Atlas of Science

Note: Found images missing from http://scimaps.org/ on December 5, 2011

Spotfire
Spotfire
An Interface to a Digital Library of the Atlas of Science
The Challenge
The Places and Spaces Program
The Expert and His Advice
The Cloud Tools
The Inspiration
The Data Sources
Other Sources of Data
The Process
The Results
Comments
Acknowledgements
References
Footnotes

Places and Spaces: Mapping Science
Banner Topics
Browse Maps
Exhibitions
Exhibit Info
Maps
Additional Elements
1st Iteration (2005): The Power of Maps
3rd Iteration (2007): The Power of Forecasts
5th Iteration (2009) Science Maps for Science Policy Makers
Questions & Answers

What is a science map?
How does the Atlas relate to the Mapping Science exhibit?
Why is the Atlas of Science so inexpensive?
Why static maps and not interactive tools?
Why are some images hand drawn?
Why are citation links reversed in the maps?
How can I gain access to high-resolution images from the Atlas?
How can I find out if a particular author or work was cited?
How can I gain access to datasets shown in the Atlas?
I have data, how can I map it?
Do you plan any future books?

Vendors & Events

Press
References
Workshops

My Research Notes

Background
First Steps:
Excerpts from Skim Reading the Book:
Actions:
EndNote

Export to Fielded Text
EndNote X4 Read Me

Spotfire

Note: For full-screen display use the Web Player Get Spotfire for iPad App Exhibit Entry. Winners

Media, iframe, embed and object tags are not supported inside of a PDF.
An Interface to a Digital Library of the Atlas of Science

The Challenge

Mills Davis, December 16, 2010: Have you heard about Katy Börner’s Atlas of Science? I just picked up a copy from Amazon for $19 -- the 2010 book is a 13x11, 254 pages, full-color, hardback from MIT Press. It's an awesome resource about the visualization of knowledge. I think you would enjoy. Also, a friend of mine says that there is a trove of the artwork that can be accessed digitally

Here is a review...

Review: Atlas of Science, Visualizing What We Know (Excerpt)
November 3, 2010 to Reviews, Visualization

Taking a closer look though, I realized that it's actually much more specific than just a visualization catalog. It really is about "visualizing what we know." As in: cataloging scientific knowledge. Think of all the books, resources, and academic papers you might find in a library and on the Web, and then think of interfaces and visualizations to access all of that in a meaningful way. That's what Atlas of Science is about, from the point of view of an information scientist.

(Mills Davis) The reviewer here points out what I was getting at….Borner could be of significant help in jumpstarting the development/blueprinting of a comprehensive information/data management system for large-scale knowledge cartography, analytics, , etc.

(Brand Niemann) The Atlas of Science is a very popular book (Amazon was sold out and so were several local bookstores - I got one of only two copies left at Barnes and Noble). The accompanying Web Site (Places and Spaces) contains portions of the book, promises to provide the databases behind the maps, and encourages submissions to 7th Iteration (2011): Science Maps as Visual Interfaces to Digital Libraries that are due January 30, 2011. The author decided to conceptualize, design, and implement a new interface to this digital library (the Book, Web Site, and exhibits) using new state-of-the-art cloud computing tools (MindTouch and Spotfire). I believe these new tools help one meet the definition of a science map: a visual rendering of a much higher dimensional, abstract topic space, calculated from data using advanced analysis and visualization algorithms that support navigation, resource management, and utilization and provide a clearer understanding of the entire landscape. The Atlas of Science contains the following quote by Lawrence M. Sanger: The ideal information resource would feature high quality of content (i.e., be accurate and complete) as well as high accessibility (i.e., excel in availability, ease of use, and interactivity). I believe this application demonstrates both high quality of content and high accessibility.
The Places and Spaces Program

Places & Spaces: Mapping Science is meant to inspire cross-disciplinary discussion on how to best track and communicate human activity and scientific progress on a global scale. It has two components: the physical part supports the close inspection of high quality reproductions of maps for display at conferences and education centers; the online counterpart provides links to a selected series of maps and their makers along with detailed explanations of how these maps work. The exhibit is a 10-year effort. Each year, 10 new maps are added resulting in 100 maps total in 2014. Source: http://scimaps.org/.

The Expert and His Advice

Edward Tufte Presidential appointment announced by White House, March 5, 2010.
NYTimes, Business Week, Newsweek, Washington Post 1, Washington Post 2, NPR interview

Tufte Comment on iPhone interface design: Better to have users looking over material adjacent in space within our eyespan rather than stacked in time. This is especially the case for statistical data, where the fundamental analytical task is to make comparisons. Also see page 159 in the book reference below.

The Cloud Tools

Mindtouch (this Wiki) and Spotfire

The Inspiration

H1N1 Spread Courtesy of TIBCO Spotfire. See Web Player. You can do Tufte’s Beautiful Evidence (2006) "sparklines" (writing with data graphics) with Tibco Spotfire Bookmarks!

The Data Sources

The book, web site and exhibit information was mined for data tables that could be easily produced in Excel for import to Spotfire. The Excel data tables could be exported to Comma Separated Values (CSV) (a widely used open format) so Excel is not required but Spotfire already does that by providing an Export function for each data table visualization pane. This is one of the reasons why this application provides high accessibility as stated in the Challenge section above.

Other Sources of Data

Initially, only the Places and Spaces and Atlas of Science were mined for data tables, but those data tables contain links to the Project Pages for the individual maps and links to data sources which will be used in the next stage of this application. In fact, several databases are being used in this initial application to demonstrate the statistical and visualizations capabilities of Spotfire.
The Process

The structure of the Places and Spaces (Web Site) and Atlas of Science (Web Site and Book) were analyzed and notes were made of ideas that came to mind. From this came a concrete and realistic plan of action that could meet both the schedule for a poster presentation at the Federation of Earth Science Partners Annual Winter Meeting on January 4, 2011, and the January 30, 2011, deadline.

The submission requirements are that the maps communicate the following:

- quality and coverage of datasets,
- the structure (ontology, taxonomy, classification hierarchy) of a dataset,
- (semantic) linkages between datasets,
- the evolution of a dataset, or
- access and usage patterns of datasets.

that are intended to support the navigation, management, and utilization of mankind’s scholarly knowledge and to make it more readily available to researchers, educators, industry, policy makers and/or the general public. Maps should show a visual rendering of a dataset together with a legend, textual description, and acknowledgements as required to interpret the map. Science map dimensions can be abstract, geographical, or feature-based, but are typically richer than simple x, y plots. Scientific knowledge can be used to generate a reference system over which other data are overlaid or be projected onto another reference system, e.g., a map of the world, but must be prominently featured.

So this application starts with the considerable advantage of high quality of content that needs to be structured into data tables that can be linked to one another (now called Getting to the 'five stars' of Linked Open data) and whose metadata (data about data) and usage (now called Provenance in Data Science) can be tracked. I created a taxonomy of the Places and Spaces (Web Site) and Atlas of Science (Web Site and Book) using this MindTouch Wiki (now called the Technical Documentation Suite) - see Table of Contents at the top of this page that starts with the Web Site Banner Topics and then the Web Site Left Side Bar Topics which include the Sub-Topics for the Atlas of Science.

I implemented a metadata format in the Excel spreadsheet that could be directly imported into Spotfire and provide the interface to the Digital Library as well as prioritize and track my work to produce the data tables.

The Results

The Phase I work lays the ground work for the Phase II work, namely to use some of the actual databases behind the maps by themselves and with linking possibilities to other map databases.

Comments

I really appreciate Mills Davis calling this to my attention!
Acknowledgements

The author acknowledges gratefully Dean Allemang, Cory Casanave, Sean Connors, Mills Davis, Li Ding, David Eng, Lee Feigenbaum, Peter Fox, Aaron Fulkerson, Jim Hendler, Ralph Hodgson, Kevin Kirby, Kevin Jackson, Bob Marcus, John McMahon, Richard Murphy, Brand Niemann, Jr., Barry Nussbaum, Matthew Phoenix, Tony Shaw, Jeff Stein, George Strawn, George Thomas, Pete Tseronis, and Edward Tufte.

References


Footnotes

IN PROCESS

Places and Spaces: Mapping Science

Source: http://scimaps.org/

Places & Spaces: Mapping Science is meant to inspire cross-disciplinary discussion on how to best track and communicate human activity and scientific progress on a global scale. It has two components: the physical part supports the close inspection of high quality reproductions of maps for display at conferences and education centers; the online counterpart provides links to a selected series of maps and their makers along with detailed explanations of how these maps work. The exhibit is a 10-year effort. Each year, 10 new maps are added resulting in 100 maps total in 2014.

- Browse all maps with options to filter by year, author, and more.
- Listing of all current & past venues.
- See what the exhibit entails, plus how to host it at your venue.

Acknowledgements

This exhibit was supported in part by the School of Library and Information Science and the Cyberinfrastructure for Network Science center at Indiana University. This material is based upon work supported by the National Science Foundation under Grant No. IIS-0238261, CHE-0524661, IIS-0534909 and IIS-0715303, the James S. McDonnell Foundation; Thomson Scientific/ Reuters; the Cyberinfrastructure for Network Science Center, University Information Technology Services, and the School of Library and Information Science, all three at Indiana University. Some of the data used to generate the science maps is from Thomson Scientific/Reuters.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
Maps

The exhibit is a 10-year effort. Each year, 10 new maps are added resulting in 100 maps total in 2014.

1st Iteration (2005): The Power of Maps
3rd Iteration (2007): The Power of Forecasts
6th Iteration (2010): Science Maps for Scholars
7th Iteration (2011): Science Maps as Visual Interfaces to Digital Libraries
8th Iteration (2012): Science Maps for Kids
9th Iteration (2013): Science Maps for Daily Science Forecasts
10th Iteration (2014): Telling Lies with Science Maps

Additional Elements

- Illuminated Diagrams
- WorldProcessor Globes
- Hands-on Science Maps for Kids
1st Iteration (2005): The Power of Maps

This iteration aims to show the power of maps to help us understand, navigate, and manage both physical places and abstract knowledge spaces. The first maps of our planet were not perfectly correct. Yet they were invaluable for navigation, exploration, and communication. Maps of science generated today cannot be comprehensive as they are generated based on only a small portion of mankind's knowledge. The generation of a comprehensive map requires the proper interlinkage of multilingual, multidisciplinary, multi-media scholarly knowledge. Note that each of the six early maps of science displayed here use a different metaphor. We are interested in inspiring discussion about which metaphors will be most effective in designing a visual index of mankind's knowledge.

Click on any map below for more information.


This iteration aims to inspire discussion about a common reference system for all of mankind's scientific knowledge. Scientists in many disciplines battled to agree on standardized reference systems such as the electromagnetic spectrum, the periodic table of elements, geographic mappings, and the celestial reference systems shown here. These standardized systems are invaluable for indexing, storing, accessing, and managing scientific data efficiently. Note that each of the six potential reference systems-- from the one-dimensional time-based system to the geospatial system to the semantic system--could potentially be used to identify the "location" of an author, paper, patent, or grant, or to show the dynamics of an author's trajectory or contribution, as well as the impact of a particular work.

Click on any map below for more information.
3rd Iteration (2007): The Power of Forecasts

The third iteration compares and contrasts seismic hazard, economic, resource depletion, and epidemic forecast maps with maps forecasting the structure and evolution of science. Real time weather forecasts are served by the national Oceanic & Atmospheric Administration (NOAA) or the National Aeronautics and Space Administration (NASA). Computational models of the movements of tectonic plates help reduce losses due to earthquakes, volcanic activity, or tsunamis. Economic models let us simulate catastrophic and sustainable futures for mankind. Epidemic models make us understand how interconnected we all are and how actions far away affect us right here. Daily science and technology forecasts would show science maps with overlays of top experts/institutions/countries, major activity bursts, or emerging research frontiers augmenting our knowledge and decision making. Why are they not available on TV, in press and online?

*Click on any map below for more information.*


This is the first of six iterations that explore the utility of science maps for different stakeholders. The maps presented here target the needs of economic decision makers. They answer questions such as:

- What is the impact of war on global trade flows?
How do accelerating communication and transportation speeds impact our lives?

What events and time lags occur from basic research to product sale?

What are the (social) networks behind illicit deals and laundered money?

What intellectual property space is claimed by whom and what growth is expected?

What is the ecological footprint of a country and how sustainable is it?

How does the ‘Product Space’ determine the economic development of nations?

How to visually empower strategy formation and value creation in organizations?

How are publications linked to patents in different areas of science?

What factors impact the happiness of citizens and which countries do well?

Click on any map below for more information.

Fifth Iteration (2009) Science Maps for Science Policy Makers

The fifth iteration shows science maps for science policy makers as well as citizens interested in understanding national priorities, spending, and achievements. Featured are two early maps, two maps of observation and sensor data, and six maps of scholarly data. The maps communicate:

- The steady increase of scientists in the total population, versus a decline of R&D investment as a fraction of GNP.
- Categories for evaluating and comparing evolving scientific collaboration.
- Needed changes in the Boston Traffic Separation Scheme to reduce the risk of ships striking whales.
- Urban mobility patterns to improve the design and management of cities.
- The U.S. federal discretionary budget.
- Return on investment for U.S. chemistry R&D including a timeline and investment cycles.
- Funding portfolios of the National Institutes of Health.
- The structure of science based on download (rather than publication) activity
- Research leadership of the U.S. compared with the top 12 competitive nations.
- Progress towards the Millennium Development

Click on any map below for more information.
Sixth Iteration (2010) Science Maps for Scholars

This is the third of six iterations that explore the utility of science maps for different stakeholders. The maps presented here target the needs of scholars. They answer questions such as:

- Who are our ancestors and how are we related to other species? How do accelerating communication and transportation speeds impact our lives?
- How do human brain regions interlink and impact our thoughts and behaviors?
- What drugs target what diseases and how do disease phenotypes interact?
- How do children learn language in complex social environments and how can language disorders be treated?
- What communities and interdisciplinary connections exist across the field of media art?
- How are scholars linked to texts, people, projects, events, their relationships, as well as personal comments?
- Which literary writers used what temporal and spatial Settings in Victorian Poetry?
- How do multiple scientific specialties merge to form a new area of science?
- How do scientists weave the fabric of science via collaborations and citations?
- Where are the academic jobs?

The 2011 iteration of the exhibit will add maps that serve as visual interfaces to digital libraries.
WorldProcessor Globes

Foreign US Patent Holders [WorldProcessor #294]
This globe represents half of all patents in the US - those registered to foreign holders. Countries with more than 1000 patents registered in the US are indicated by name, with the point size of the representative text scaled according to the square root of the total number of US patents held. Were the number of domestically held US patents to be indicated according to this logic, the entire surface of the globe would be covered. Special thanks to John Burgoon, Monika Zhu, and Stephen Oh © 2006 Ingo Gunther

Patterns of Patents & Zones of Invention [WorldProcessor #286]
This globe plots the total amount of patents granted worldwide, beginning in 1883 with just under 50,000, hitting 650,000 in 1993 (near the North Pole), and (shifting the scale to the southern hemisphere) continuing to 2002 on a rapid climb towards 1 million. Geographic regions where countries offer environments conducive to fostering innovation are represented by topology. Additionally, nations where residents are granted an average of 500 or more US patents per year are called out in red by their respective averages in the years after 2000. © 2005 Ingo Gunther

Shape of Science
This rendering is of a prospective tangible sculpture of the Shape of Science, based on the research of Richard Klavans and Kevin Boyack, spatializing the quantified connectivities and relative flows of inquiry within the world of science. © 2006 Ingo Gunther w/ Stephen Oh

Illuminated Diagram Display

The Illuminated Diagram maps and installations were created by Kevin W. Boyack (scientometrics and data shaping), John Burgoon (geographic mapmaking), Peter Kennard (system design and programming), Richard Klavans
The Illuminated Diagram displays come in two different versions (see below).

**LCD Version (shown above)**
Uses 2 LCDs with printed maps stuck onto screens.
- [Low resolution clip](19.6 MB)
- [High resolution clip](147.62 MB)
- [10 second low resolution clip](617 KB)

**Projection Version**
Uses 2 projectors with printed maps mounted on the wall. The video clips below feature a demo with W. Bradford Paley at the New York Public Library exhibit (April 3 - August 30, 2006).
- [Video](2.29 MB)
- [YouTube](

**Topic Map**
The word "science" covers a huge diversity of topics: from mathematics and astronomy to medicine, even to certain approaches to the humanities. This map begins to show how distinct areas of study are defined and how they are related.

Seven hundred seventy-six nodes are distributed around a generally ring-like structure. They represent scientific topics, more properly called paradigms, and are essentially groups of recently published papers. Each node represents tens or thousands of papers; this map was created by scrutinizing more than 1.3 million of them.

The writers of scientific papers are careful to reveal all the work they build on, so we can think of each paper's author as a micro-librarian: gathering all the other papers relevant to his or her topic. In this map we put two papers in the same node if four authors gathered them into a later paper. Nodes are labeled with the unique terms that occur most often in
the papers, provided those terms can be understood in a wider context. Thus you can read the actual language used by the scientists exploring each topic.

The curving links between nodes show how topics are related: the more strongly two topics are related, the darker that link is drawn. Links curve to make them easier to follow with the eye. We show 4,370 links here, leaving thousands of fainter ones undrawn.

The circular structure is no accident, nor is it arbitrarily imposed on the data; it comes from the structure of science itself. If you imagine that every link is a rubber band (stronger when it's darker), and every node has a small force field around it, pushing away nearby nodes, this dynamic balance of forces automatically creates the layout. Thus we can see that Physics (at approximately 1:00) relates through Astrophysics to Astronomy (around 12:30), but it also relates to Chemistry (more toward 2:00). And the jutting peninsula of Organic Chemistry at 3:00 has unexpectedly few connections to the thicket of Medicine, spread from 5:30 to 7:00. Instead, it connects to Medicine through Analytical Chemistry: the tool base of applied chemistry actually used in medicine, which studies techniques like Spectroscopy and Proteomics (the large node at the base of the peninsula).

**Geographic Map**

Here we have arranged the same papers on a more familiar map. Each tiny glyph on the map represents not cities, but a number of papers that have an author in that location. In the field of Information Visualization there is an expectation that if you show the same data in two different views you can get a better feel for it, much as an architect will look at both floor plan and elevations to understand a building. But how can we tell where in the world papers in one topic node were published? Or what topics are studied in a specific geographic location? We simply paint them to look the same in both views. The InfoVis technique called "brushing and linking" lets you do exactly that. Paint a location (by brushing your finger over an area on the lectern’s touchscreen) and it will glow on the geographic map. Since the views are linked by the computer, it can paint topics studied in that area on the topic map: the brighter a topic glows, the more papers on that topic originated in your brushed area. Conversely, touching a topic node will tell you where in the world that topic is studied. We use a display technique called "Illuminated Diagrams" to add the flexibility of an interactive program to the incredibly high data density of a print.

This technique is generally useful when there is too much pertinent data to be displayed on a screen but the data is relatively stable. The computer can direct the eye to what’s important by using projectors as smart spotlights, animating stories in the static data (such as the spread of an idea's influence), giving a radar-like "grand tour" of science, or highlighting query results (as when you touch the lectern) with an overlay of moving light.
The Hands-on Science Maps for Kids were created by Fileve Palmer (painting), Julie Smith (data acquisition), Elisha Hardy and Katy Börner (graphic design).

We would like to thank Stephen Miles Uzzo (Director of Technology) and Michael Lane (Director of Exhibit Services) at the New York Hall of Science for manufacturing the physical maps.

These maps invite children to see, explore, and understand science from above. One map shows our world and the places where science gets done. The other shows major areas of science and their complex interrelationships. Both maps also appear in the Illuminated Diagram display, see above. Drawings by Fileve Palmer were added to make different continents as well as different areas of science more tangible. Children, and adults alike, are invited to help solve the "puzzle" by sliding major scientists, inventors, and inventions into their proper places. Start by selecting either of the two maps. Decide if you want to place famous people or major inventions first. Turn the map over when you are done and start again. Look for the many hints hidden in the drawings to find the perfect place for each puzzle piece. At the exhibit, pick-up one of the handouts and make your very own map of science. What science experiments

Download the Learning Objective for the exhibit.
Download the Clue Sheet for the Hands-on Science Maps for Kids.
View more information about the Hands-on Science Maps for Kids.
This DVD contains a guided tour of the Places & Spaces: Mapping Science exhibit when it was featured at the New York Public Library. It also contains images of all of the exhibit maps, additional elements featured as part of the exhibit, and information about each of the map makers.

More information about the exhibit video »

Store

Source: http://scimaps.org/flat/store/

Purchase Maps

Any exhibit map can be purchased. Each map is 24x30", with different printing options:

Matte OR Glossy Inkjet - $35 per map
Glossy Premium Archival Ink - $75 per map
plus shipping.

You may also purchase a poster version of each iteration at a cost of $40 per set, or $150 for the entire set of 5 iterations. (plus shipping)

We're still working on the new ordering system for the Places & Spaces map store. In the meantime, if you would like to purchase anything, contact Beth Works (bworks@indiana.edu).

Advisory Board

Source: http://scimaps.org/flat/advisory_board/
Current Members

Katy Börner

Katy Börner <katy@indiana.edu> is the Victor H. Yngve Professor of Information Science at the School of Library and Information Science, Adjunct Professor in the School of Informatics, Core Faculty of Cognitive Science, Research Affiliate of the Biocomplexity Institute, Fellow of the Center for Research on Learning and Technology, Member of the Advanced Visualization Laboratory, and Founding Director of the Cyberinfrastructure for Network Science Center at Indiana University. Her research focuses on the development of visualization methodologies (knowledge domains, users of 3D virtual worlds, interfaces to digital libraries), networks and diffusion of knowledge, and the development of infrastructures for large scale scientific collaboration and computation. She and her colleagues at the Cyberinfrastructure for Network Science Center serve the Scholarly Database of 25 million scholarly records, Information Visualization Cyberinfrastructure, and the Network Workbench Tool and Community Wiki.

Deborah MacPherson

Deborah MacPherson <dewmacp@gmail.com> is projects director for the 501(c)(3) nonprofit organization Accuracy & Aesthetics based in Vienna VA. She has over 15 years experience designing exhibitions to tell stories about history, science, and society <www.deborahmacpherson.com>. Accuracy & Aesthetics was established in 2004 with the mission of making sense of the digital age for purposes of international research and teaching <www.accuracyandaesthetics.com>. Deborah is an advocate for the creation of simple overviews for the general public and experts venturing outside their discipline. She is interested in looking at and discussing a wide variety of approaches for fitting together humanity's collective knowledge and expertise in logical and beautiful maps. Places & Spaces is particularly interesting because it is an interdisciplinary scientific effort with the aim of making science more understandable and intriguing to the masses. Her hope is that some time in the future, techniques for networking and mapping science may also be used to connect arts, music, and humanities databases in a similarly rigorous and appealing manner.

Kevin Boyack

Kevin Boyack <kboyack@sandia.gov> is President of SciTech Strategies, Inc., and has been with the company since summer of 2007. Previously he spent 17 years at Sandia National Laboratories where he worked in various areas including combustion (experimental and modeling), transport processes, socio-economic war gaming, and science mapping. Since joining SciTech his work has centered on developing more accurate global maps of science. In addition, he has created algorithms to generate institution and country competency maps based on the SciTech global mapping techniques, and has done large scale comparisons of similarity approaches.

Sara Fabrikant

Sara Irina Fabrikant <sara@geo.uzh.ch> a Swiss mapematician, is currently an Associate Professor of Geography and head of the Geographic Information Visualization and Analysis (GIVA) group at the GIScience Center <http://www.geo.uzh.ch/gia/aboutus/> at the Geography Department of the University of Zurich, Switzerland. Her research and teaching interests lie in geographic information visualization (geovis), GIScience and cognition, graphical user interface design and dynamic cartography. She received an M.S. in geography from the University of Zurich and a Ph.D. in geography from the University of Colorado at Boulder. She was awarded a Rotary International Ambassadorial Scholarship to study Geographic Information Science for one academic year at the University of Canterbury, Christchurch, New Zealand, in 1993. She publishes in a variety of GIScience/geovis related journals and is currently a member of the Editorial Boards of Cartographic Perspectives, Cartographica, Revue Internationale de Géomatique, and...
Transactions in GIS, in addition to her Program Committee memberships for various GIScience/geovis related conferences (e.g., GIScience, COSIT, InfoVis (UK), Diagrams, etc.). She has made various presentations (in English and in German) at national and international professional meetings, including invited keynotes and other lectures at universities in North America, Europe, Asia, and New Zealand. Other service include an elected post on the council of the Association of Geodetic Information Laboratories in Europe, and memberships of the Association of American Geographers, the International Cartographic Association's Commission on Visualization and Virtual Environments, the North American Cartographic Information Society, and the Swiss Society of Cartography.

Peter A. Hook

Peter A. Hook <pahook@indiana.edu> is currently a doctoral student at Indiana University--Bloomington where he is a member of Dr. Katy Börner's Information Visualization Laboratory. He has a J.D. from the University of Kansas (1997) and a M.S.L.I.S. from The University of Illinois (2000). Prior to doctoral study, he was a law librarian for four years. His primary research focus is information visualization. Particular interests include the visualization of knowledge organization systems, concept mapping, and the spatial navigation of bibliographic data in which the underlying structural organization of the domain is conveyed to the user. Additional interests include social network theory, knowledge organization systems, and legal bibliometrics and informatics.

Andre Skupin

Andre Skupin <skupin@mail.sdsu.edu> is an associate professor of Geography at San Diego State University. Prior to this he held an associate professor position at the University of New Orleans. He received a Master's degree in Cartography at the Technical University Dresden, Germany, and a doctoral degree in Geography at the State University of New York at Buffalo. During his graduate studies he performed research at the National Center for Geographic Information and Analysis (NCGIA). He has worked in the geographic information systems (GIS) industry in Germany, the United States, and South Africa. Dr. Skupin's core research area is the application of geographic metaphors, cartographic principles, and computational methods in the visualization of non-geographic information. His research is strongly interdisciplinary, aimed especially at increased cross-fertilization between geography, information science, and computer science. For example, he has developed new approaches to create map-like knowledge domain visualizations on the basis of high-dimensional vector space models and artificial neural networks. Recent work includes novel methods for visualizing individual human movement and demographic change as trajectories in n-dimensional attribute space.

Bonnie DeVarco

Bonnie DeVarco <devarco@cruzio.com> is an interdisciplinary researcher, writer and curator and is a Media X Distinguished Visiting Scholar at Stanford University. She writes and lectures on Design Science, virtual worlds, next generation geographic information systems, information visualization and the culture of cyberspace. Bonnie has served as an education technology consultant for the past 20 years (PBS, AIANY Center for Architecture, San Diego and Imperial County Boards of Education, James Burke's Knowledge Web, UC Santa Cruz, UCOP, the Buckminster Fuller Institute, DigitalSpace, Silicon Graphics and others). She is founder of VLearn3D, the first international networking hub for educators using multi-user worlds in education 1998-2005. She has regularly produced educational events in cyberspace and in distributed physical locations and leads efforts to research, explore and develop new opportunities for telecollaboration, visualization, education and environmental action using advanced satellite and network technologies, visualization and open source tools. Bonnie serves on a variety of boards and advisory boards, including Contact Consortium, NextNow Collaboratory, Places & Spaces: Mapping Science and the Buckminster Fuller Challenge Prize. She served as archivist for the Buckminster Fuller collection from 1989-1995 and is completing a book on Fuller titled Invisible Architecture II. She is currently co-authoring Shape of Thought, on the history and evolution of
visual language, with Eileen Clegg and is co-editing a book on *Ludic Cartography* with Matteo Bittanti and Dr. Henry Lowood.

**Dawn Wright**

Dawn Wright <dawn@dusk.geo.orst.edu> is professor of Geography and Oceanography at Oregon State University. Her research interests include geographic information science, marine geography, tectonics of mid-ocean ridges, and the processing and interpretation of high-resolution bathymetric, video, and underwater photographic images. As director of the Davey Jones Locker Seafloor Mapping/Marine GIS Laboratory (dusk.geo.orst.edu/djl/samoa/) at OSU, she and her students develop 3-D visualizations of the seafloor, GIS tools for benthic terrain characterization, and most recently, ontologies and semantics distributed oceanographic databases. Dawn serves on the editorial boards of the *International Journal of Geographical Information Science*, *Transactions in GIS*, and *Geospatial Solutions*, as well as on the National Academy of Sciences' National Needs for Coastal Mapping and Charting Committee. Her most recent books include *Undersea with GIS* (ESRI Press, 2002), *Marine and Coastal Geographical Information Systems* (with D. Bartlett, Taylor & Francis, 2000), and *Place Matters: Geospatial Tools for Marine Science, Conservation, and Management in the Pacific Northwest* (with A. Scholz, Oregon State University Press, 2005).

**Former Advisor**

**Chaomei Chen**

Chaomei Chen <chaomei.chen@cis.drexel.edu> is Associate Professor in the College of Information Science and Technology at Drexel University and Visiting Professor in the School of Information Systems, Computing and Mathematics at Brunel University. His research includes information visualization, detecting and visualizing evolving scientific paradigms and knowledge diffusion, visual navigation in hypertext and digital libraries, and human-computer interaction. He is the founder and Editor-in-Chief of *Information Visualization*, published quarterly by Palgrave Macmillan. He is the author of *Information Visualization: Beyond the Horizon* (Springer, 2004) and *Mapping Scientific Frontiers: The Quest for Knowledge Visualization* (Springer, 2003).

**Former Curators**

Julie Smith (now Julie Davis) <jsmarie@gmail.com> was the co-curator of the Places & Spaces exhibit from August 2006 - August 2007. She recently graduated with a bachelor's degree in English and Anthropology from Indiana University where her undergraduate thesis work focused on developing better interpretation of remote sensing data in Archaeological fieldwork. She has a strong interest in seeing the knowledge we ‘discover’ in research institutions and universities made better available to the general public in more universally comprehensible forms. She has explored this interest in the past while working with local museums creating presentations of history and archaeological research, and is excited about working with the Places and Spaces exhibit because of the broad potential it offers to introduce the public to science research.

Elisha Hardy

Elisha Hardy, efhardy@indiana.edu was the Senior Graphic Designer and co-curator of the Places & Spaces exhibit. She graduated from Indiana University in 2007 with a Bachelors in Fine Arts with a focus on Graphic Design. She has been with the project since June 2005. She has been involved in the design of many of the maps from each iteration as well as posters, handouts,
postcards and other designs for the exhibit. She served as a curator of the exhibit from October 2007 to December 2010.

Contact Information

Source: http://scimaps.org/flat/contact/

My Note: May put this in a Spotfire database

Curator and Co-Curator

**Katy Börner**
Curator

Indiana University, School of Library and Information Science
Wells Library 021
1320 E. 10th St, Bloomington, IN 47405
Bloomington, IN. 47405, USA
E-mail: katy@indiana.edu
Phone: 812 855 3256 | Fax: 812 855 6166

**Elisha Hardy**
Senior Graphic Designer / Co-Curator

Cyberinfrastructure for Network Science Center
Wells Library 022
1320 E. 10th St, Bloomington, IN 47405
Email: efhardy@indiana.edu
Phone: (812) 856-7034 | Fax (812) 855-6166

Poster Owners

<table>
<thead>
<tr>
<th>Contact</th>
<th>Location</th>
<th>Posters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kevin Boyack</strong>, SciTech Strategies</td>
<td>Albuquerque, NM</td>
<td>iterations 1-5</td>
</tr>
<tr>
<td><strong>Chaomei Chen</strong>, Drexel University</td>
<td>Philadelphia, PA</td>
<td>iterations 1-3</td>
</tr>
</tbody>
</table>
Deborah MacPherson, Specifications, Research, Design at Accuracy&Aesthetics
Vienna, VA iterations 1-5 & movies and actors

NYPL Archive, SIBL
Schwarzman Building - Map Div. 06-1420
New York, NY iterations 1-2

David Rumsey, Cartography Associates
San Francisco, CA iterations 1-2

Andre Skupin, San Diego State University
San Diego, CA iterations 1-5

Julie (Davis) Smith, Former Co-curator of Places & Spaces
Chicago, IL iterations 1-3

Stephen Uzzo, NY Hall of Science
Queens, NY iterations 1-5, & Wiki

Nick Vaczek, Binghamton University (host)
Binghamton, NY iterations 1-5, & Wiki

South America

Abel Packer and Elenice de Castro, BIREME
Sao Paulo, Brazil iterations 1-5 as book, NeuroViz, Bibsonomy, 5th as poster

Europe

Petra Ahrweiler, University College of Dublin
Dublin, Ireland iterations 1-5

Michael Batty, University College London
London, England iterations 5-6

Sarah Fabrikant, University of Zurich - Irchel
Zurich, Switzerland iterations 1-5

Kepa Landa, Coordinator of Audio Lab at Arteleku
San Sebastián, Spain iterations 1-5

Andrew Ravenscroft, Learning Technology Research Institute (LTRI), London Metropolitan University
London, United Kingdom iterations 1-5

Jorg Reichardt, Institute of Theoretical Physics at University of Würzburg
Germany iterations 1-4

Andrea Scharnhorst, Virtual Knowledge Studio for the Humanities and Social Sciences
The Netherlands iterations 1-5
Sidebar Topics

Exhibitions
Source: [http://scimaps.org/flat/exhibitions/](http://scimaps.org/flat/exhibitions/)

My Note: Same as before Exhibitions

My Note: Built a database for Spotfire

News/Press

My Note: Built a database for Spotfire

Downloads
Source: [http://scimaps.org/flat/host/](http://scimaps.org/flat/host/)

Setup
The exhibit can be displayed in three different setups:

**Physical Exhibit**
Individually mounted maps PLUS additional elements

**Banner Exhibit**
Maps only, printed on fabric-like paper and mounted on stands
Poster Exhibit
Maps only, half-size printed on large poster sheets

Custom
We are happy to work with your venue to create a custom/hybrid setup.

Maps
The exhibit is a 10-year effort. Each year, 10 new maps are added resulting in 100 maps total in 2014.

- 1st Iteration (2005): The Power of Maps
- 3rd Iteration (2007): The Power of Forecasts
- 6th Iteration (2010): Science Maps for Scholars
- 8th Iteration (2012): Science Maps for Kids
- 9th Iteration (2013): Science Maps for Daily Science Forecasts
- 10th Iteration (2014): Telling Lies with Science Maps

Additional Elements
- Illuminated Diagrams
- Worldprocessor Globes
- Hands-on Puzzle Maps for Kids
- Exhibit Video
Physical Exhibit

The full exhibit includes:

- 10 individually printed and mounted maps *per iteration* & separately printed labels (24x30" | 60.96x76.2 cm)
- 1 Compare & Contrast panel *per iteration* (14x20" | 35.56x50.8 cm)
- 1 Introduction Panel (42x42" | 106.68x106.68 cm)
- All Additional Elements

View more information & technical details in [English](#) | [German](#)
Banner Exhibit

- Each panel is 35x80 inches | 89x203 cm
- 5 panels per iteration (two maps per panel)
- 1 Intro Panel
- 1 Compare & Contrast panel per iteration

Poster Exhibit
The poster exhibit consists of two posters *per iteration*. Each poster includes the title, author and description of each map. Introduction text and compare and contrast between maps is also included. In addition, some of the posters include past press and venue information.

Currently, the poster sizes are as follows:

**1st Iteration (2005): The Power of Maps**
Poster 1: 70x36 inches | 178x91.5 cm  
Poster 2: 66x36 inches | 168x91.5 cm

Poster 1: 60x36 inches | 153x91.5 cm  
Poster 2: 65x36 inches | 165x91.5 cm

**3rd Iteration (2007): The Power of Forecasts**
Poster 1: 61x36 inches | 155x91.5 cm  
Poster 2: 65x36 inches | 165x91.5 cm

**4th Iteration (2008): Science Maps for Economic Decision Makers**
Poster 1: 61x36 inches | 155x91.5 cm  
Poster 2: 67x36 inches | 168x91.5 cm

**5th Iteration (2009): Science Maps for Science Policy Makers**
6th Iteration (2010): Science Maps for Scholars
Poster 1: 61x36 inches | 155x91.5 cm
Poster 2: 67x36 inches | 168x91.5 cm

Own a Map of Science
Source: http://scimaps.org/flat/store/
My Note: Same as previous Store

History of the Exhibit
Source: http://scimaps.org/flat/history/
The exhibit was envisioned by Katy Börner, Kevin Boyack, Sarah I. Fabrikant, Deborah MacPherson and André Skupin in January 2005. Katy Börner and Deborah MacPherson curated the first two iterations of the exhibit. Also in 2005, Bonnie DeVarco co-curated a GIS version of the 1st iteration of the exhibit and launched it at the ESRI Conference in July 2005. In September 2006, Julie M. Davis took over the co-curator position and curated the 3rd iteration. In October 2007, Elisha Hardy took over Julie’s position and served as the co-curator for the 4th and 5th iteration of the exhibit.

Advisory board members comprise Deborah MacPherson, Accuracy & Aesthetics (knowledge management and architecture), Kevin W. Boyack, SciTech Strategies (chemistry and business intelligence), Sara Irina Fabrikant, University of Zürich, Switzerland (geography & psychology), Peter A. Hook, Indiana University (law and library science), André Skupin, San Diego State University (geography and information science), Bonnie DeVarco, MediaTertia - Emerging Technologies in Education (writer and educator), Chaomei Chen, Drexel University (information science), and Dawn Wright a.k.a. "Deepsea Dawn", Oregon State University (geology and physical geography). Their biographies are available via Advisory Board page.

Last Modified April 21, 2009 | Graphic Design by Elisha Hardy

Call for Submissions
Source: http://scimaps.org/flat/call/
My Note: This is what I am going to do!

Background and Goals
The Places & Spaces: Mapping Science exhibit was created to inspire cross-disciplinary discussion on how to best track and communicate human activity and scientific progress on a global scale. It has two components: (1) physical exhibits enable the close inspection of high quality reproductions of maps for display at conferences and education centers and
the online counterpart (http://scimaps.org) provides links to a selected series of maps and their makers along with detailed explanations of how these maps work.

Places & Spaces is a 10-year effort. Each year, 10 new maps are added, which will result in 100 maps total in 2014. Each iteration of the exhibit attempts to learn from the best examples of visualization design. To accomplish this goal, each iteration compares and contrasts four existing maps with six new maps of science. Themes for the different iterations/years are:

- 1st Iteration (2005): The Power of Maps
- 3rd Iteration (2007): The Power of Forecasts
- 6th Iteration (2010): Science Maps for Scholars
- 7th Iteration (2011): Science Maps as Visual Interfaces to Digital Libraries
- 8th Iteration (2012): Science Maps for Kids
- 9th Iteration (2013): Science Maps for Daily Science Forecasts
- 10th Iteration (2014): Telling Lies With Science Maps

Places & Spaces was first shown at the Annual Meeting of the Association of American Geographers in April 2005. Since then, the physical exhibit has been displayed at more than 175 venues in over 15 countries, including eleven in Europe, plus Japan, China, Brazil, Canada, and the United States. A schedule of all display locations can be found at http://scimaps.org/exhibitions.

Submission Details

The 7th iteration of the Mapping Science exhibit is devoted to science maps that serve as visual interfaces to digital libraries. These maps might communicate the

- quality and coverage of datasets,
- the structure (ontology, taxonomy, classification hierarchy) of a dataset,
- (semantic) linkages between datasets,
- the evolution of a dataset, or
- access and usage patterns of datasets.

They are intended to support the navigation, management, and utilization of mankind’s scholarly knowledge and to make it more readily available to researchers, educators, industry, policy makers and/or the general public.

We invite maps that show a visual rendering of a dataset together with a legend, textual description, and acknowledgements as required to interpret the map. Science map dimensions can be abstract, geographical, or feature-based, but are typically richer than simple x, y plots. Scientific knowledge can be used to generate a reference system over which other data, e.g., funding opportunities or job openings, are overlaid or be projected onto another reference
Each initial entry must be submitted by Jan 30th, 2011 and needs to include:

- Low resolution version of map
- Title of work
- Author(s) name, email address, affiliation, mailing address
- Copyright holder (if different from authors)
- Description of work: Scholarly needs addressed, data used, data analysis, visualization techniques applied, and main insights gained (100-300 words)
- References to publications in which the map appeared
- Links to related projects/works

Entries should be submitted via email to the curators of the exhibit: Katy Börner (katy@indiana.edu) and the exhibit designer Michael J. Stamper (mstamper@indiana.edu) using the email subject header “Mapping Science Entry”.

Review Process

All submissions will be reviewed by the exhibit advisory board and invited scholars from academia, industry, and government. Submissions will be judged in terms of

- **Scientific value** – quality of data collection, analysis and communication of results. Appropriate (innovative?) application of existing algorithms and/or development of new approaches.
- **Value for scholars** – what major insight does the map provide and why does it matter? Is the map easy to understand by scholars and the exhibit audience?

Final Submission

Authors of winning entries will be contacted at the end of February and invited to submit final entries by April 30th, 2011. Each final entry comprises:

- Title of Work
- Author(s) name, email address, affiliation, mailing address
- 24 x 30 inch, 300 dpi, landscape version of map
- Official map description (200 words)
- Biographies and photos of all authors (100 words each)
- Signed copyright and reproduction agreement

Map makers are welcome to use the expertise and resources of the exhibit curators when designing their final maps. The layout and production of the 6th iteration maps are expected to be ready for display by mid-June, 2011.
Important Dates

Submit initial entries: January 30th, 2011
Notification to mapmakers: February 28th, 2011
Submit final entries: April 30th, 2011
7th Iteration ready for display: June 15th, 2011

Exhibit Advisory Board

- Deborah MacPherson, Accuracy&Aesthetics
- Kevin Boyack, SciTech Strategies, Inc.
- Sara Irina Fabrikant, Associate Professor of Geography and head of the Geographic Information Visualization and Analysis (GIVA) group at the GIScience, Geography Department, University of Zürich, Switzerland
- Peter A. Hook, Law Librarian, Indiana University
- André Skupin, Associate Professor of Geography, San Diego State University
- Bonnie DeVarco, Media X, Stanford University
- Dawn Wright, Professor of Geography and Oceanography, Oregon State University

Please feel free to send any questions you might have regarding the judging process to Katy (katy@indiana.edu) keep subject header.

See 2008 and 2009 Call for Submissions.

Atlas of Science

Introduction

Overview, promotion, and how to order.

Source: http://scimaps.org/atlas/

Katy Börner

Published by MIT Press
Pre-order via Amazon, Barnes & Nobles, or MIT Press.

$29.95T/£22.95 cloth
13 x 11, 288 pp.
500 color illus.
978-0-262-01445-8

Download brochure with full size sample pages

Cartographic maps have guided our explorations for centuries, allowing us to navigate the world. Science maps have the potential to guide our search for knowledge in the same way, allowing us to visualize scientific results. Science maps
help us navigate, understand, and communicate the dynamic and changing structure of science and technology—help us make sense of the avalanche of data generated by scientific research today. Atlas of Science, featuring more than thirty full-page science maps, fifty data charts, a timeline of science-mapping milestones, and 500 color images, serves as a sumptuous visual index to the evolution of modern science and as an introduction to "the science of science"—charting the trajectory from scientific concept to published results.

Atlas of Science, based on the popular exhibit, "Places & Spaces: Mapping Science," describes and displays successful mapping techniques. The heart of the book is a visual feast: Claudius Ptolemy's Cosmographia World Map from 1482; a guide to a PhD thesis that resembles a subway map; "the structure of science" as revealed in a map of citation relationships in papers published in 2002; a visual periodic table; a history flow visualization of the Wikipedia article on abortion; a globe showing the worldwide distribution of patents; a forecast of earthquake risk; hands-on science maps for kids; and many more. Each entry includes the story behind the map and biographies of its makers.

Not even the most brilliant minds can keep up with today's deluge of scientific results. Science maps show us the landscape of what we know.

“In today's confusing and fast-changing world, if we are to shape our children's lives for the best, it is essential that we understand what science is thinking, where it's coming from, and where it's going. This fascinating, lucid, brilliantly illustrated book shows us all that.”
--James Burke, author of Connections

“Science is a voyage of discovery and Katy Börner has provided its first atlas. This excellent book offers a compendium of all that is best in explaining visual maps of our scientific knowledge.”
--Michael Batty, University College London, author of Cities and Complexity

“Featuring one unique and intriguing visual design after another, Atlas of Science illustrates the origin and evolution of science mapping.”
--Chaomei Chen, Drexel University, author of Mapping Scientific Frontiers

Download page from MIT catalog  Download Postcard

Images
Access references and download high resolution images
Source: http://scimaps.org/atlas/part1.html

My Note: Built a database for Spotfire

References
Search all references and download in fielded format


My Note: Built a database for Spotfire

Author
About the author

Source: http://scimaps.org/atlas/author.html

KATY BÖRNER is the Victor H. Yngve Professor of Information Science at the School of Library and Information Science and Founding Director of the Cyberinfrastructure for Network Science Center (http://cns.slis.indiana.edu) at Indiana University. She is a curator of the Places & Spaces: Mapping Science exhibit (http://scimaps.org). Her research focuses on the development of data analysis and visualization techniques for information access, understanding, and management. She is particularly interested in the study of the structure and evolution of scientific disciplines; the analysis and visualization of online activity; and the development of cyberinfrastructures for large scale scientific collaboration and computation. She holds a MS in Electrical Engineering from the University of Technology in Leipzig, 1991 and a Ph.D. in Computer Science from the University of Kaiserslautern, 1997. Her home page is at http://info.slis.indiana.edu/~katy

History
History of the Atlas

Source: http://scimaps.org/atlas/history.html
Some of you asked why, when, where, and how the Atlas came into existence. Here are some factoids.

**Why?**

The first entry in Börner’s Atlas diary is from January 4, 2007. It reads: “The Atlas is not only for the 300 scientometricians that have historically studied and mapped science, but for anybody who needs better access to science and technology results.” I want to “show readers a world—the world of knowledge—in new ways. I want to introduce them to a Candy Land of new insights, methods, tools, and solutions.”

Later the diary reads: “Still sorting through five years of research. It is interesting to puzzle the many bits and pieces together to see a larger picture emerge. The main contribution of the Atlas might not be the many maps, but the conceptualization of how science evolves dynamically and how it can be measured, mapped, and understood.”

**When?**

Data collection for the Atlas began in 2005 with the debut of the first exhibit maps. Much of the writing for the Atlas of Science was done during Börner’s sabbatical in Spring 2007. It continued until Summer 2009. Final files were submitted to MIT in April 2010.

**Where?**

Writing happened mostly at Börner’s home in the middle of an Indiana forest. As the project progressed, printouts of pages, possible imagery, and page layouts started to fill most of the walls. Two new large file cabinets were acquired to organize all the material needed for the Atlas.

Text, raw data, and images, together with hand-drawn sketches of the layout were used by Elisha Hardy Allgood to design mock-ups of each double-page spread. These mock-ups were essential for finalizing the amount of text, the concrete image(s), and the final layout for each page. Text and imagery had to go hand-in-hand to create synergies not achievable by any alone, yet each major theme had to fit on a double-page spread. Later, the design mock-ups were used as the basis for the final print design.
How?

Many different datasets were considered for rendering the figures and maps in the Atlas. Ultimately, we used only the highest-quality datasets for which permissions could be acquired. Interested to connect current data and prior work, we extended earlier charts of scientific productivity using current data. Due to copyright regulations, these charts could not be included in the Atlas.

The decision of how to list the more than 1800 references was a difficult one. Some of the pages have more than 80 references and placing 80 four-digit numbers in the text would have cluttered up the pages. The listing of references and credits by double-page spread, accompanied by a searchable listing of all references, was a compromise between usability and affordability.

Atlas Trivia

The Atlas features more than 30 full-page science maps, 50 data charts, a timeline of science-mapping milestones, and 500 color images. It was written on four different laptops and two desktop computers. The raw files use over 10GB of disk space.

Questions & Answers

You ask, the author answers

Source: http://scimaps.org/atlas/questions.html

What is a science map?

While a cartographic map represents our three-dimensional physical world, a science map is a visual rendering of a much higher dimensional, abstract topic space. Science maps are calculated from data such as research papers, patents, and funding awards using advanced analysis and visualization algorithms. Like cartographic maps, science maps support navigation, resource management, and utilization and provide a clearer understanding of the entire landscape.

How does the Atlas relate to the Mapping Science exhibit?

Visitors of the Mapping Science exhibit—a ten-year effort to introduce maps of science to a general audience—expressed an interest in learning more about the maps. The Atlas of Science covers the first three years of the exhibit: Power of Maps (debut in 2005), Reference Systems (2006), and Forecasts (2007). It details the aim and interpretation of the maps, how they were created, and why, together with biographies of the mapmakers. The Atlas also
gives an introduction to science maps, explains their history and how the maps are generated, and discusses a likely future of science maps.

**Why is the Atlas of Science so inexpensive?**

The complete layout and design of the Atlas—design and print preparation of all images, layout of text and imagery for all parts, compilation and rendering of references and index terms, jacket design, and the securing of more than xx copyrights—was done at the Cyberinfrastructure for Network Science Center at the School of Library and Information Science, Indiana University. It is our dream that anybody can learn about and benefit from science maps.

If you received more for your money than expected, please consider donating to the exhibit that brings large-scale maps and additional exhibit elements to science museums, libraries, and other public venues (see [listing](#)). You can also [purchase](#) any of the exhibit maps—the income is used to bring science maps to classrooms and museums.

**Why static maps and not interactive tools?**

The design of most maps shown in the Atlas started with a highly interactive exploration of the data, algorithm parameter spaces, and different visual mappings using tools like VxInsight, HistCite, the Science of Science Tool, and many others. The result of this exploration process is a theory-driven yet pragmatic selection of data sets, algorithms, parameter values, and visual designs that best communicate contemporary research. The Atlas does hint at the highly iterative process (p. 51) but cannot capture it on paper. Instead, it shows maps that visualize key insights. This is analogous to highly optimized cartographic maps and weather forecast maps included in newspapers. Most of the maps in the [recent iterations of the exhibit](#) have complementary online counterparts that support interactive exploration.

**Why are some images hand drawn?**

Explanatory sketches like on pages 51, 53, 55, 59, and 65 were drawn by the author to indicate their conceptual nature. Labels were recreated using script type fonts.

**Why are citation links reversed in the maps?**

In the Atlas, citation linkages are represented by arrows that point from older papers to more recent papers, indicating the direction of the information flow. Examples can be seen on pages 53, 55, 108, and 138 or in Eugene Garfield's "HistCite Visualization of DNA Development" map on p. 121. Note that this norm is also used in the visionaries' timeline (p.16-17), Derek de Solla Price's rendering of the flow of authors through annual indexes representing different scientific disciplines (p. 56), Waldo Tobler's FlowMaps (p. 161), the UCSD map (p. 171), and knowledge flows in chemistry research (p. 203). The Science of Science (Sci2) Tool ([http://sci.slis.indiana.edu/sci2](http://sci.slis.indiana.edu/sci2)) implements this norm for the extraction, analysis, and visualization of citation networks for papers, patents, etc. Counterexamples are the Historiograph rendering on page 123 and the explanation of research fronts on p. 165 (arrows are labeled with ‘cites’). These two figures use the direction of arrows to indicate that newer papers actively cite older papers.
**How can I gain access to high-resolution images from the Atlas?**

More than 380 images from the Atlas together with their source credits have been made available at [http://scimaps.org/atlas/maps](http://scimaps.org/atlas/maps). Exhibit maps are distributed at 150 dpi only. All exhibit science maps can be purchased as archival ink prints.

**How can I find out if a particular author or work was cited?**

Reading 35 pages of references just to find the source for one citation is time consuming. We recommend using [http://scimaps.org/atlas/references](http://scimaps.org/atlas/references) when searching for specific references. Image credits and data credits are not included. The site also provides an EndNote file of all references cited in the Atlas. A visualization of the co-author network derived from the EndNote file can be found [here](http://scimaps.org/atlas/references). It has 1,223 author nodes (518 unconnected isolates) and 1,332 co-author links.

**How can I gain access to datasets shown in the Atlas?**

We are in the process of making key datasets and source credits available online at [http://scimaps.org/atlas/data](http://scimaps.org/atlas/data), so anybody can add data and re-render charts.

**I have data, how can I map it?**

There are many tools available that support the study and mapping of science (see Table 5 in a recent *Scientometrics* paper, Table 5). The *Science of Science* (Sci2) Tool was specifically developed for study at the micro, meso, and macro scale. If you see a map in the Atlas that you like, feel free to contact the map maker(s) to get more information, start a collaboration, or request a price estimate for a specific project.

**Do you plan any future books?**

Colleagues and I are editing a Springer book on *Models of Science Dynamics* that will feature reviews of different model types used to predict the structure and dynamics of science. It will become available in 2011.

We are also planning a follow-up book on the Atlas that features the next six iterations of the exhibit devoted to science maps for different users: Economic Decision Makers (2008), Science Policy Makers (2009), Scholars (2010), Visual Interfaces to Digital Libraries (2011), Kids (2012), and Daily Science Forecasts (2013). It will not become available before 2014.

**Vendors & Events**

Where to buy

Source: [http://scimaps.org/atlas/vendors.html](http://scimaps.org/atlas/vendors.html)

My Note: Built a database for Spotfire (Done)
Press
What others have been saying
Source: http://scimaps.org/atlas/press.html
My Note: Built a database for Spotfire (Done)

References
This page provides a listing of relevant scholarly books, papers, and presentations that explain the history of mapping science as well as major algorithms and techniques applied. A listing of web sites that deal with other forms of data and information visualization is given at the end.
Source: http://scimaps.org/flat/references/
My Note: Building a database for Spotfire (Done)

Workshops
Scientific meetings, workshops, and conferences are instrumental to recent advances in mapping science research and this exhibit. Key events are listed here to encourage browsing of relevant research and to acknowledge the many scholars, practitioners, and educators that freely shared their knowledge and expertise across disciplinary and cultural boundaries.
Source: http://scimaps.org/flat/workshops/
My Note: Built a database for Spotfire (Done)

My Research Notes

Background
I have been a great admirer of this work since I became aware of it when Susan Turnbull (who I collaborated with) did the workshop - http://colab.cim3.net/cgi-bin/wiki.pl?ExpeditionWorkshop/MappingPublicGoodsAndServices_ConnectingToScienceAndScholarlyKnowledge_2007_08_14 (this wiki version)

Please note that Patricia Hilton’s map of what she heard at that workshop was based on my presentation at http://semanticommunity.info/Best_Practices/Web_2.0_Locate_Collaborate_and_Integrate

First Steps:
Google Search: Katy Börner’s Atlas of Science
Atlas of Science: Visualizing What We Know
The Atlas features more than 30 full-page science maps, 50 data charts, a timeline of science-mapping milestones, and 500 color images. It was written on four different laptops and two desktop computers. The raw files use over 10GB of disk space.

Questions and Answers: http://scimaps.org/atlas/questions.html

Databases: http://scimaps.org/atlas/data

References: http://scimaps.org/atlas/part1-references.html

Requested PC Version of Mac File. Action: Do database!

Call for Participation: http://scimaps.org/flat/call/

January 31, 2011

The 7th iteration of the Mapping Science exhibit is devoted to science maps that serve as visual interfaces to digital libraries. These maps might communicate the quality and coverage of datasets, the structure (ontology, taxonomy, classification hierarchy) of a dataset, (semantic) linkages between datasets, the evolution of a dataset, or access and usage patterns of datasets.

They are intended to support the navigation, management, and utilization of mankind’s scholarly knowledge and to make it more readily available to researchers, educators, industry, policy makers and/or the general public.

We invite maps that show a visual rendering of a dataset together with a legend, textual description, and acknowledgements as required to interpret the map. Science map dimensions can be abstract, geographical, or feature-based, but are typically richer than simple x, y plots. Scientific knowledge can be used to generate a reference system over which other data, e.g., funding opportunities or job openings, are overlaid or be projected onto another reference system, e.g., a map of the world, but must be prominently featured. See http://scimaps.org/all-maps-1-6.pdf for an overview of the 60 maps already featured in the exhibit.

Each initial entry must be submitted by Jan 30th, 2011 and needs to include:

- Low resolution version of map
- Title of work
- Author(s) name, email address, affiliation, mailing address
- Copyright holder (if different from authors)
- Description of work: Scholarly needs addressed, data used, data analysis, visualization techniques applied, and main insights gained (100-300 words)
- References to publications in which the map appeared
- Links to related projects/works
Excerpts from Skim Reading the Book:

Data Acquisition and Preprocessing

Pages 60-61

The ideal information resource would feature high quality of content (i.e., be accurate and complete) as well as high accessibility (i.e., excel in availability, ease of use, and interactivity). Lawrence M. Sanger

My Comment: This describes my use of MindTouch and Spotfire!

Attributes: Data Types, Sizes, and Formats; Data Quality; Data Coverage; Data Acquisition; Data Preprocessing; Data Augmentation; Baseline Statistics; Data Integration and Federation (Centralized Approaches, Centralized - Deep Web Search Approaches, and Peer-to-Peer Approaches; Evolving Interoperability Standards and Tools (CrossRef Web Services, The W3C SWEO Linking Open Data Community Project, Practical Ontology of Scholarly Data, and Digitometric Services and Tools); and Data Preservation.

Taxonomy Visualization of Patent Data

Pages 132-135.

Topics: Aim, Interpretation, Impact and Prior Art.

Subtopics: Data, Reference System, Data Overlays, Details, and Unique Features.

Impact of Air Travel on Global Spread of Infectious Diseases

Pages 150-151.

Topics and Subtopics: None!

Science of Science Policy Maps for Government Agencies

Pages 202-203.

Topics: Towards a "Science of Science"; Funding Science; Judging Quality Research; Computing Funding Impact; Geography of Science; Science Dynamics; and Scientific Wealth of Nations.

References and Credits

Pages 212 - 246.

Note: Contents and Acknowledgements are no in Web Version.

Thompson Reuters End Note
http://www.endnote.com/endemo.asp

Need to download and install before opening the End Note download from the Atlas Web Site! Done.

My Concept and Design: Create a MindTouch - Spotfire Interface to the Digital Library of Science - the Atlas of Science - by building a database of the Web Site (Images, References, and End Notes, and selected Databases behind several of the Maps!

Actions:

Downloaded the Postcard, MIT Catalog Entry, and Borner Blad (see attachments below)

Started to build the References databases by screen scraping to Excel and designing a database.

Had trouble working with the End Notes - sent an email to Elisha Hardy asking for a PC version and was told to download EndNote and use it to open it. I thanked her and told her I was working on a better approach to this. Training

I discovered that building the image file database might be a better/easier way to build the references databases!

EndNote

Export Options Are: All Fields (see excerpt below), All Annotated, All Author Date, All Numbered, Other Styles: This style will allow you to see the entire contents of your EndNote library along with the names of the EndNote fields and reference types in numerous other styles! See Files Attached Below.

Export to Fielded Text

Reference Type: Edited Book
Record Number: 400
Year: 1966-2011
Title: Annual Review of Information Science and Technology
City: Medford, NJ
Publisher: Information Today, Inc.
Short Title: Annual Review of Information Science and Technology

Reference Type: Generic
Record Number: 14
Year: 1991
Title: Encyclopaedia Britannica
Secondary Author: P. W. Goetz
Secondary Title: The New Encyclopaedia Britannica
Place Published: Chicago
Publisher: Encyclopaedia Britannica, Inc.
Edition: 15th
Short Title: Encyclopaedia Britannica

Reference Type: Generic
Record Number: 237
Year: 2010
Title: "Henri-Marie Lafontaine"
Secondary Title: Encyclopaedia Britannica Online
Short Title: "Henri-Marie Lafontaine"
URL: http://www.britannica.com/EBchecked/...rie-Lafontaine
Access Date: March 30, 2010

Reference Type: Web Page
Record Number: 1171
Author: AAAS
Year: 2007
Title: AAAS Report XXXII: Research and Development Fiscal Year 2008
Access Date: January 6, 2008
Short Title: AAAS Report XXXII: Research and Development Fiscal Year 2008
URL: http://www.aaas.org/spp/rd/rd08main.htm

Reference Type: Web Page
Record Number: 1172
Author: AAAS
Year: 2008
Title: Trends in Federal Research by Discipline, FY 1970-2006
Access Date: March 1, 2008
Short Title: Trends in Federal Research by Discipline, FY 1970-2006
URL: http://www.aaas.org/spp/rd/discip06.pdf

Reference Type: Web Page
Record Number: 1173
Author: AAAS
Year: 2008
Title: AAAS Report XXXIII: Research & Development Fiscal Year 2009
Access Date: October 6, 2009
Short Title: AAAS Report XXXIII: Research & Development Fiscal Year 2009
URL: http://www.aaas.org/spp/rd/rd09main.htm

Reference Type: Book
Record Number: 214
Author: J. Abbate
Year: 1999
Title: Inventing the Internet
City: Cambridge, MA
Publisher: MIT Press
Short Title: Inventing the Internet
I. NEW FEATURES

* Import and create new records from PDF files. Whether you are importing a single file or a folder of PDF files, EndNote uses metadata and DOI information to create a new reference and attach the source PDF. Basic bibliography information will be added automatically for most journal articles, conference proceedings, conference papers and reports.

* Search the contents of attached PDF files. You’ll find a new option on the field list to search PDF files separately, or in combination with the reference data.

* Modify references easily in the new Quick Edit tab on the main library window. Use the tabs to preview formatted references, search your library and online resources, and now edit references—all without opening additional windows.

* Create new groups by comparing, combining or suppressing existing groups. The new smart groups are updated dynamically as your library grows.

* Transfer up to 10,000 references between the desktop and EndNote Web to share online groups with other EndNote users. Shared groups are now included when you Cite While You Write from EndNote Web.

* Expand your library retrieval results by adding wildcards within search terms.

* Edit references when comparing duplicates-copy/paste and save changes in the side-by-side view.

Cite While You Write new features

* Add hyperlinks between in-text citations and the bibliography reference in Microsoft Word using any journal style.

* Use expanded functionality when editing citations-track usage and more.

* Meet the complete APA 6th style requirements including specific handling of references with eight or more authors, hyphenated first names and DOI data.

* Improved footnote handling for the Chicago Manual of Style and similar footnote-based bibliographic styles.

* Traveling Library enhancements recognize references when sharing Word documents for better collaboration.
*Get a quick citation report of references cited in a Microsoft Word document with a new auto-group in the EndNote library.

* Import & Create Records from PDF files - EndNote uses metadata and DOI information to create a new record and attach the source PDF.

II. RELEASE NOTES

Compatibility Issues:

* EndNote X4 libraries are not backwards compatible with EndNote 7 or lower. When opening a library from EndNote 5, 6, or 7, EndNote X4 will convert the library to the current format and leave the original library unchanged. EndNote X4 libraries consist of both an .enl file and a .DATA folder that must be kept together when sharing libraries.

* EndNote X4 users who have the language sort set to Korean may lose their database sort settings when opening EndNote X4 libraries with EndNote 8, 9, X, X1, or X2. Sort settings will likely default to the first item in the sort list - "System Default" or "English".

Documentation Notes:

* This EndNote installation includes a short electronic manual, which is installed in your EndNote program folder: GettingStartedGuide.PDF is available to get you up and running. You can open and view these files with the free Adobe Acrobat Reader.

* The EndNote Help file is available from the "Help" menu. Most windows and dialogs also include context-sensitive help from a "Help" button or by pressing the F1 key. If you have an Internet connection, you can automatically open hot-linked URLs with your default browser.

Technical Notes:

Notes regarding computers with installations of Microsoft Word XP.

* Smart Tags must be enabled to run EndNote's Instant Formatting feature.

* The latest Microsoft Service Update should be installed on your computer. To download this service update, go to http://office.microsoft.com/ProductU...es/default.asp.

III. INSTALLATIONS

Upgrade Notes:

* Upgrading from an Earlier Version
While it is not required, it is strongly advised to uninstall older versions of EndNote before you install EndNote X4. Before you begin, back up custom styles, filters, connection files and databases. Uninstall your older EndNote by going to "Start > Control Panel > Add/Remove Programs."

Demo Notes:

* About the Demo
This is a fully functional trial version of EndNote X4. You will have 30 days after you first use the program to evaluate EndNote and all of its features.

After those 30 days are up, the program will revert to a feature-restricted EndNote Viewer.

After the program reverts to an EndNote Viewer, you will still be able to open EndNote libraries, search, sort, and print references. However, with the EndNote Viewer you cannot:
- Add or edit references in a library that has 10 or more references already in it.
- Format more than 10 citations in a paper
- Retrieve more than 10 references from a remote database
- Import more than 10 references
- Export more than 10 references at one time

You can purchase a product code and convert your installation to the full unrestricted version of EndNote X4 by clicking Activate EndNote from the Help menu.

For an EndNote tutorial, refer to the EndNote Getting Started Guide, an Adobe Acrobat "PDF" file installed in the EndNote Demo program folder. You will need to download a copy of Acrobat Reader (from Adobe) to read this guide. You can find the Acrobat Reader at [http://www.adobe.com/prodindex/acrobat/readstep.html](http://www.adobe.com/prodindex/acrobat/readstep.html)

* Installing the Demo
If you have a full, upgrade, or volume version of EndNote installed on your system, please note that the EndNote Demo installer will replace Cite While You Write related files. When your demo period has expired or if you choose to use Cite While You Write or Services from the full version, follow the instructions provided in the Installing Cite While You Write Support in Word topic in the help file.

Volume Notes:

* About the Volume
EndNote Volume edition is licensed under a volume purchase agreement. Unless you are a designated distributor under this license, you may not distribute this software to anyone inside or outside of your site. This copy of EndNote is registered to your institution. You may register individually to receive announcements about product updates.

* Installing the Volume
An EndNote volume license product key can only be used when the MSI installer is run in Administrative Mode. The installer will need to be run using the following command from a command line: `msiexec /a ENX4Inst.msi`

In Administrative Mode, the installer will prompt for the volume product key which generates the license.dat file. The license.dat file must accompany the installer for volume license redistribution in order to bypass the product key installation prompt.

Optionally, one may check the "Perform administrative installation" checkbox to get an output of the complete installer contents, along with the license.dat; leaving this option unchecked, will produce the license.dat file and the ENX4Inst.msi.

For more details, see Microsoft MSI documentation, the About Mass Program Installations EndNote help topic, or www.endnote.com/ksi.

----------------------------------------------------

IV. CONTACT INFORMATION
----------------------------------------------------

Thomson Reuters
Web/Email: http://www.endnote.com

Contact Sales
Phone: 1-760-438-5526
Fax: 1-760-438-5573

Contact Technical Support
Contact Form: http://www.endnote.com/encontact.asp
Go to http://scientific.thomson.com/support/support/hours/ for hours and holiday closures.

Please see the EndNote website for contact information for our international distributors regarding sales, customer service, and technical support.