Visual Analytics: Mining, Mapping, and Accelerating Local and Global Science and Technology

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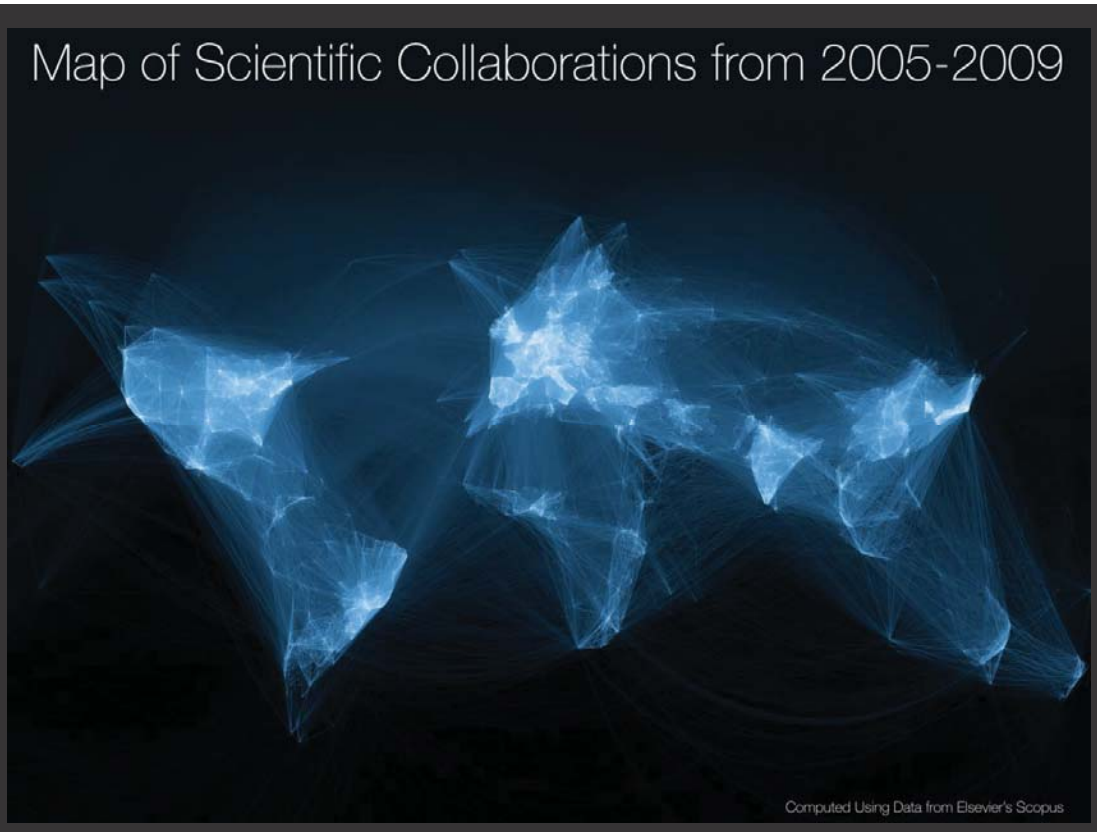
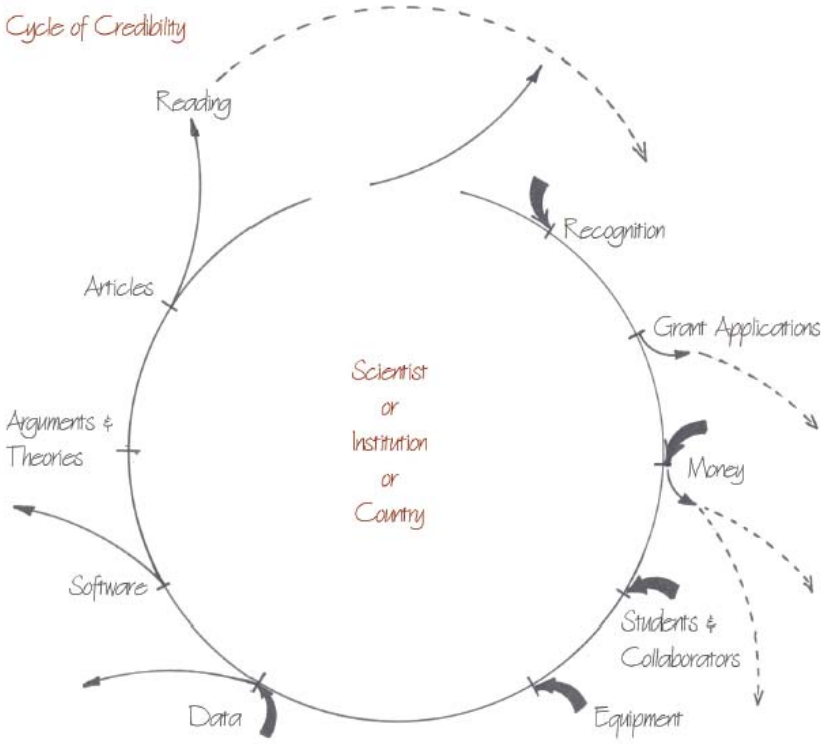
Indiana University, USA

New Science Roadmaps for Global Research Panel, AAAS 2016
Wilson C, Marriott Wardman Park, Washington, DC

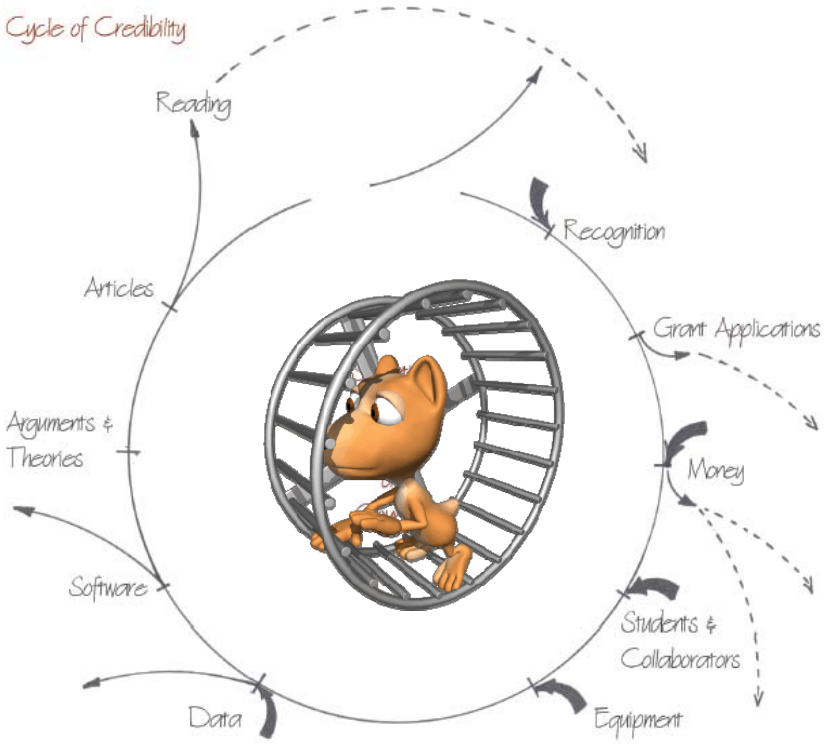
Saturday, February 13, 2016, 3:00-4:30PM



Olivier H. Beauchesne, 2011. Map of Scientific Collaborations from 2005-2009



Bruno Latour and Steve Woolgar, 1986. Cycle of Credibility.



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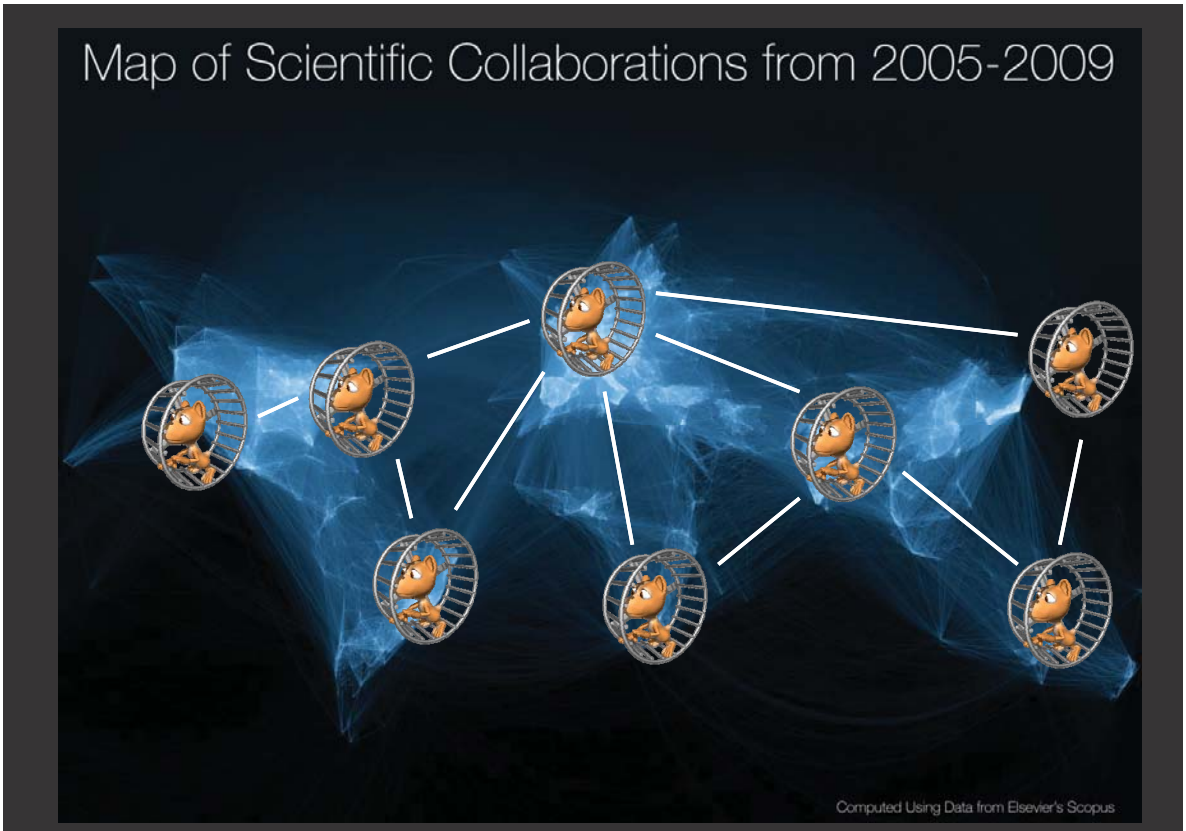

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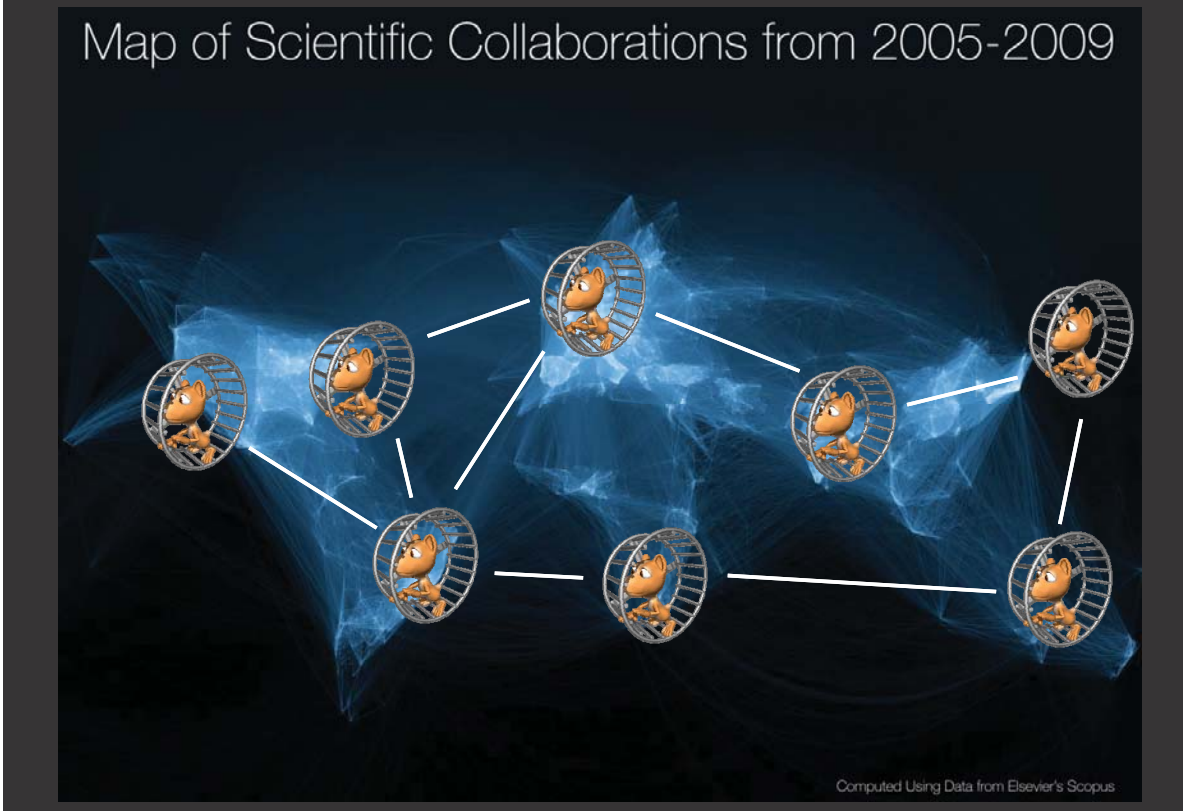


Olivier H. Beauchesne, 2011. Map of Scientific Collaborations from 2005-2009

The Global 'Scientific Food Web'

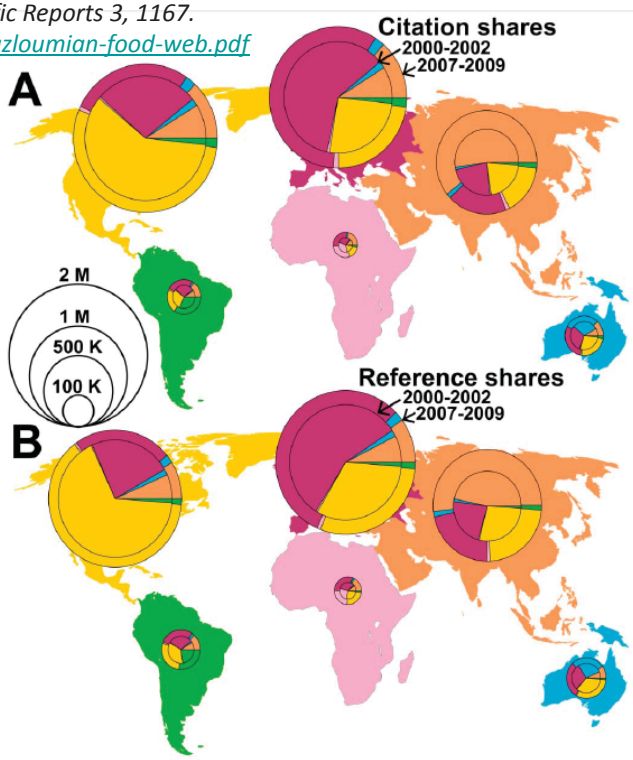
Mazloumian, Amin, Dirk Helbing, Sergi Lozano, Robert Light, and Katy Börner. 2013. "Global Multi-Level Analysis of the 'Scientific Food Web'". Scientific Reports 3, 1167.
http://cns.iu.edu/docs/publications/2013-mazloumian-food-web.pdf

Contributions:

Comprehensive global analysis of scholarly knowledge production and diffusion on the level of continents, countries, and cities.

Quantifying knowledge flows between 2000 and 2009, we identify global sources and sinks of knowledge production. Our knowledge flow index reveals, where ideas are born and consumed, thereby defining a global 'scientific food web'.

While Asia is quickly catching up in terms of publications and citation rates, we find that its dependence on knowledge consumption has further increased.



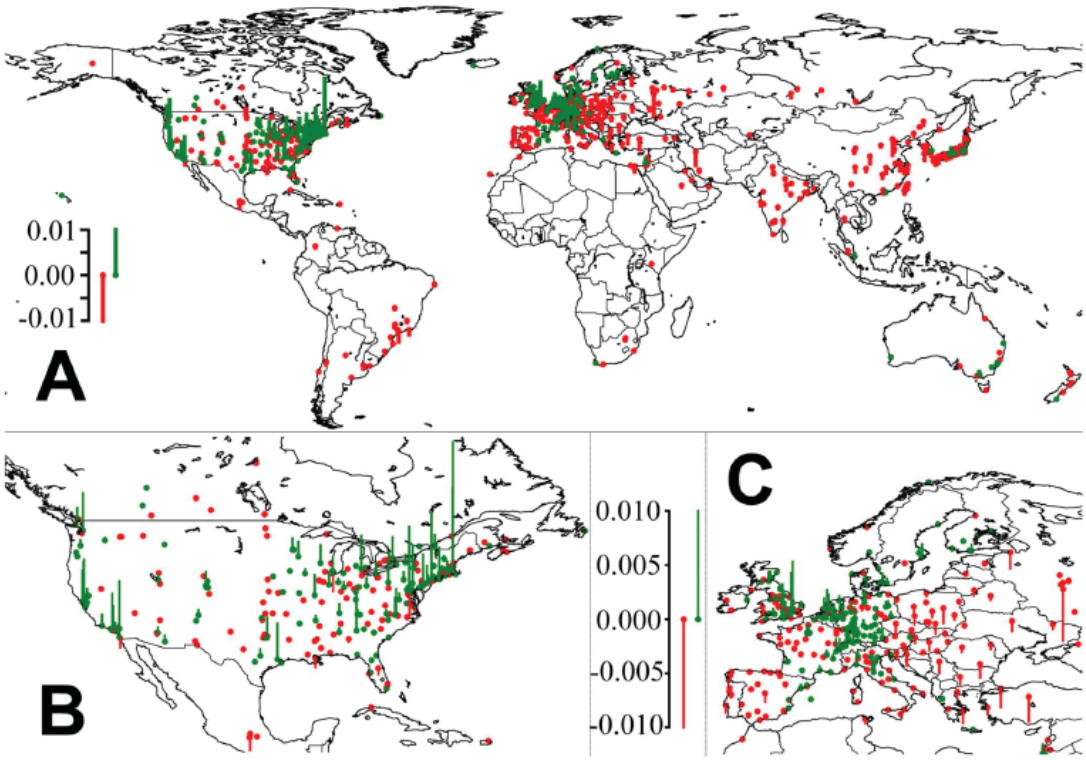
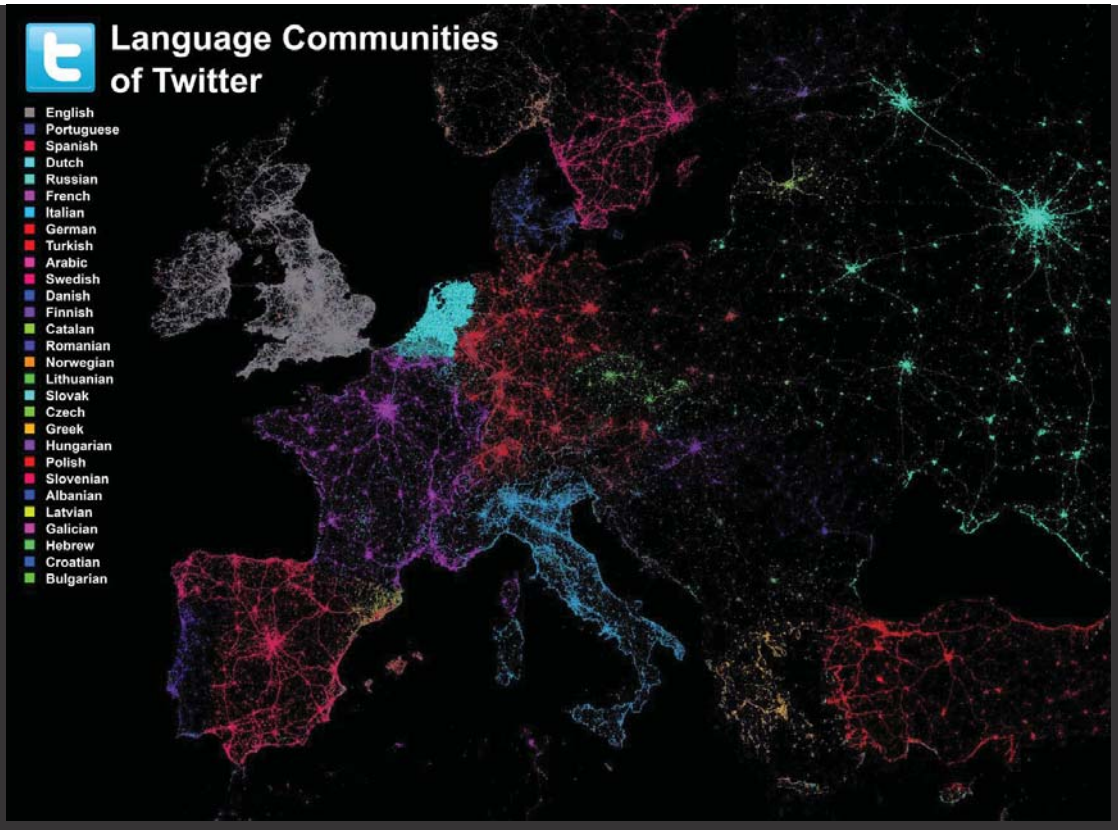
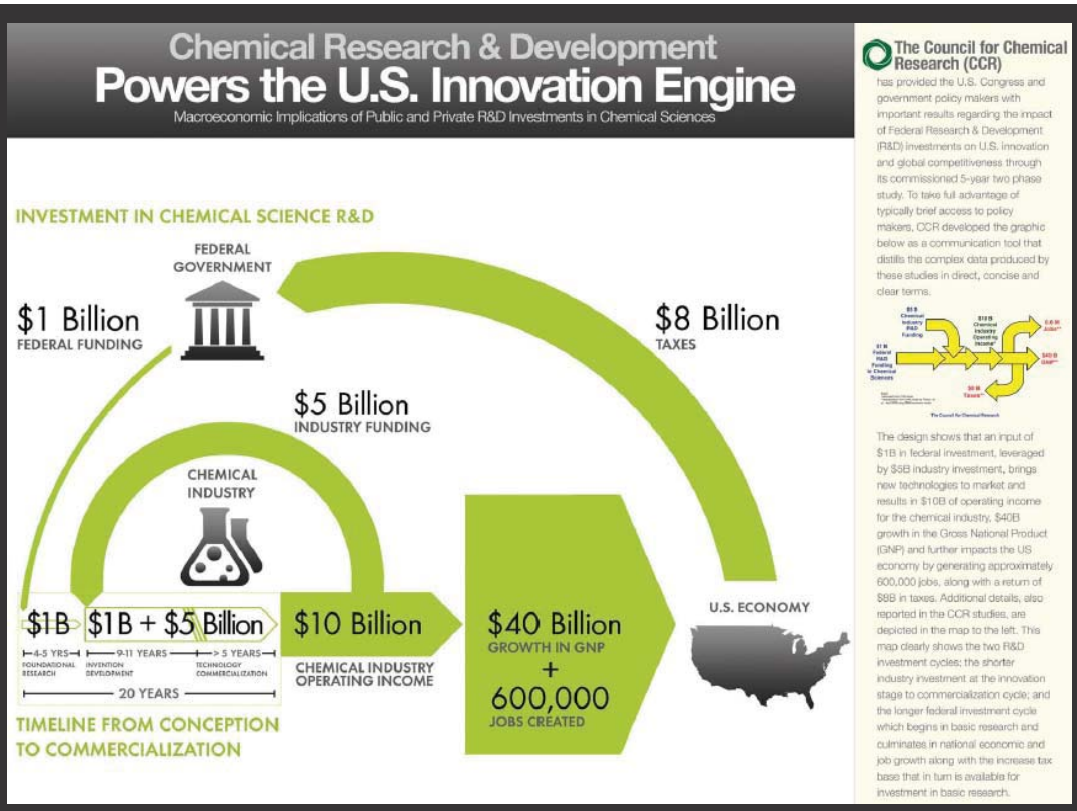


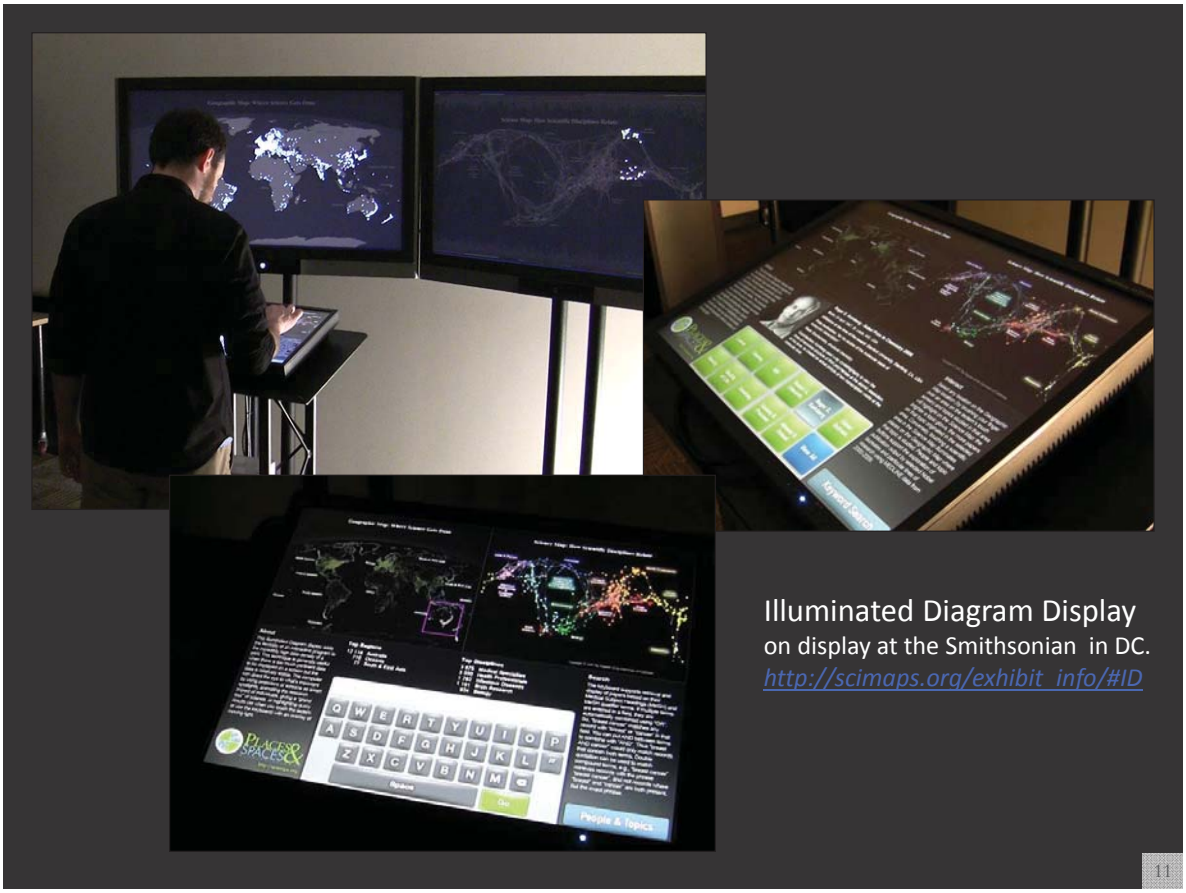
Figure 2 | World map of the greatest knowledge sources and sinks, based on our scientific fitness index. Green bars indicate that the number of citations received is over-proportional, red that the number of citations received is lower than expected (according to a homogeneous distribution of citations over all cities that have published more than 500 papers). It can be seen that most scientific activity occurs in the temperate zone. Moreover, areas of high fitness tend to be areas that are performing economically well (but the opposite does not hold).



Language Communities of Twitter - Eric Fischer - 2012



Council for Chemical Research. 2009. Chemical R&D Powers the U.S. Innovation Engine. Washington, DC. Courtesy of the Council for Chemical Research.



Illuminated Diagram Display
on display at the Smithsonian in DC.
http://scimaps.org/exhibit_info/#ID

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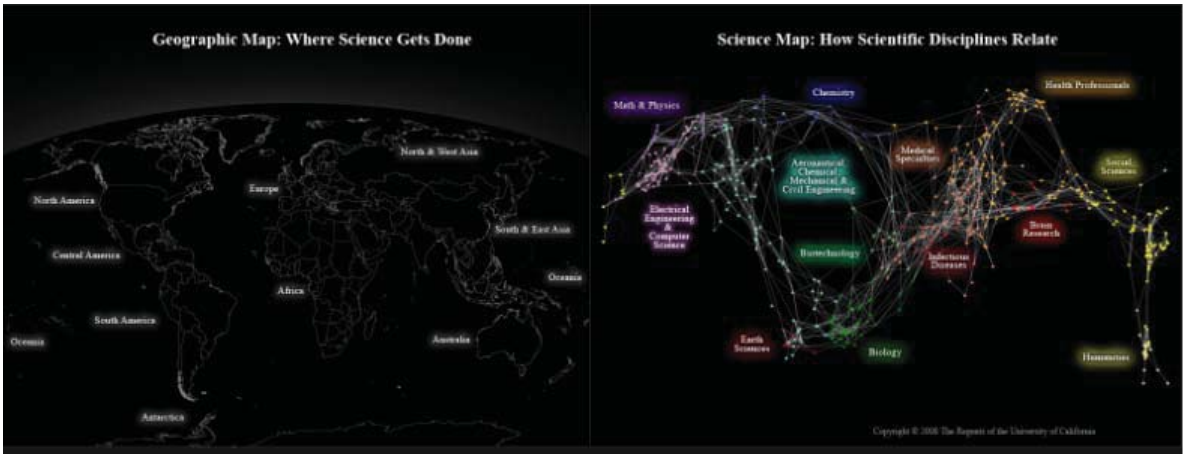

About

This Illuminated Diagram display adds 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 or screens as smart spotlights, animating the research impact of individuals, giving a "grand tour" of science, or highlighting query results (as when you touch the lectern or use the keyboard) with an overlay of moving light.

PLACES & SPACES
http://scimaps.org

Top Five Continents

North America - 4,000 records
South & East Asia - 3,589
Australia - 2,431
Africa - 2,208
South America - 1,562

Top Five Scientific Disciplines

Math & Physics - 4,000 records
Health Professionals - 3,589
Social Sciences - 2,431
Aeronautical, Chemical, Mechanical & Civil Engineering - 2,208
Humanities - 1,562

Input your search query here.

Q W E R T Y U I O P
A S D F G H J K L "
Z X C V B N M ⌫
Space Go

Search

The keyboard supports retrieval and display of papers based on their Medical Subject Headings (MeSH) and MeSH qualifier terms. If multiple terms are entered in a field, they are automatically combined using "OR". So, "breast cancer" matches any record with "breast" or "cancer" in that field. You can put AND between terms to combine with "AND". Thus "breast AND cancer" would only match records that contain both terms. Double quotation can be used to match compound terms, e.g., "breast cancer" retrieves records with the phrase "breast cancer", and not records where "breast" and "cancer" are both present, but the exact phrase.

People & Topics

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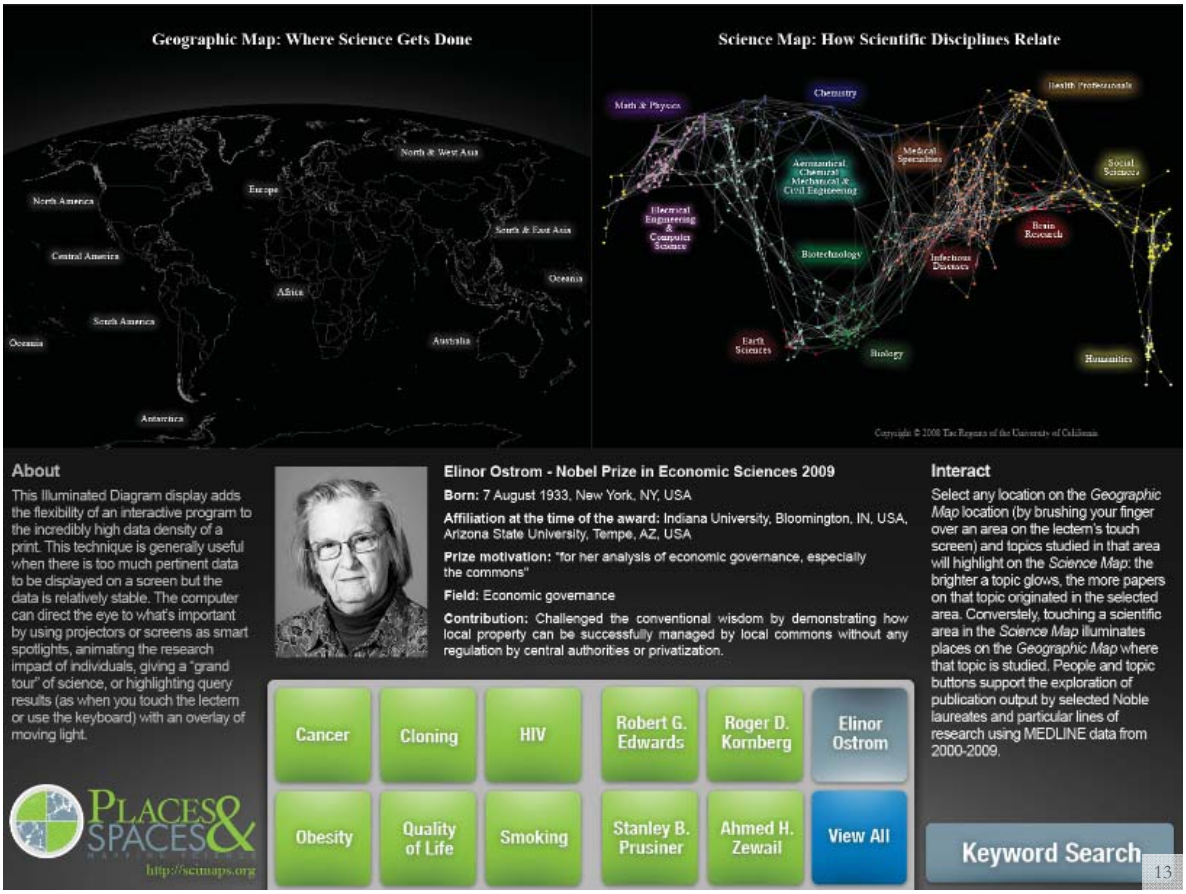

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Science Maps in "Expedition Zukunft" science train visiting 62 cities in 7 months 12 coaches, 300 m long Opening was on April 23rd, 2009 by German Chancellor Merkel
http://www.expedition-zukunft.de

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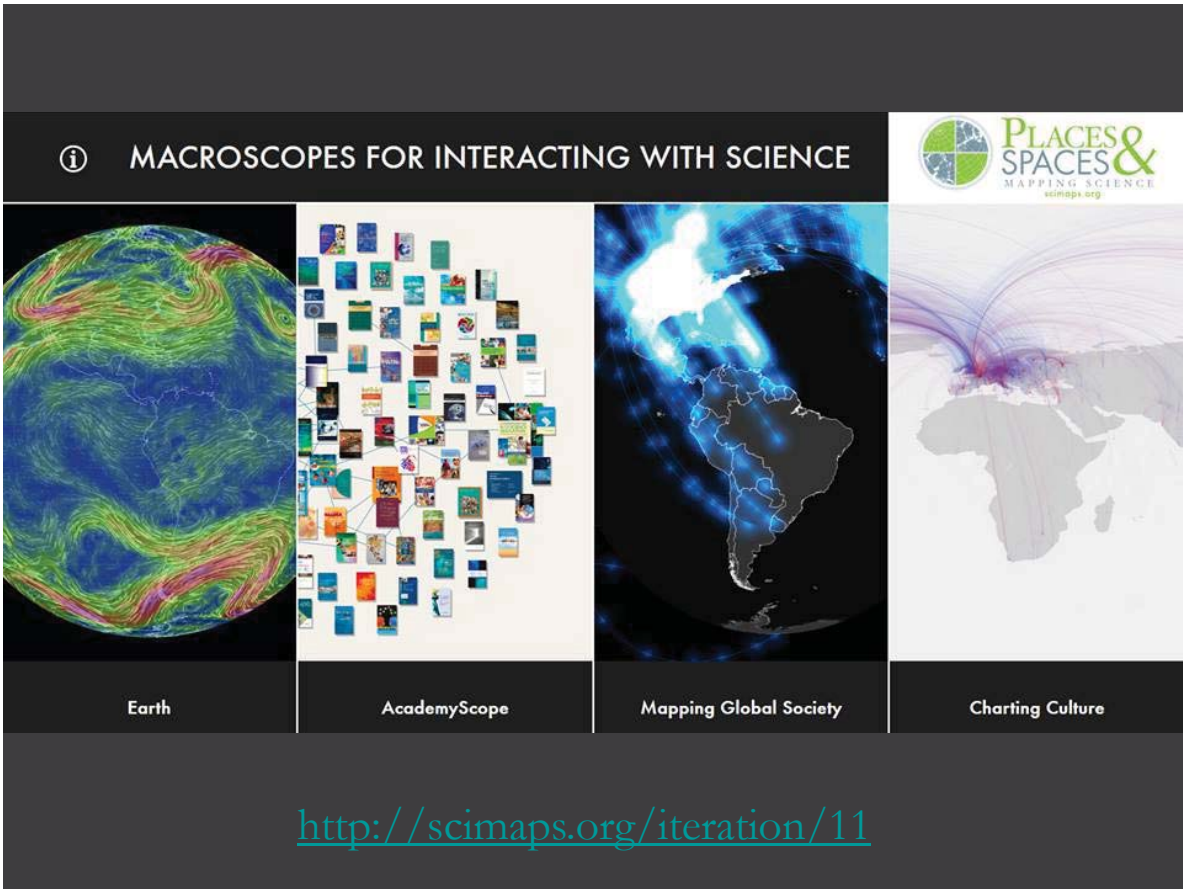
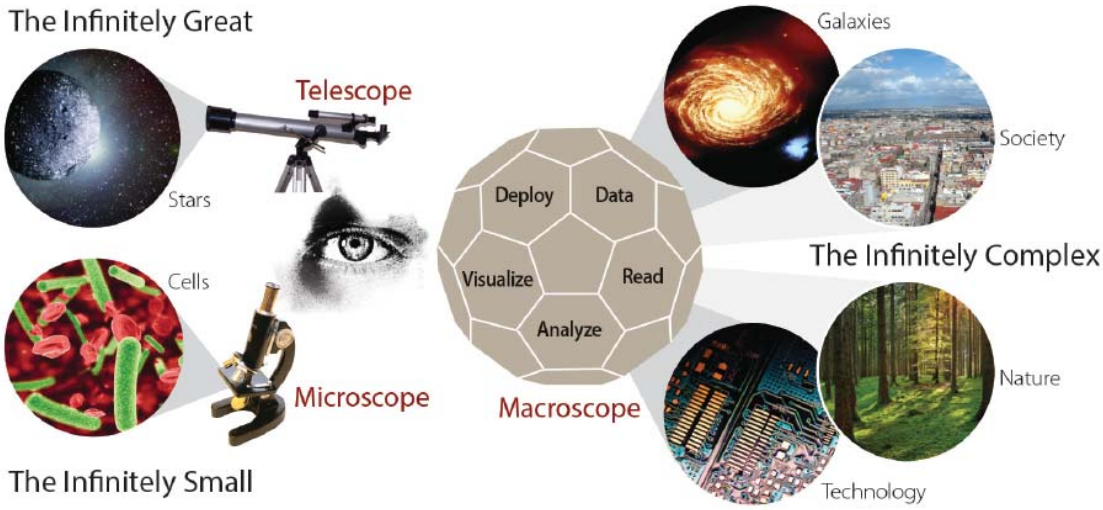
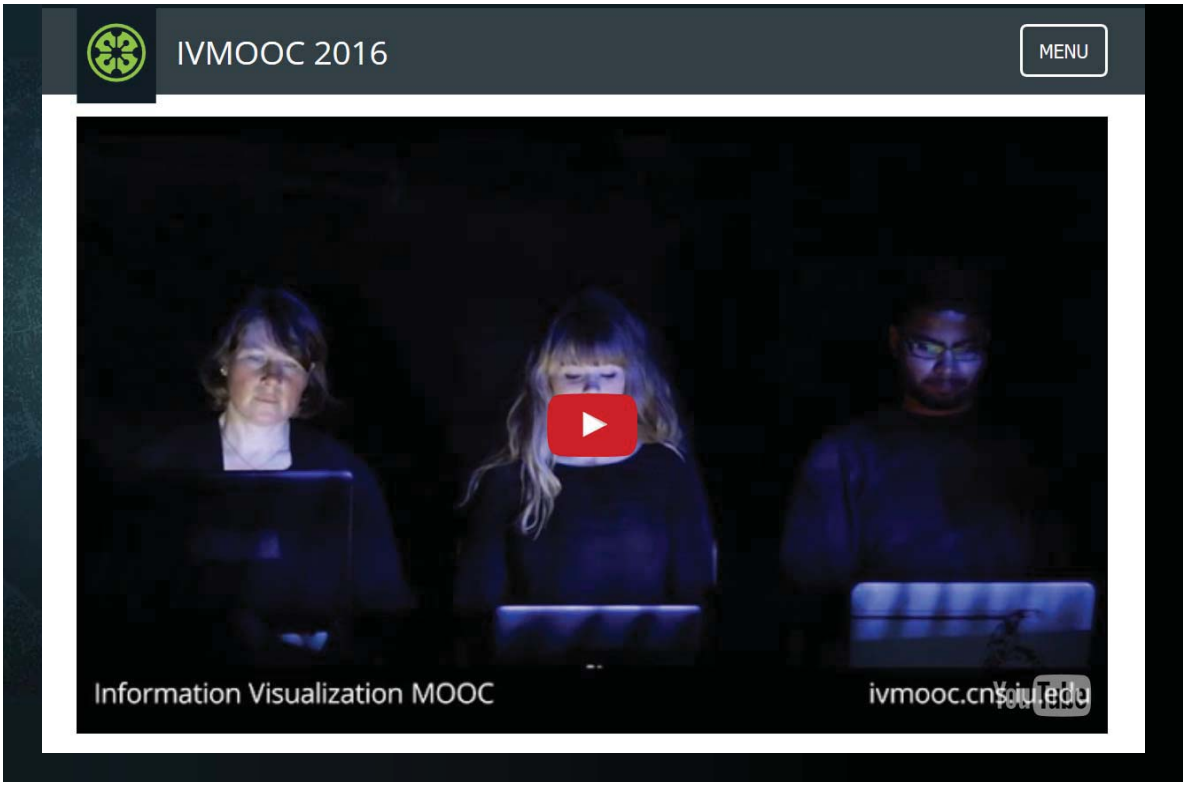
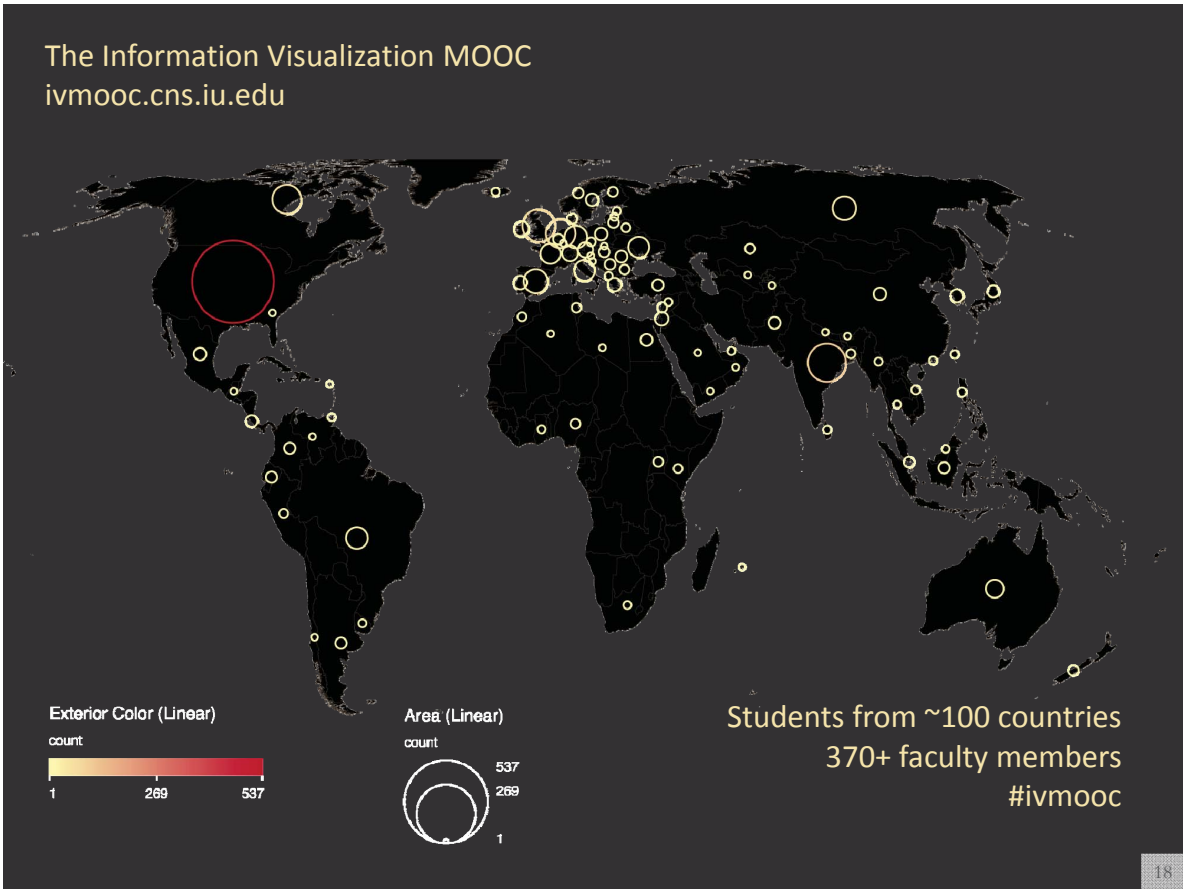


Microscopes, Telescopes, Macroscopes Plug-and-Play Macroscopes





Register for free: http://ivmooc.cns.iu.edu. Class restarts Jan 12, 2016.



Course Schedule

Part 1: Theory and Hands-On

- **Session 1** – Workflow Design and Visualization Framework
- **Session 2** – "When:" Temporal Data
- **Session 3** – "Where:" Geospatial Data
- **Session 4** – "What:" Topical Data

Mid-Term

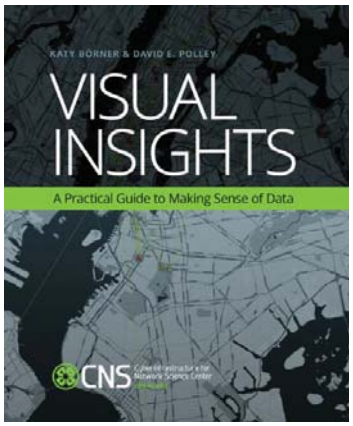
- **Session 5** – "With Whom:" Trees
- **Session 6** – "With Whom:" Networks
- **Session 7** – Dynamic Visualizations and Deployment

Final Exam

Part 2: Students work in teams on client projects.

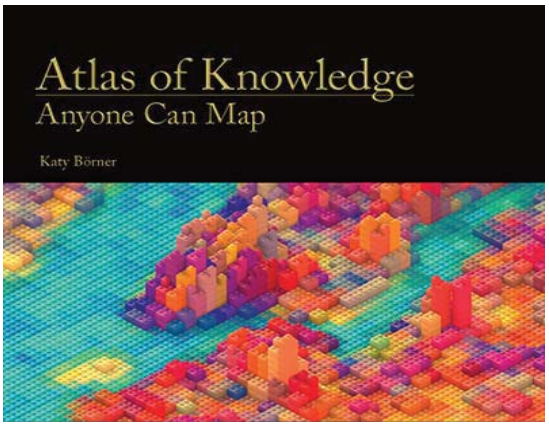
Final grade is based on Class Participation (10%), Midterm (30%), Final Exam (30%), and Client Project(30%).

Books Used in the IVMOOC



Teaches timely knowledge:

Advanced algorithms, tools, and hands-on workflows.



Teaches timeless knowledge:

Visualization framework—exemplified using generic visualization examples and pioneering visualizations.

Places & Spaces Exhibit at the David J. Sencer CDC Museum, Atlanta, GA
January 25-June 17, 2016

Seeing for Action - Using Maps and Graphs to Protect the Public's Health.

CDC Opening Event: Maps of Health
Tutorial and Symposium
February 4-5, 2016

PLACES & SPACES MAPPING SCIENCE

Curated by the Cyberinfrastructure for Network Science Center

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Hidalgo, César A., Bailey Klinger, Albert-László Barabási, and Ricardo Hausmann. 2007. See also The Product Space map from Phase I of *Places & Spaces*.

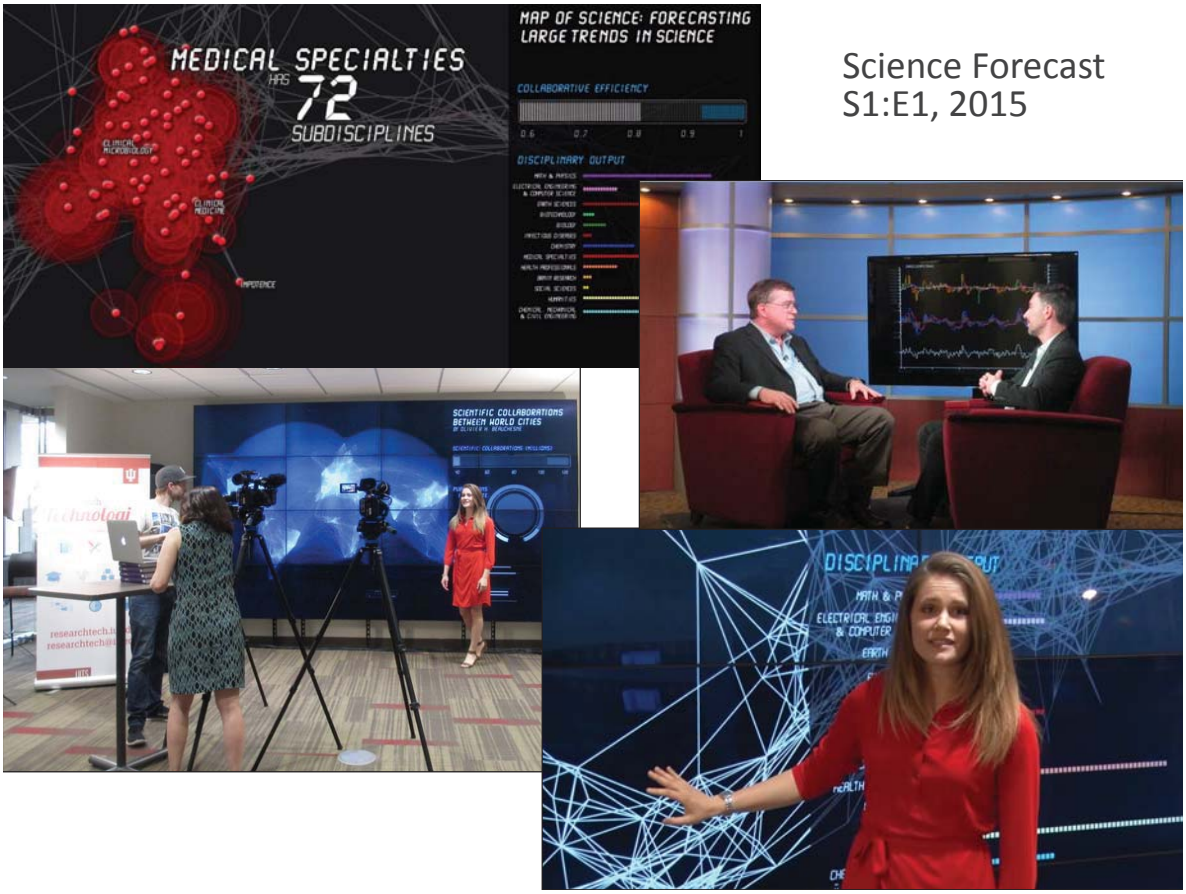
Call for Macroscope Tools for the *Places & Spaces: Mapping Science* Exhibit (2016) http://scimaps.org/call

Background and Goals

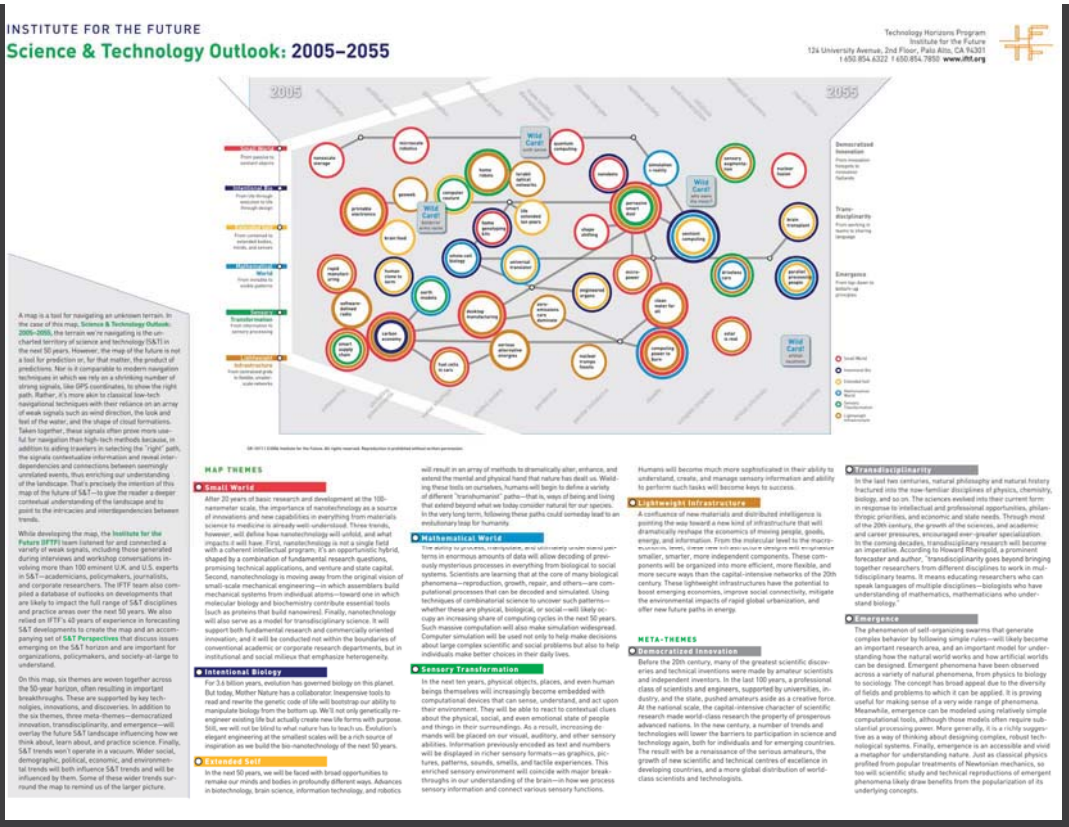
The *Places & Spaces: Mapping Science* exhibit was created to in
communicate human activity and scientific progress on a glol
that enable the close inspection of large-scale maps in public
conferences; (2) novel, interactive macroscope tools that let

Themes for the upcoming iterations/years are:

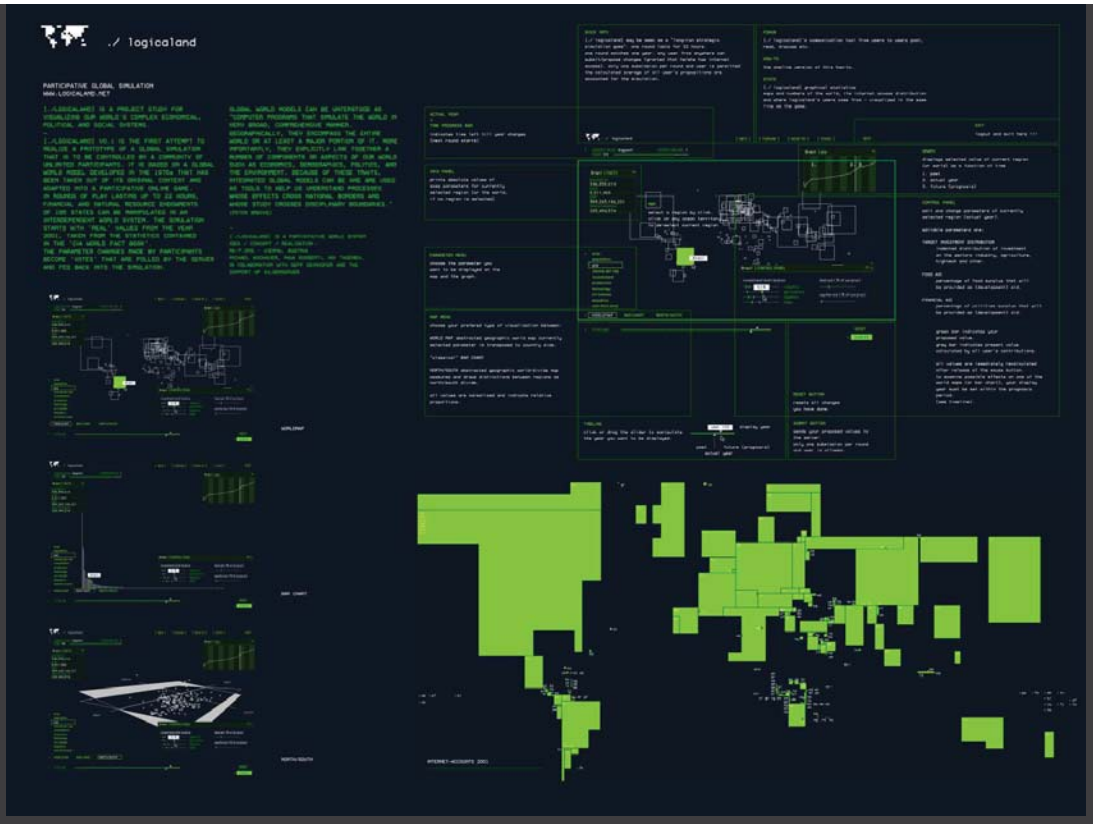
- 11th Iteration (2015): Macroscopes for Interacting With Science
- 12th Iteration (2016): Macroscopes for Making Sense of Science
- 13th Iteration (2017): Macroscopes for Forecasting Science
- 14th Iteration (2018): Macroscopes for Economic Decision Makers
- 15th Iteration (2019): Macroscopes for Science Policy Makers



Science Forecast
S1:E1, 2015



Science & Technology Outlook: 2005-2055 - Alex Soojung-Kim Pang, David Pescovitz, Marina Gorbis, Jean Hagan - 2006



Logicland Participative Global Simulation - Michael Ashauer, Maia Gusberti, Nik Thoenen - 2002

This conference is co-funded by the NSF Science of Science and Innovation Policy (SciSIP) program. It brings together international experts and practitioners that develop and apply mathematical, statistical, and computational models to increase our understanding of the structure and dynamics of science, technology and innovation, see details at http://modsti.cns.iu.edu.

References

Börner, Katy, Chen, Chaomei, and Boyack, Kevin. (2003). **Visualizing Knowledge Domains.** In Blaise Cronin (Ed.), *ARIST*, Medford, NJ: Information Today, Volume 37, Chapter 5, pp. 179-255. http://ivl.slis.indiana.edu/km/pub/2003-borner-arist.pdf

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). http://www.pnas.org/content/vol101/suppl_1/

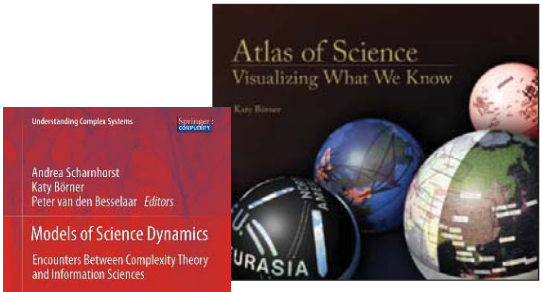
Börner, Katy (2010) **Atlas of Science: Visualizing What We Know**. The MIT Press. http://scimaps.org/atlas

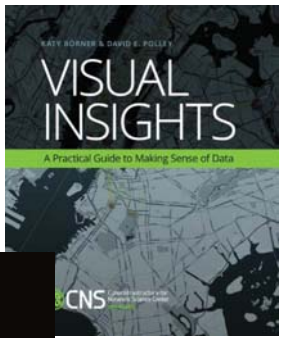
Scharnhorst, Andrea, Börner, Katy, van den Besselaar, Peter (2012) **Models of Science Dynamics**. Springer Verlag.

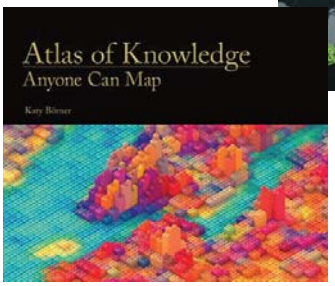
Katy Börner, Michael Conlon, Jon Corson-Rikert, Cornell, Ying Ding (2012) **VIVO: A Semantic Approach to Scholarly Networking and Discovery**. Morgan & Claypool.

Katy Börner and David E Polley (2014) **Visual Insights: A Practical Guide to Making Sense of Data**. The MIT Press.

Börner, Katy (2015) **Atlas of Knowledge: Anyone Can Map**. The MIT Press. http://scimaps.org/atlas2







All papers, maps, tools, talks, press are linked from http://cns.iu.edu
These slides are at http://cns.iu.edu/docs/presentations

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