University, Bloomington, IN
katy@indiana.edu

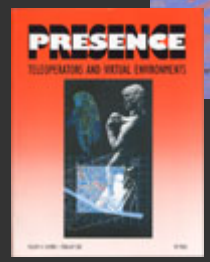
Designing cyberinfrastructure to enable US-China collaboration in tobacco control and research

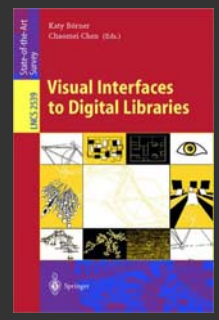
Beijing, China
March 27-29, 2008

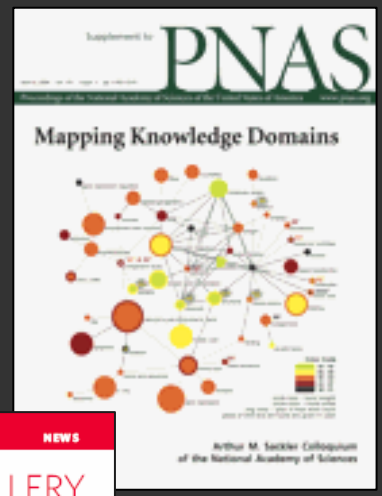
Computational Scientometrics

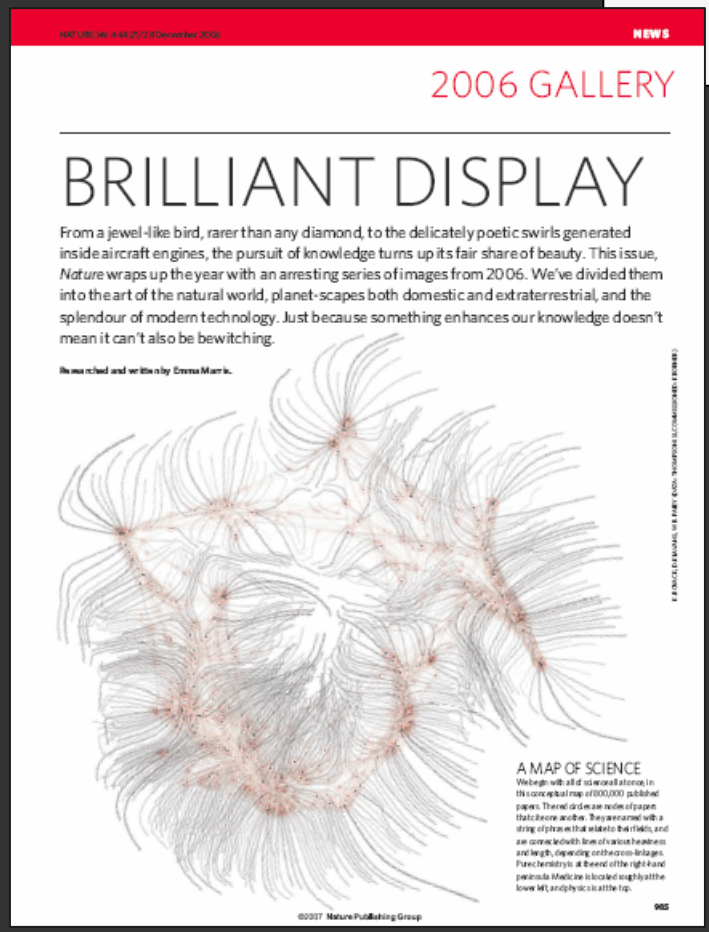
Studying science by scientific means











- Börner, Katy, Chen, Chaomei, and Boyack, Kevin. (2003). **Visualizing Knowledge Domains.** In Blaise Cronin (Ed.), Annual Review of Information Science & Technology, Volume 37, Medford, NJ: Information Today, Inc./ASIST, chapter 5, pp. 179-255.
- Shiffrin, Richard M. and Börner, Katy (Eds.) (2004). **Mapping Knowledge Domains.** Proceedings of the National Academy of Sciences of the United States of America, 101(Suppl_1).

- **Places & Spaces: Mapping Science** exhibit, soon on display at the National Research Council, Ottawa, Canada. http://scimaps.org.

Studying the Emerging Global Brain: Analyzing and Visualizing the Impact of Co-Authorship Teams

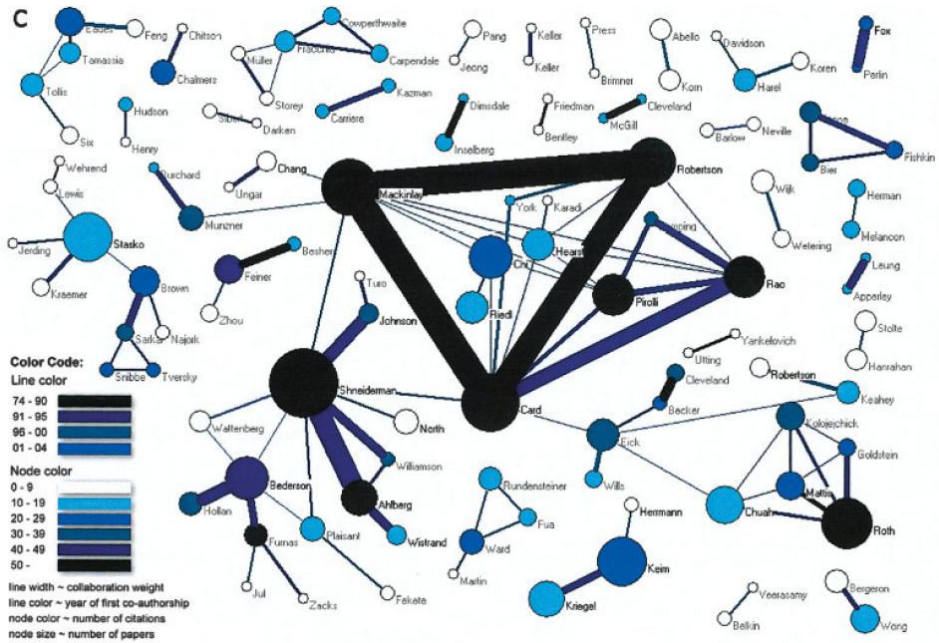
Börner, Dall'Asta, Ke & Vespignani (2005) Complexity, 10(4):58-67.

Research question:

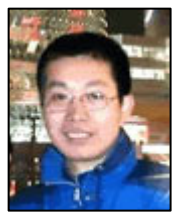
- Is science driven by prolific single experts or by high-impact co-authorship teams?

Contributions:

- New approach to allocate citational credit.
- Novel weighted graph representation.
- Visualization of the growth of weighted co-author network.
- Centrality measures to identify author impact.
- Global statistical analysis of paper production and citations in correlation with co-authorship team size over time.
- Local, author-centered entropy measure.





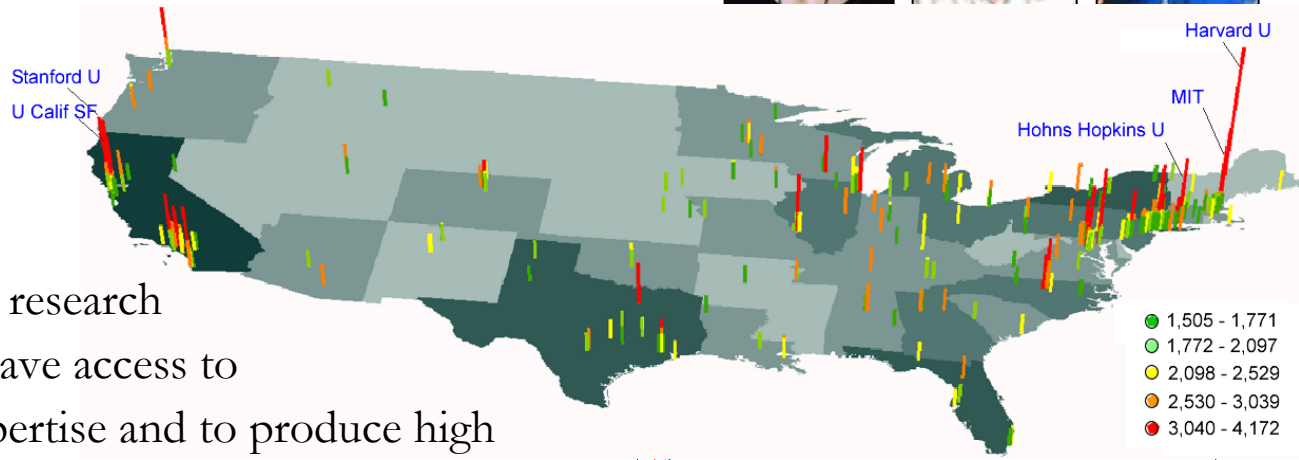


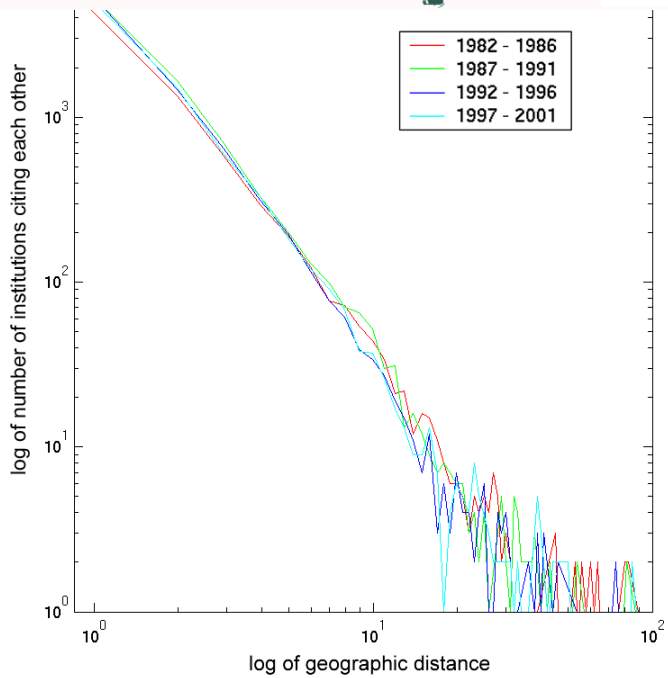

Spatio-Temporal Information Production and Consumption of Major U.S. Research Institutions

Börner, Katy, Penumarthy, Shashikant, Meiss, Mark and Ke, Weimao. (2006) Mapping the Diffusion of Scholarly Knowledge Among Major U.S. Research Institutions. Scientometrics. 68(3), pp. 415-426.

Research questions:

1. Does space still matter in the Internet age?
2. Does one still have to study and work at major research institutions in order to have access to high quality data and expertise and to produce high quality research?
3. Does the Internet lead to more global citation patterns, i.e., more citation links between papers produced at geographically distant research instructions?





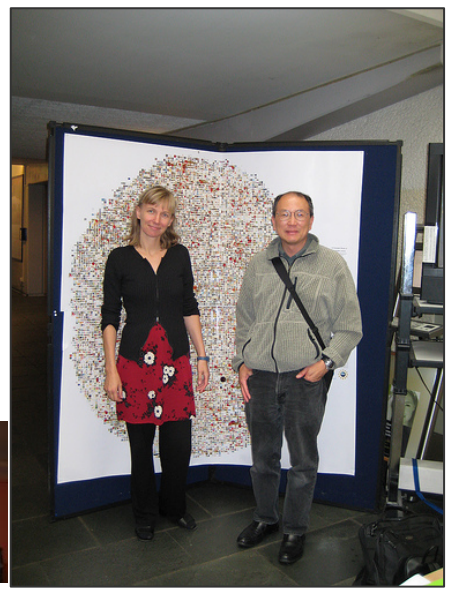
Contributions:

- Answer to Qs 1 + 2 is YES.
- Answer to Qs 3 is NO.
- Novel approach to analyzing the dual role of institutions as information producers and consumers and to study and visualize the diffusion of information among them.

Studying large scale social networks such as Wikipedia

Vizzards 2007 Entry

Second Sight: An Emergent Mosaic of Wikipedian Activity, The NewScientist, May 19, 2007



Second sight

Image: Bruce W. Herr and Todd M. Holloway

Power struggle

How do you keep track of the bubbling mass of information that is Wikipedia? This chaotic-looking mosaic is one attempt to show which topics are contained in the online encyclopedia, and those most hotly contested.

It's a mind-boggling task. About 4 million "Wikipedians" have made over 130 million edits, and the English-language version alone contains 1.7 million articles. Every second a new edit is made, and every day 2000 new articles spring up.

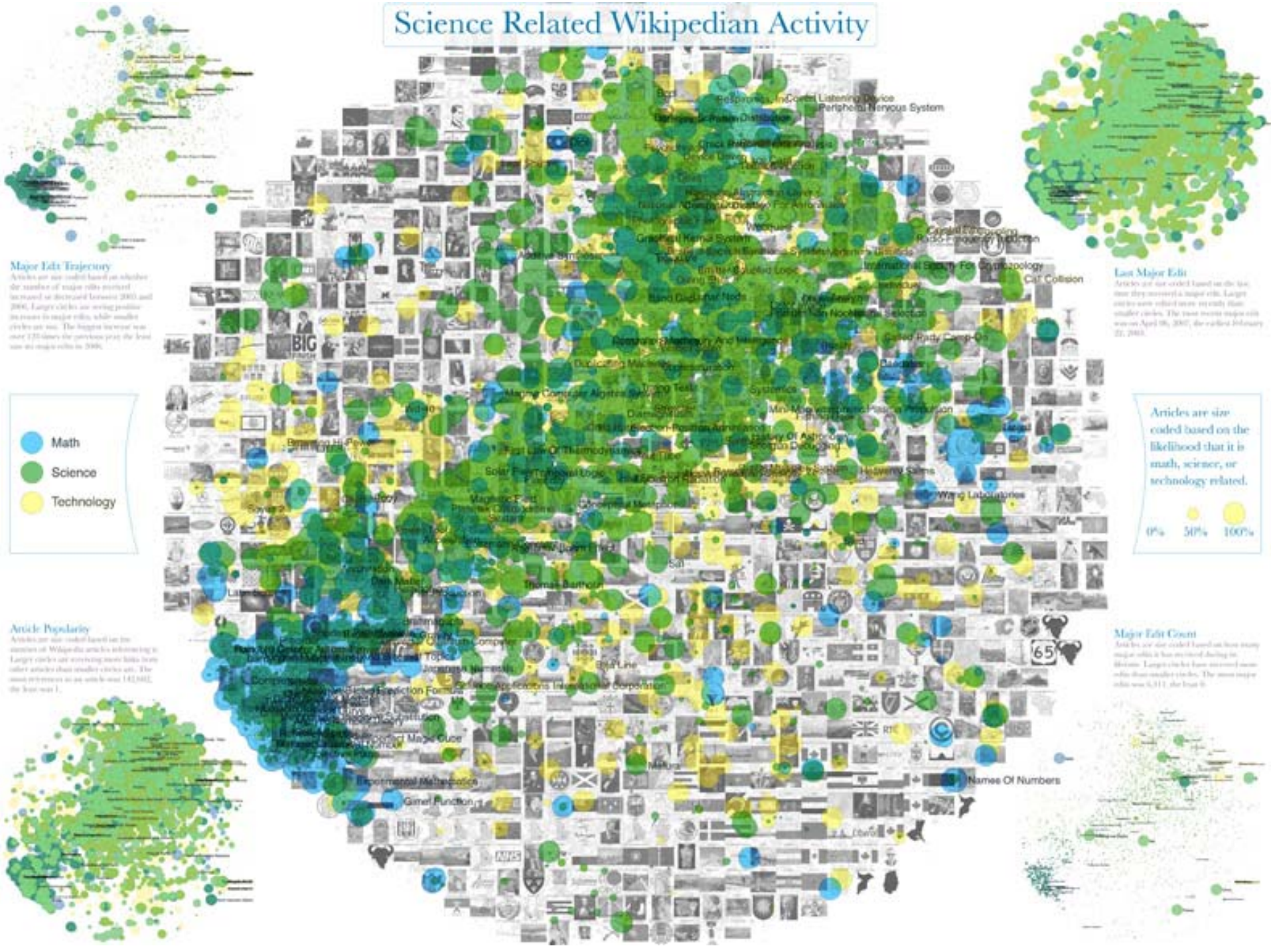
To make sense of it all, Bruce Herr and Todd Holloway of Indiana University, Bloomington, created clusters of 300 or so articles that touch on a related topic, such as a religion or a famous person. For each cluster they took one picture from the most popular article and laid them out in a circular grid.

Atop the grid are coloured dots showing how often and how recently each article has been edited. The larger, darker dots mean more intense activity. The list of blitzed articles reveals the idiosyncratic priorities of Wikipedians: Jesus, Adolf Hitler, Nintendo, Hurricane Katrina, Britney Spears and Albert Einstein.

Updating the image in real time would allow Wikipedia's administrators to spot where arguments are taking place, Herr suggests. If rival contributors are repeatedly changing each other's entries, for example, a page could be locked until the mood cools (locked pages at the time of writing include entries on Sheffield Wednesday football club, Mikhail Gorbachev and pigs).

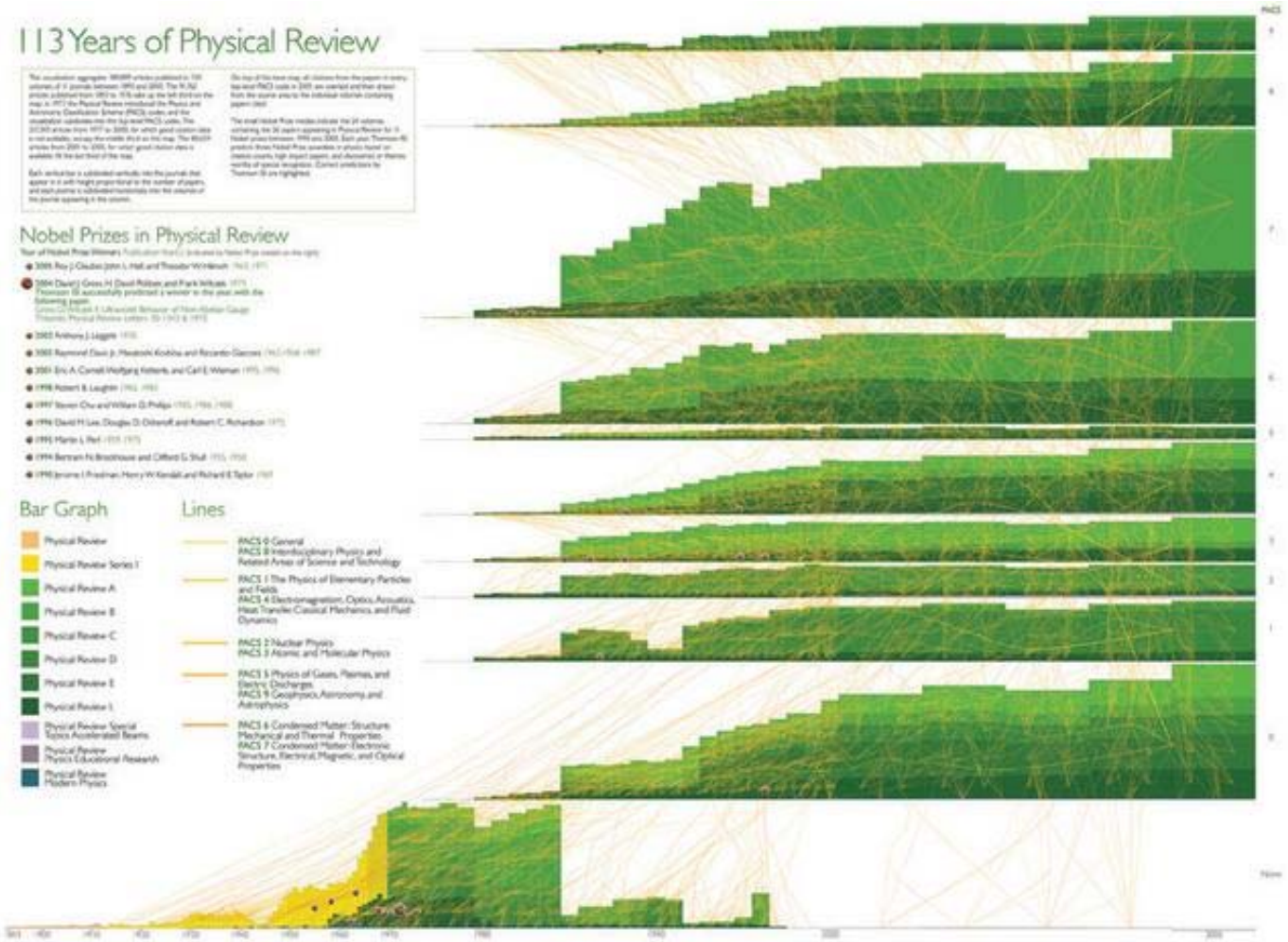
The mosaic has been commended in a competition for images that visualise network dynamics, coinciding with this week's International Workshop and Conference on Network Science in Bloomington.

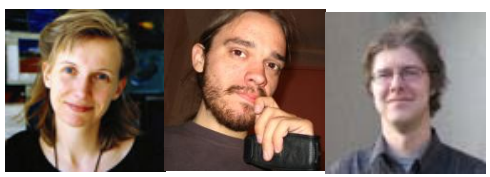
Science Related Wikipedian Activity



113 Years of Physical Review

Bruce W. Herr II and Russell Duhon (Data Mining & Visualization), Elisha F. Hardy (Graphic Design), Shashikant Penumarthy (Data Preparation) and Katy Börner (Concept)





Places & Spaces: Mapping Science

a science exhibit that introduces people to maps of sciences, their makers and users.

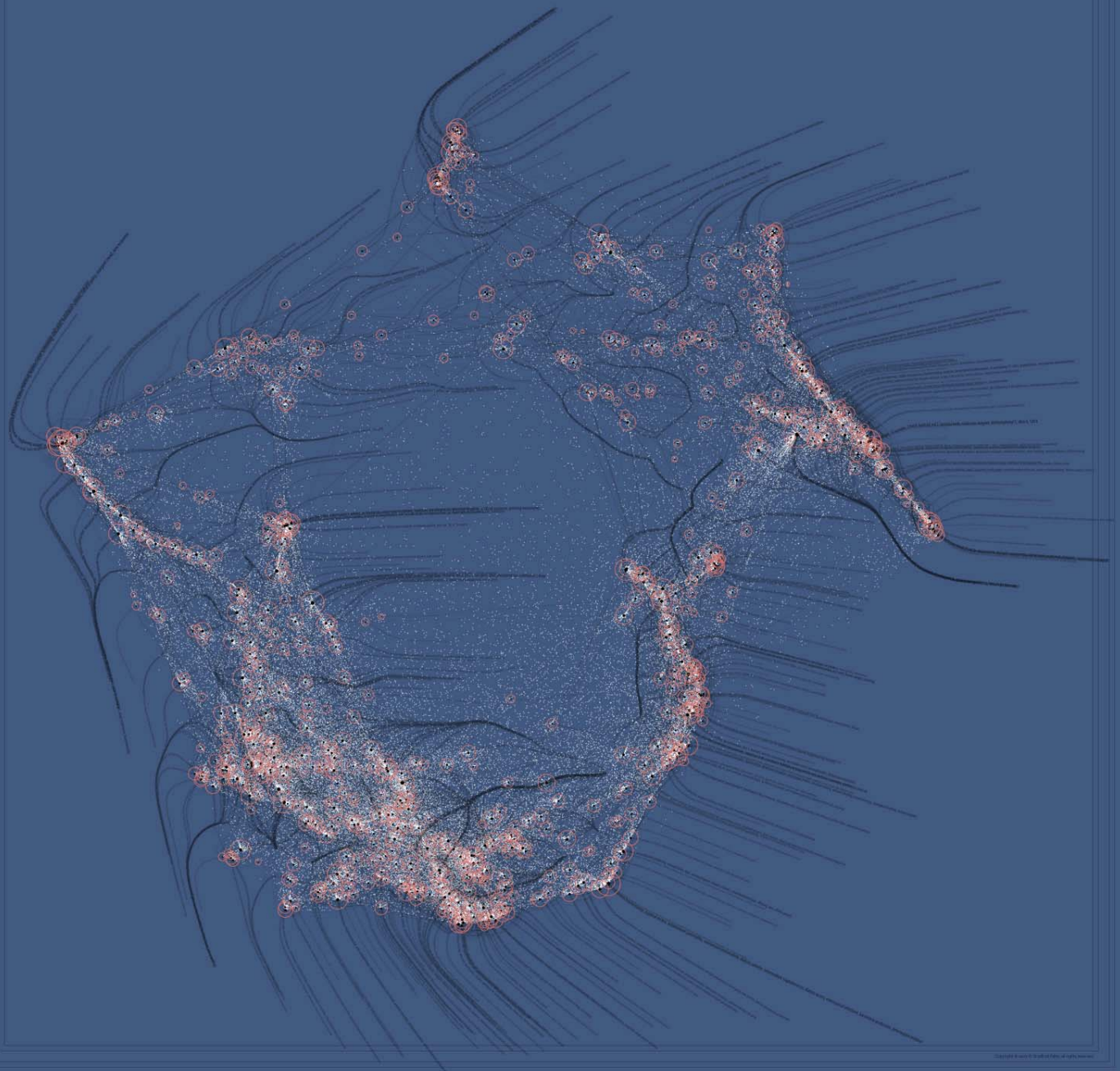
http://scimaps.org.

Exhibit Curators: Dr. Katy Börner & Elisha Hardy

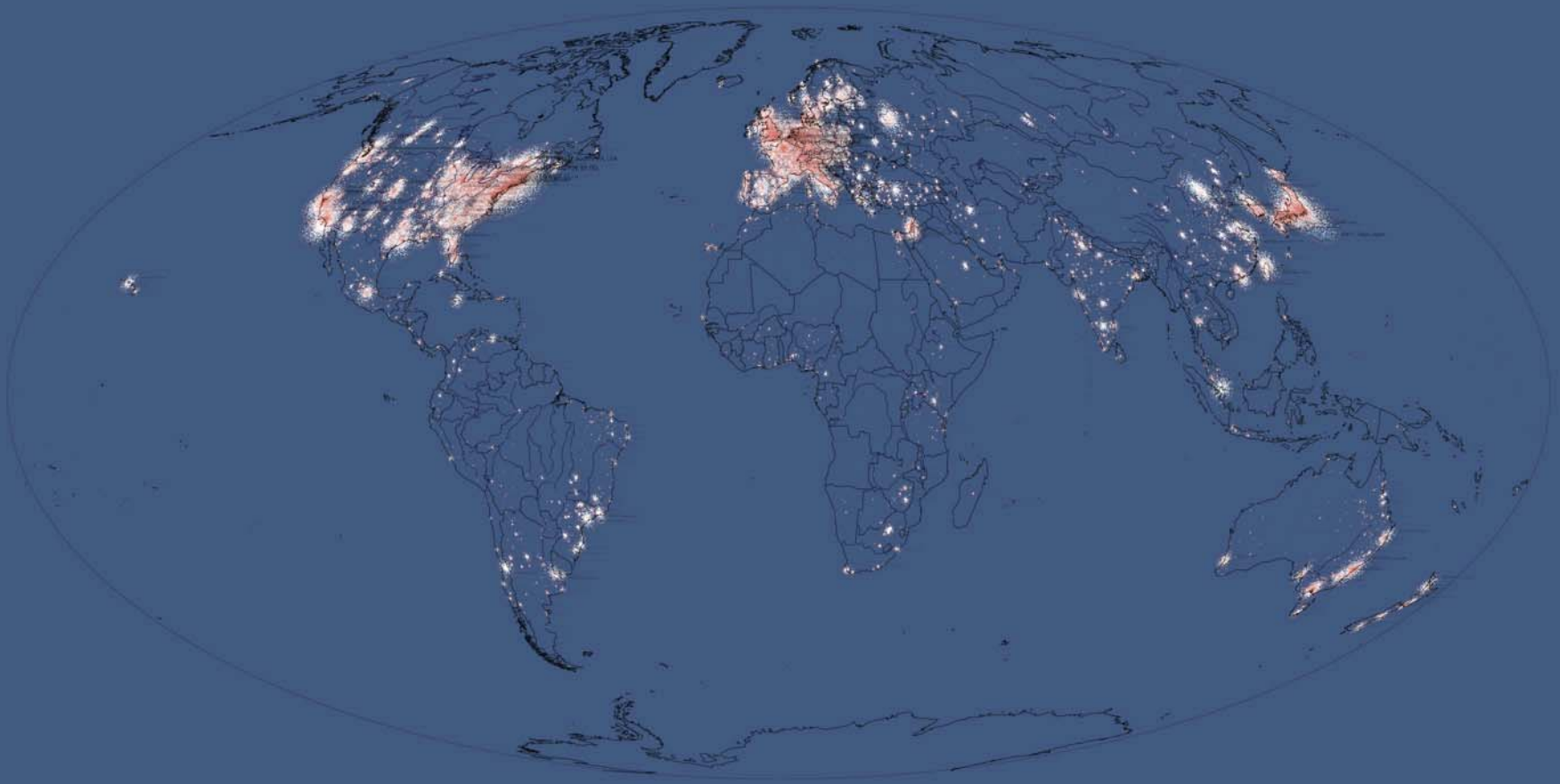
Illuminated Diagram Display

W. Bradford Paley, Kevin W. Boyack, Richard Kalvans, and Katy Börner (2007) Mapping, Illuminating, and Interacting with Science. SIGGRAPH 2007, San Diego, CA.

Topic Map: How Scientific Paradigms Relate

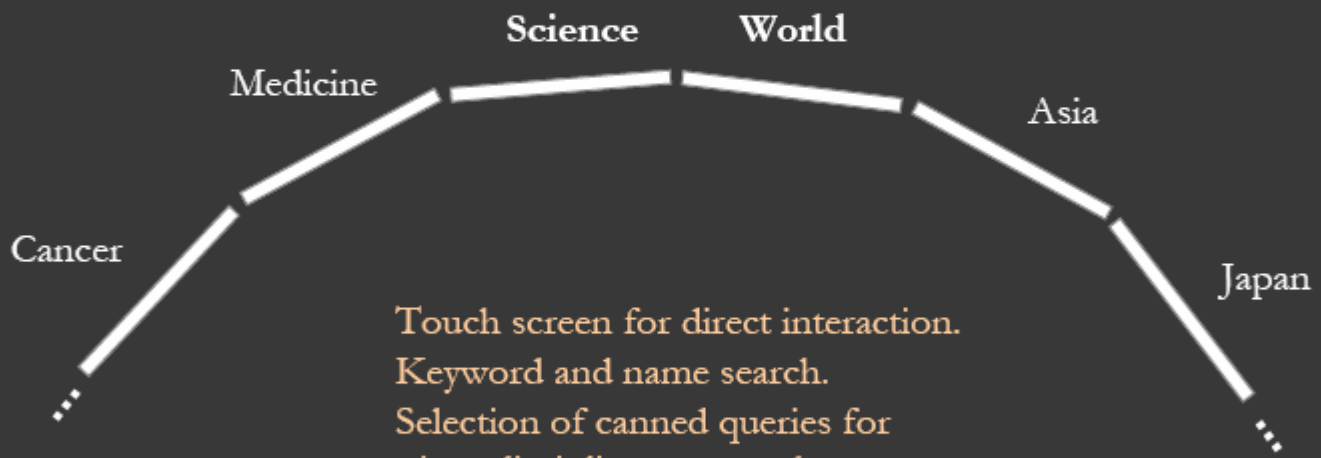


Geographic Map: Where Science Gets Done

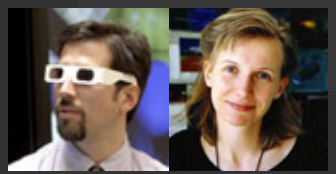


Re-implementation of Illuminated Diagram Software (in progress)
by Advanced Visualization Lab, Indiana University

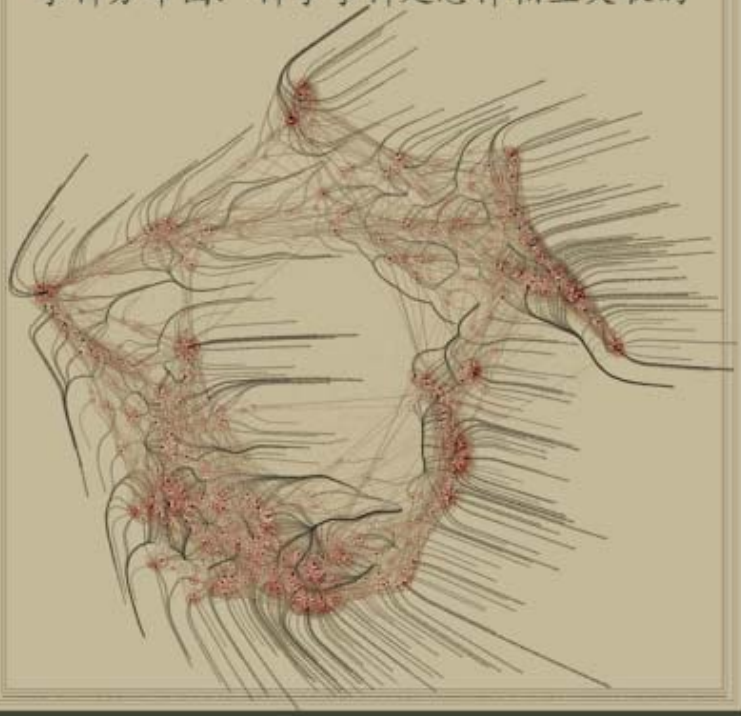
Drives unlimited number of ID screens.



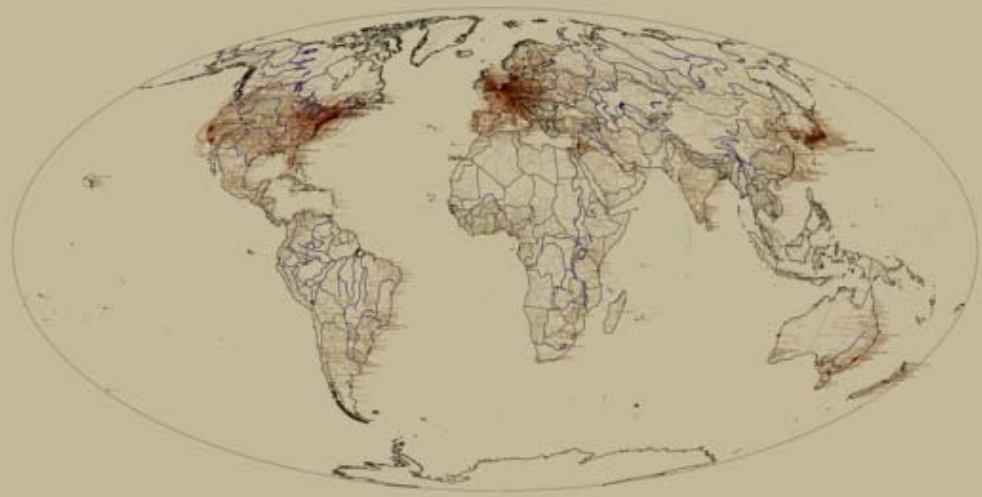
Touch screen for direct interaction.
Keyword and name search.
Selection of canned queries for
- interdisciplinary research areas
- famous people
- activity patterns, e.g., bursts, trends, etc.



学科分布图：科学学科是怎样相互关联的



世界地图：科学研究在哪里进行着



你可以通过触摸屏在地图上随意指点来改变所到之处的光亮强度。当你触摸世界地图的某一点时，在那个地理位置上的所有研究机构会被点亮。同时在这些研究机构工作的学者的论文所属的学科会在学科分布图上被点亮。而当你触摸学科分布图的某一点时，在那个位置上的科学学科会被点亮。同时从事这些学科研究的研究机构在世界地图上的分布会被点亮。

纳米技术

这里显示所有和纳米技术相关的科学学科。纳米技术和科学研究人类在无形的空间里改造世界的能力。这些空间存在于极其微小以至单个原子的结构中。目前大部分有关纳米的研究主要集中在物理、化学和材料科学领域。它们主要位于学科分布图上半部分的右面。不过，纳米技术在生物学和医药学研究里的应用也越来越多。生物学和医药学位于学科分布图下半部分的右面。

探索科学学科的相互关联性

所有科学学科 显示所有776种科学学科	**纳米技术** 有关微观粒子的科学
可持续性 一些与人类寄予长期希望相关的科学	**化学和生物** 化学和生物科学的交叉部分

光柱缓慢的扫过所有相互关联的科学学科，每一个学科以及从事这方面科学研究的研究机构在世界地图上的位置会被逐一点亮。首先，显示屏会点亮那些产出论文最多，最活跃的科学学科。然后那些小学科或冷门学科会被逐一点亮。

探索某个学者的科学著作的影响力的传播

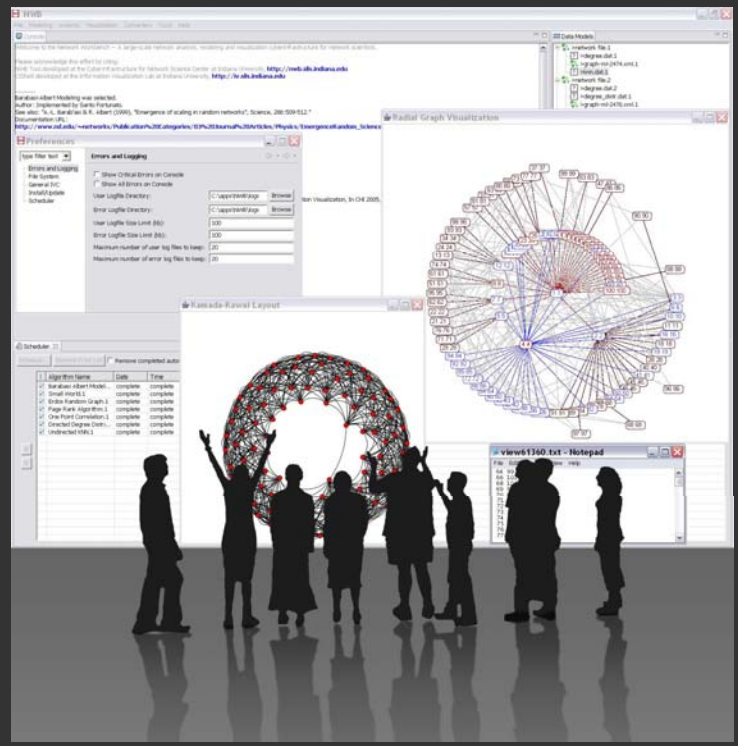
弗郎西.科里克 DNA双螺旋状的发现者之一	**阿尔伯特.爱因斯坦** 用相对论重新激活了物理学	**迈克尔.费舍尔** 发现了物质转变模式的关键步骤	**苏珊.费斯克** 研究人的认知是如何产生偏见的
约舒亚.雷德伯格 细菌遗传机制研究的先驱	**德里克.德索拉.普里斯** 著名的“科学计量学之父”	**理查德.扎尔** 采用激光化学技术研究分子动态分布	**关于本次展览** 与此展览相关人员和机构

显示屏通过四步来展示某个学者对科学的贡献以及影响力的传播。首先，显示屏点亮该学者所发表的论文所属的学科在学科分布图上的位置以及该学者从事这项研究时所在的研究机构在世界地图上的位置。到目前为止，所有这些论文的引用率仍然很高。第二步，显示屏点亮所有引用在第一步中被点亮的原始论文的论文在学科分布图上的位置以及它们在世界地图上的位置。第三步，显示屏点亮所有引用了在第二步中被点亮的论文的学科在学科分布图上的位置以及它们在世界地图上的位置。第四步，显示屏点亮所有引用了在第三步中被点亮的论文的学科在学科分布图上

Designing Scholarly Marketplaces

The Cyberinfrastructure for Network Science Center at IU serves

- **Scholarly Database of 18 million scholarly records, https://sdb.slis.indiana.edu**
- **Information Visualization Cyberinfrastructure, http://iv.slis.indiana.edu**
- **Network Workbench Tool and Community Wiki, http://nwb.slis.indiana.edu**



Börner, Katy, Sanyal, Soma & Vespignani, Alessandro. (2007). Network Science. In Cronin, Blaise (Eds.), Annual Review of Information Science & Technology (Vol. 41, pp. 537-607), chapter 12, Medford, NJ: Information Today, Inc./American Society for Information Science and Technology.

NWB Tool: Interface Elements

http://nwb.slis.indiana.edu

Load Data

Select Preferences

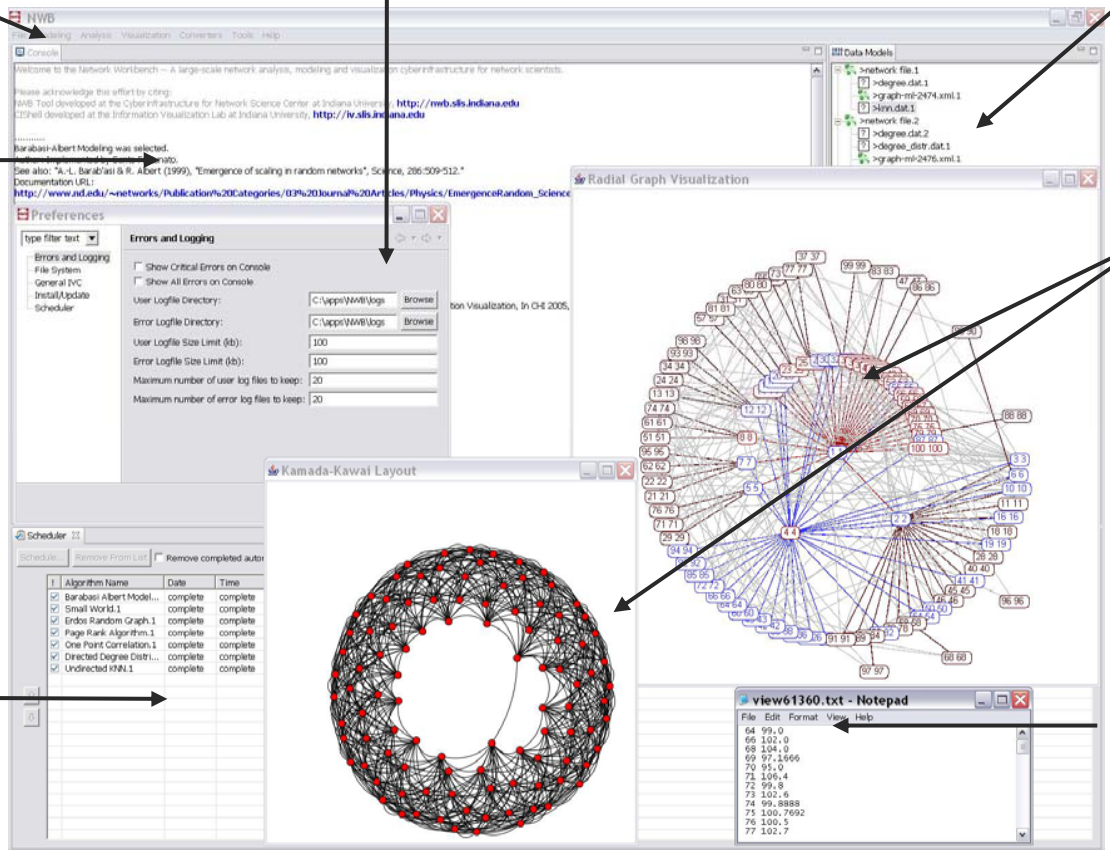
List of Data Models

Console

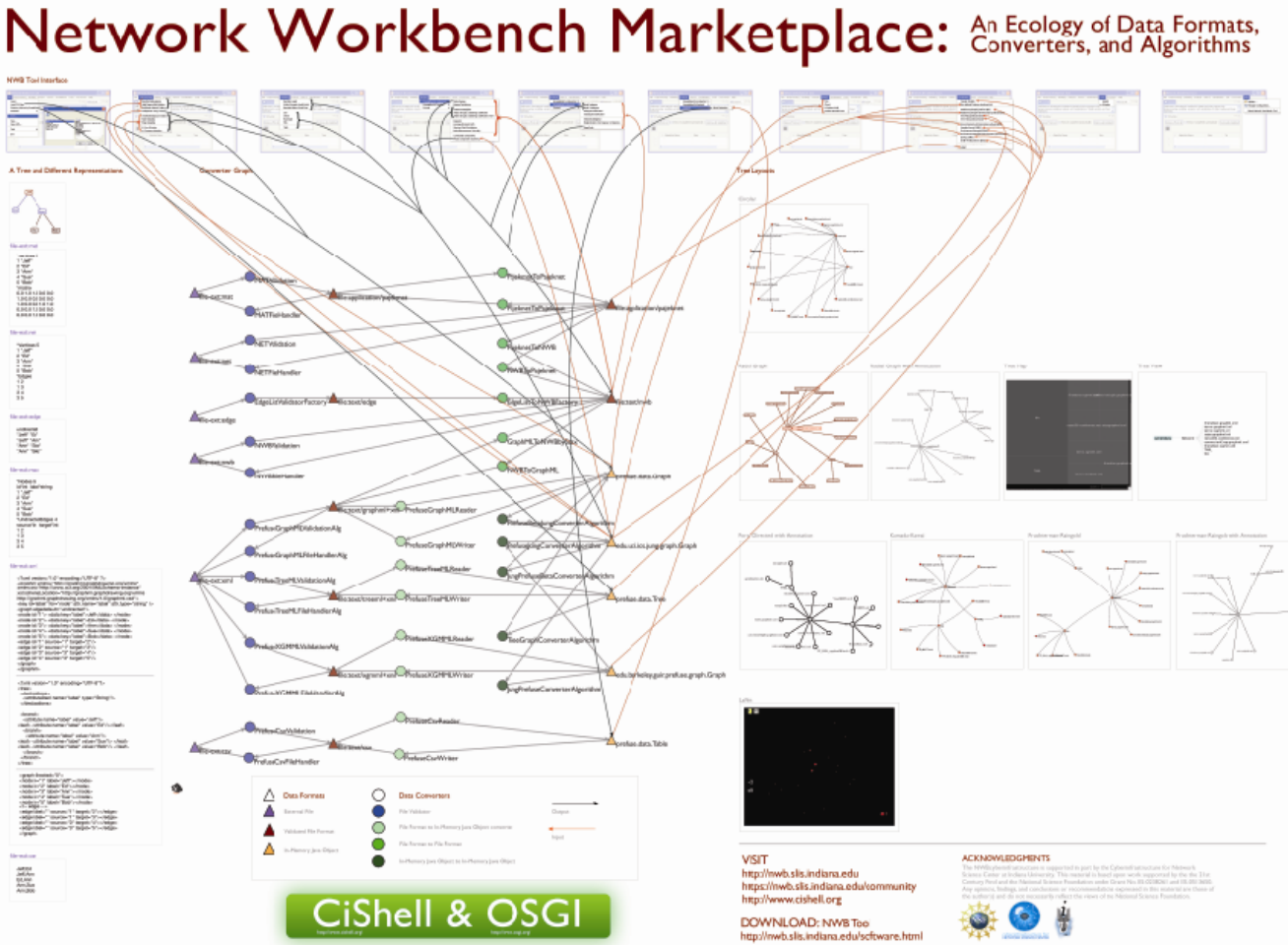
Visualize Data

Scheduler

Open Text Files



NWB Community Wiki



https://nwb.slis.indiana.edu/community/

Education – Learning Modules, NWB User and Developer Workshops

NetworkWorkbench

A Workbench for Network Scientists

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Main

People
NWB Tool
Update Sites
Custom Fillings

Datasets

Algorithms

Related Work
FAQ

Statistics

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reddit SUBMIT
DEL.ICIO.US
RSS

Custom Fillings

Many scientists use a very specific subset of algorithms and datasets in their work. Here, we link to custom fillings designed by different researchers. Descriptions of custom fillings frequently resemble learning modules providing an easy introduction into the working styles of different sciences.

Physics

Analysis of Large-Scale Networks by Soma Sanyal.

Biology

Analysis of Biological N

Scientometrics

Modeling the Co-Evolu
Sanyal & Katy Börner.
Map Your Bibtex File[2]
Semantic Analysis of S

Internet Research

Error and Attack Toler
Search Performance o

Others

Data Conversion Servi
Parallel Coordinate Visu
Bruce W. Herr II.

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Huang with students at the Complex System Summer School in Beijing, China