Multi-Scale Maps of Scholarly Activity

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Chemical Information Section Luncheon at the
American Chemical Society Meeting, Indianapolis, IN.

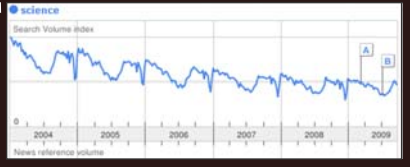
September 10, 2013

Terra bytes of data

Descriptive & Predictive Models

Find your way

Find collaborators, friends



Identify trends

Places & Spaces: Mapping Science
scimaps.org

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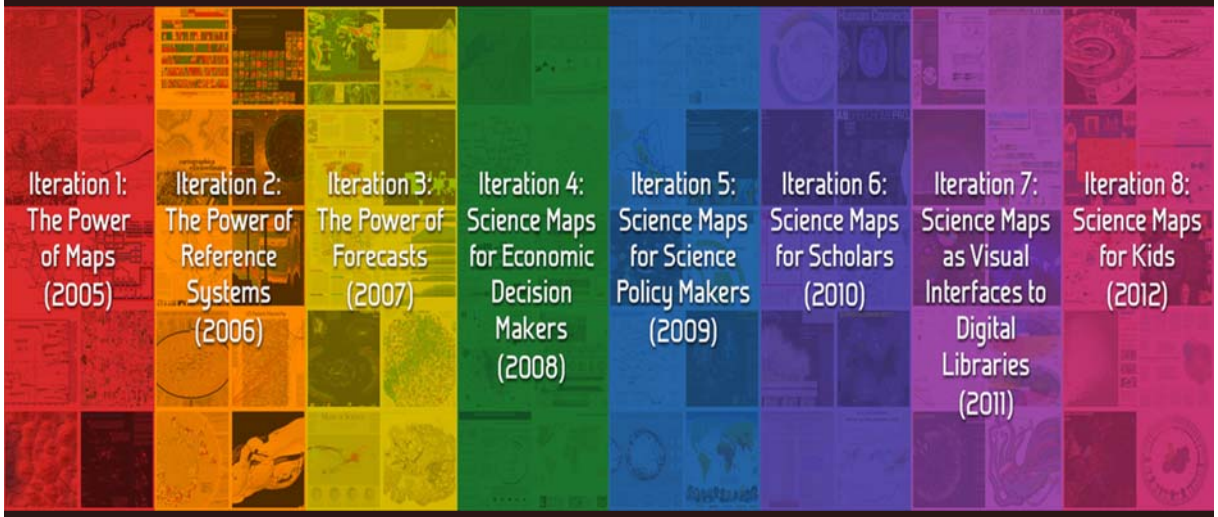
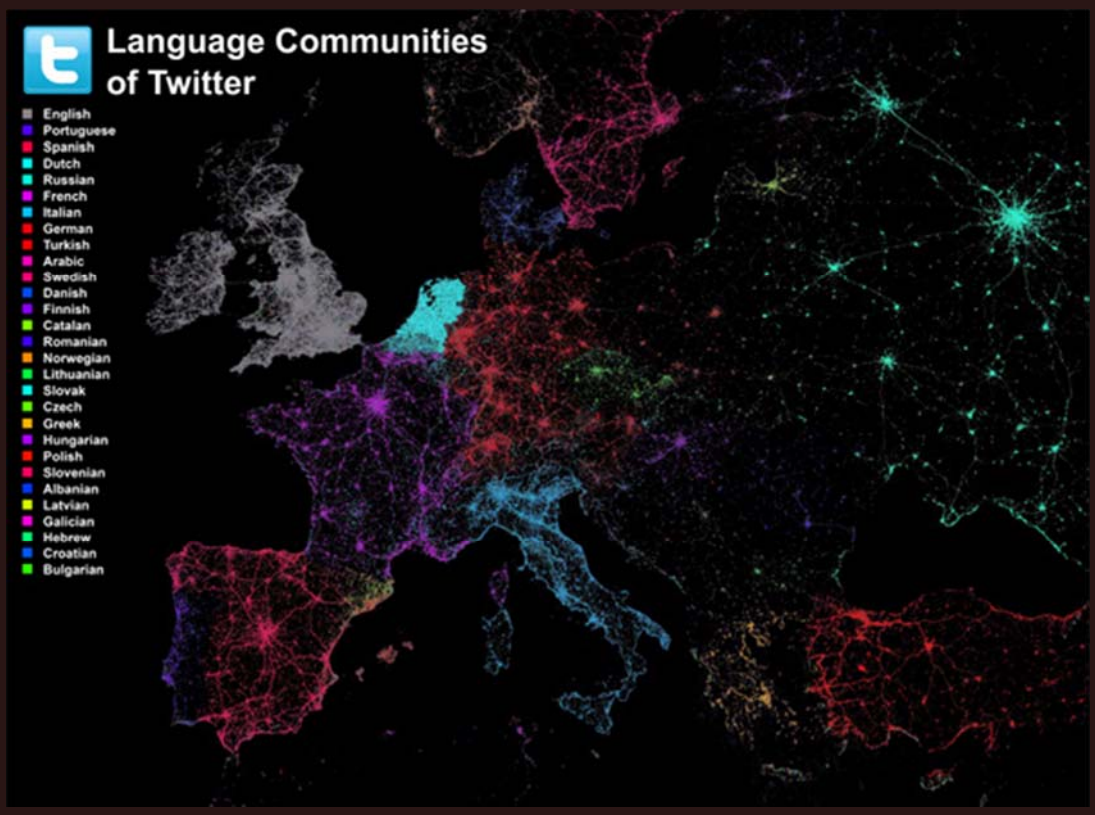
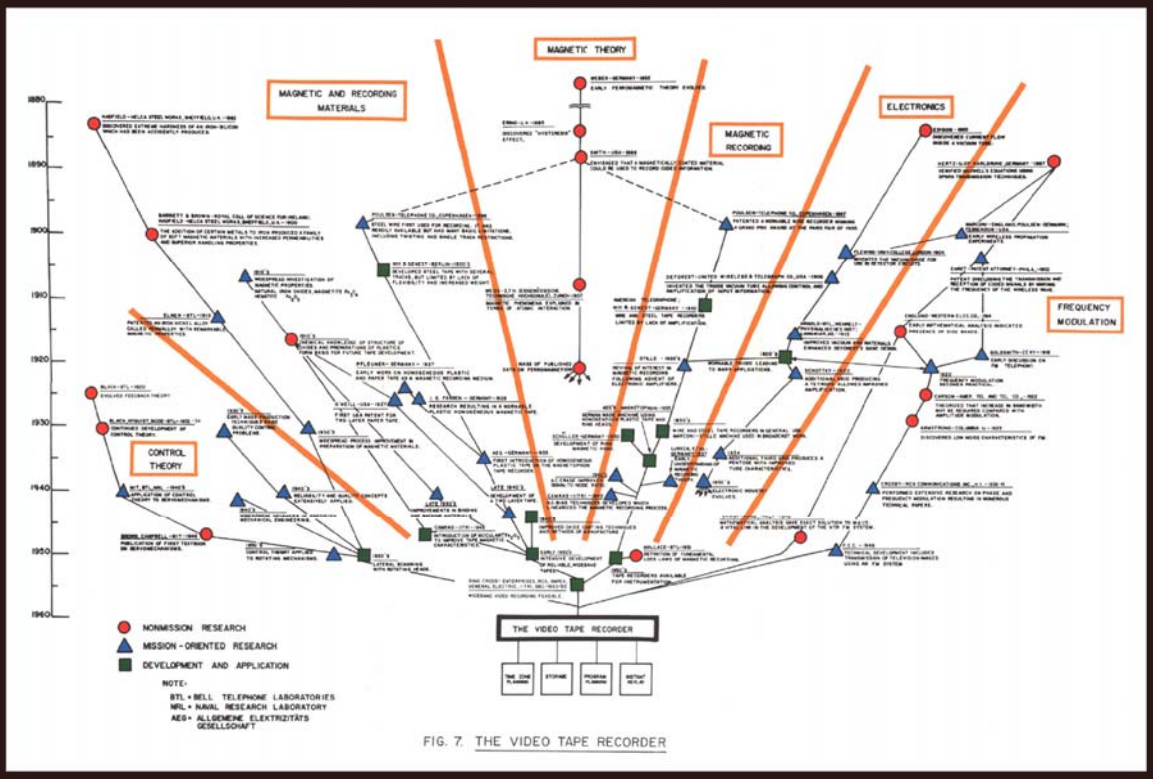
scimaps.org

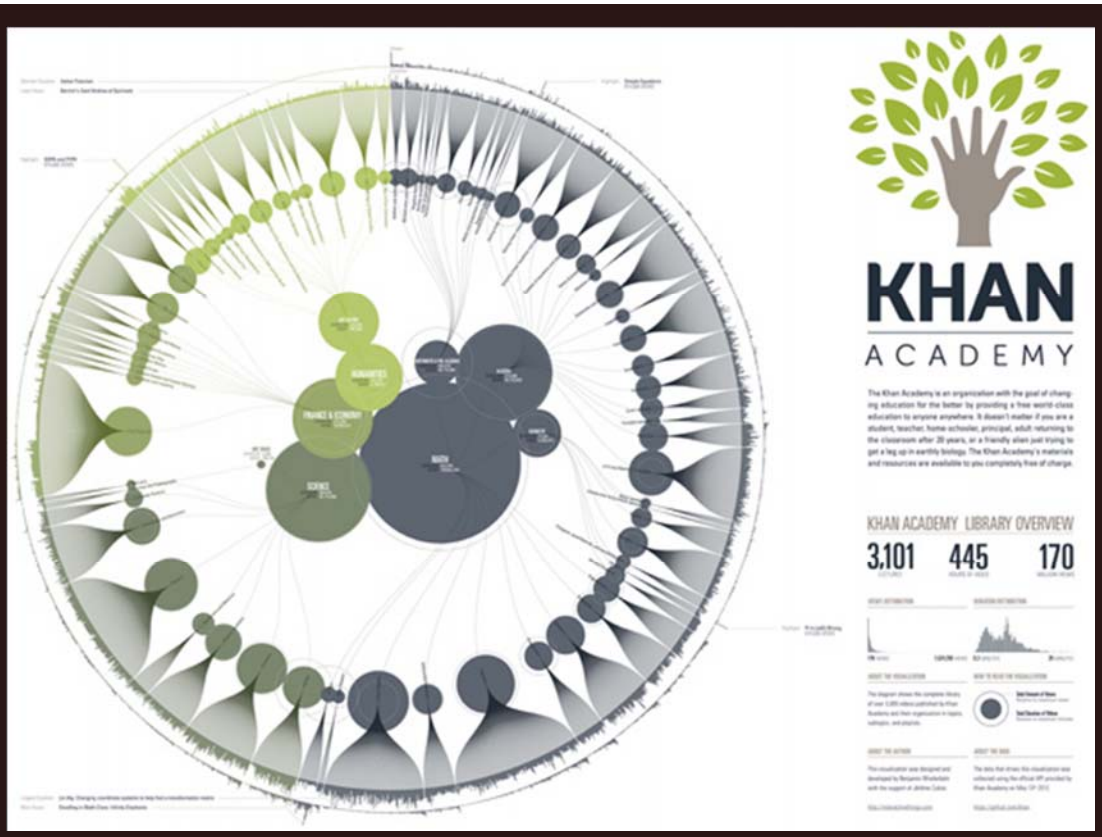




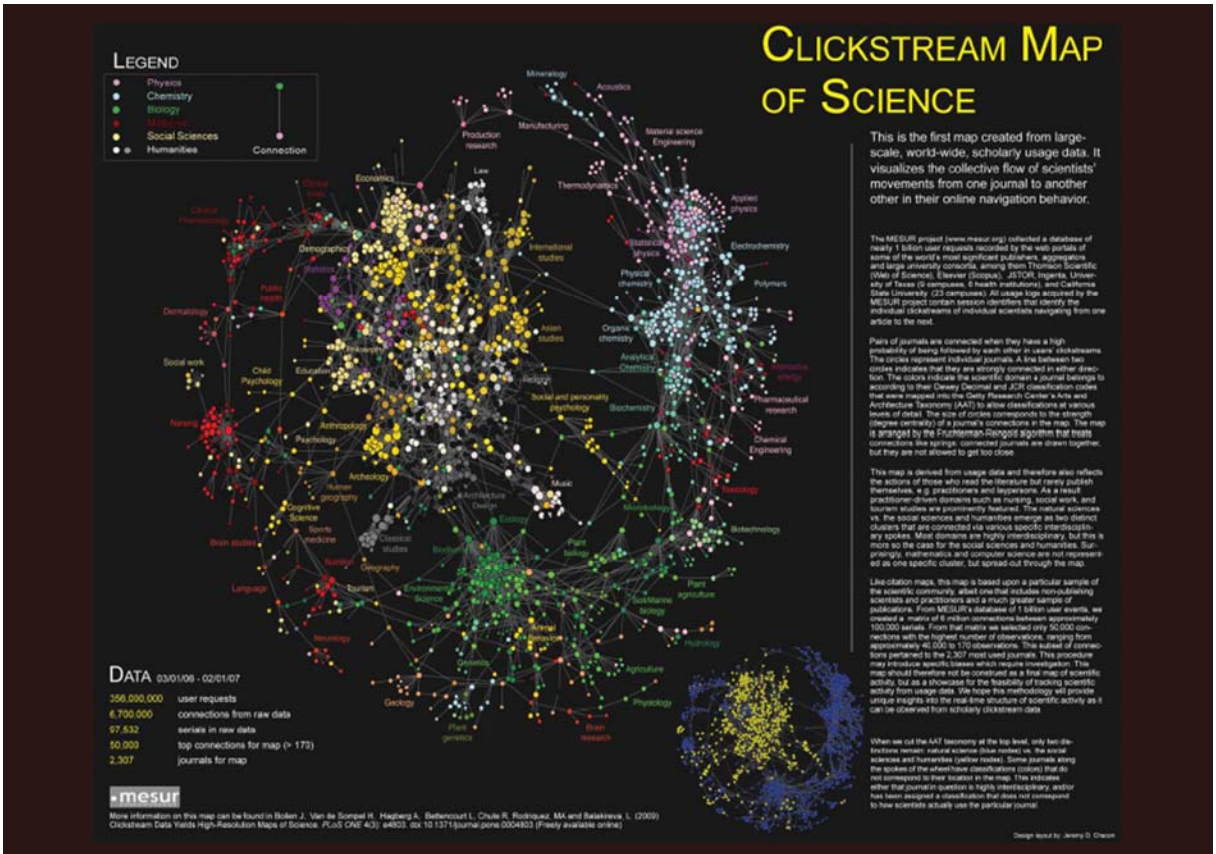
Eric Fischer. 2012. Language Communities of Twitter.



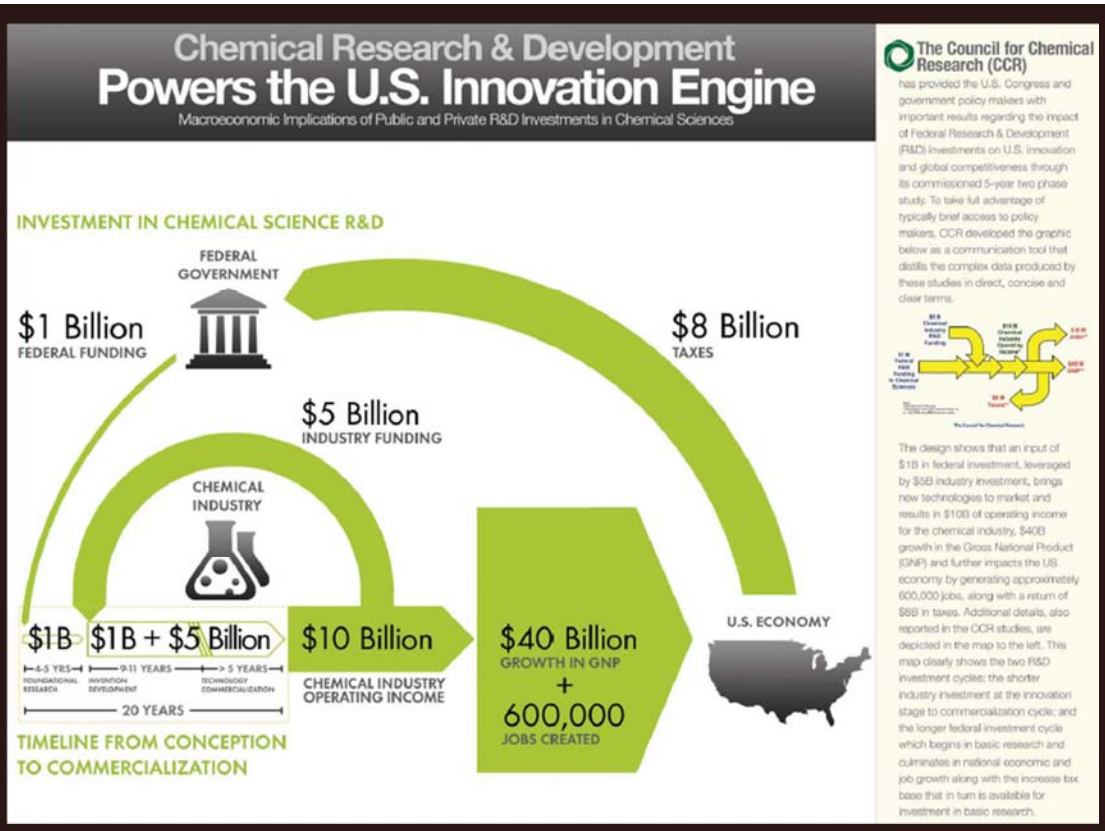
G. Benn and Francis Narin. 1968. Tracing of Key Events in the Development of the Video Tape Recorder



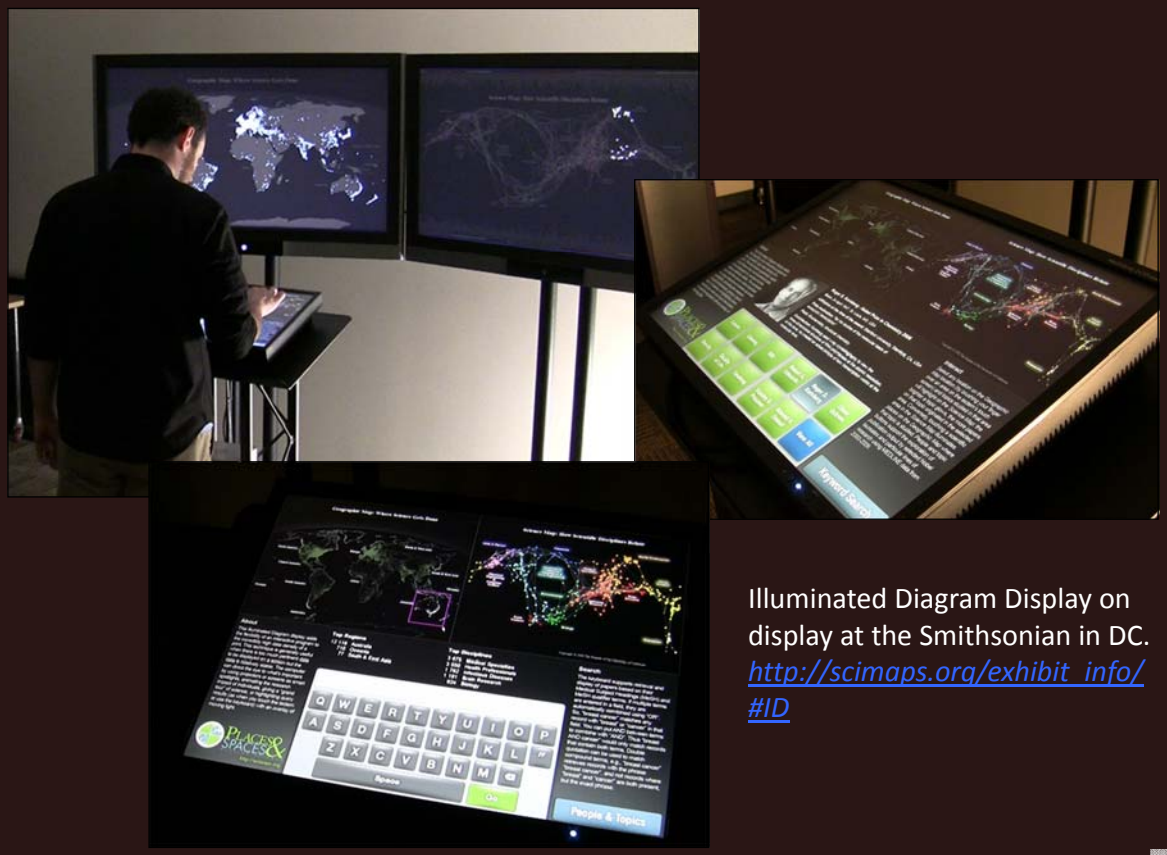
Benjamin Wiederkehr and Jérôme Cukier. 2012. Khan Academy Library Overview.



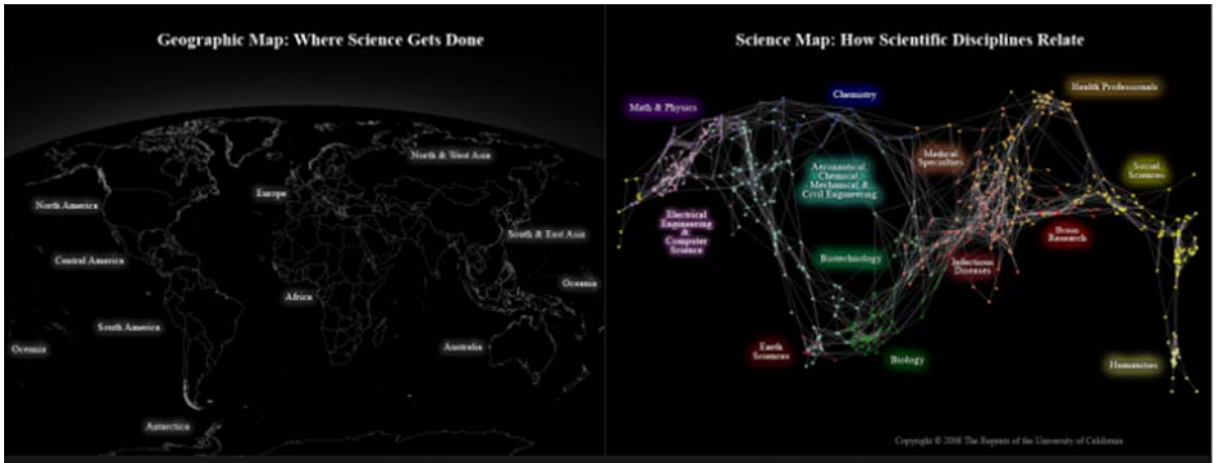
Bollen, Johan, Herbert Van de Sompel, Aric Hagberg, Luis M.A. Bettencourt, Ryan Chute, Marko A. Rodriquez, Lyudmila Balakireva. 2008. A Clickstream Map of Science.



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



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

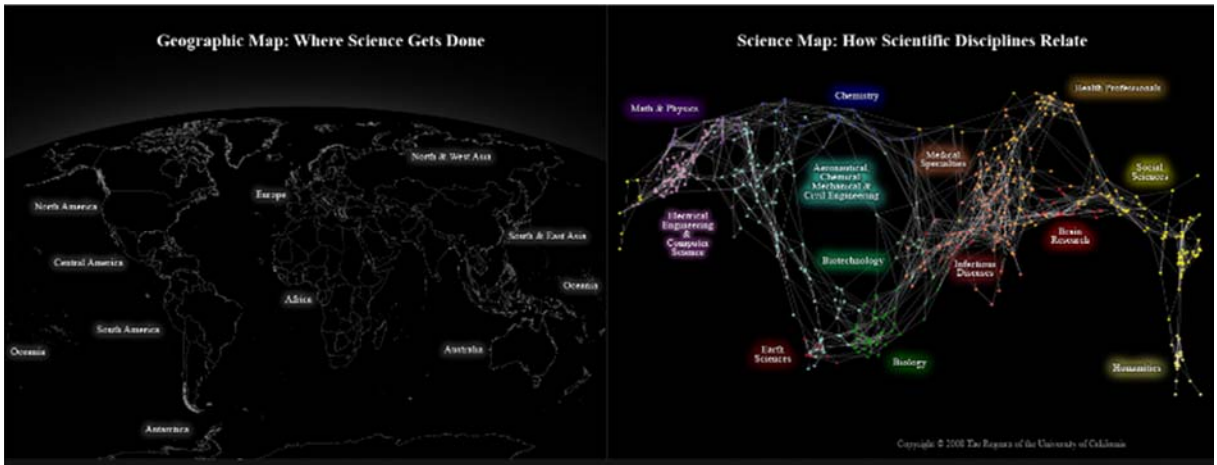
Input your search query here.

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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PLACES & SPACES
http://scimaps.org

Elinor Ostrom - Nobel Prize in Economic Sciences 2009

Born: 7 August 1933, New York, NY, USA

Affiliation at the time of the award: Indiana University, Bloomington, IN, USA; Arizona State University, Tempe, AZ, USA

Prize motivation: "for her analysis of economic governance, especially the commons"

Field: Economic governance

Contribution: Challenged the conventional wisdom by demonstrating how local property can be successfully managed by local commons without any regulation by central authorities or privatization.

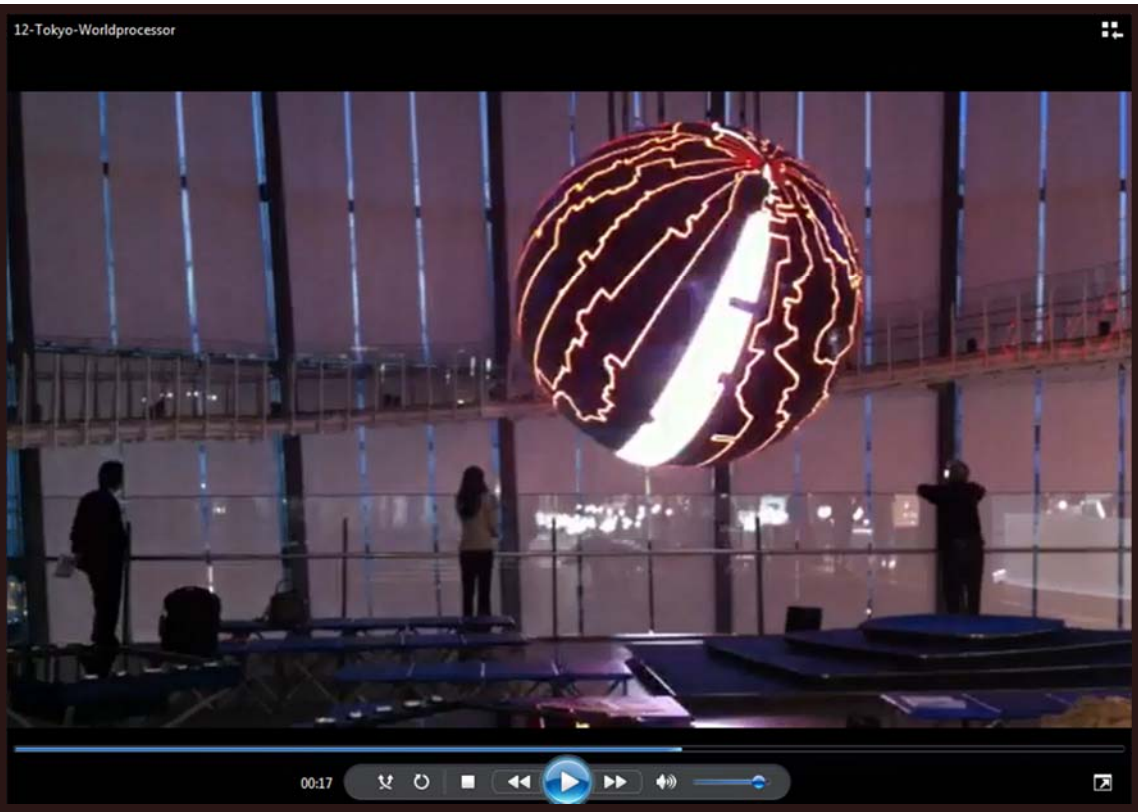
Cancer | Cloning | HIV | Robert G. Edwards | Roger D. Kornberg | Elinor Ostrom

Obesity | Quality of Life | Smoking | Stanley B. Prusiner | Ahmed H. Zewail | View All

Interact

Select any location on the *Geographic Map* location (by brushing your finger over an area on the lectern's touch screen) and topics studied in that area will highlight on the *Science Map*: the brighter a topic glows, the more papers on that topic originated in the selected area. Converstely, touching a scientific area in the *Science Map* illuminates places on the *Geographic Map* where that topic is studied. People and topic buttons support the exploration of publication output by selected Noble laureates and particular lines of research using MEDLINE data from 2000-2009.

Keyword Search



Ingo Gunther's Worldprocessor globe design on display at the Giant Geo Cosmos OLED Display at the Museum of Emerging Science and Innovation in Tokyo, Japan

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

Debut of 5th Iteration of Mapping Science Exhibit at MEDIA X was on May 18, 2009 at Wallenberg Hall, Stanford University, *http://mediax.stanford.edu*, *http://scaleindependentthought.typepad.com/photos/scimaps*

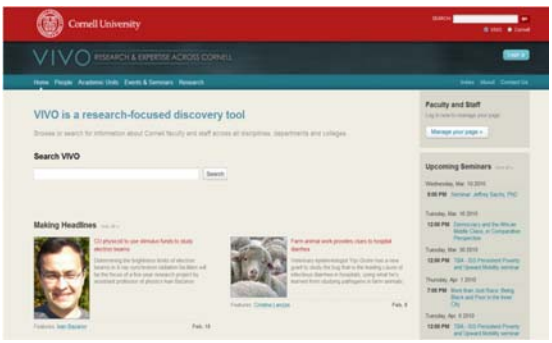
Places & Spaces *Digital Display in North Carolina State's brand new Immersion Theater*

VIVO International Researcher Network

VIVO
Enabling a National Network of Scientists

VIVO: A Semantic Approach to Creating a National Network of Researchers (http://vivoweb.org)

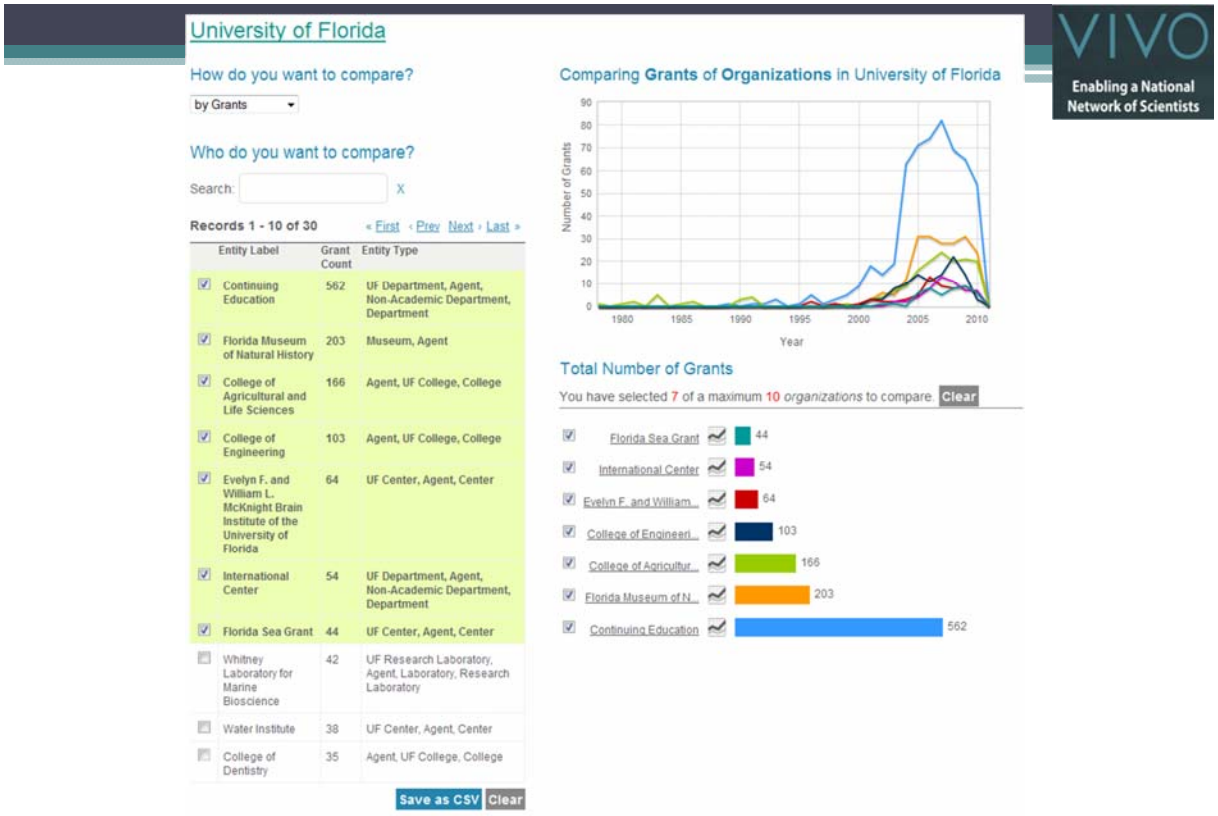
- Semantic web application and ontology editor originally developed at Cornell U.
- Integrates research and scholarship info from systems of record across institution(s).
- Facilitates research discovery and cross-disciplinary collaboration.
- Simplify reporting tasks, e.g., generate biosketch, department report.



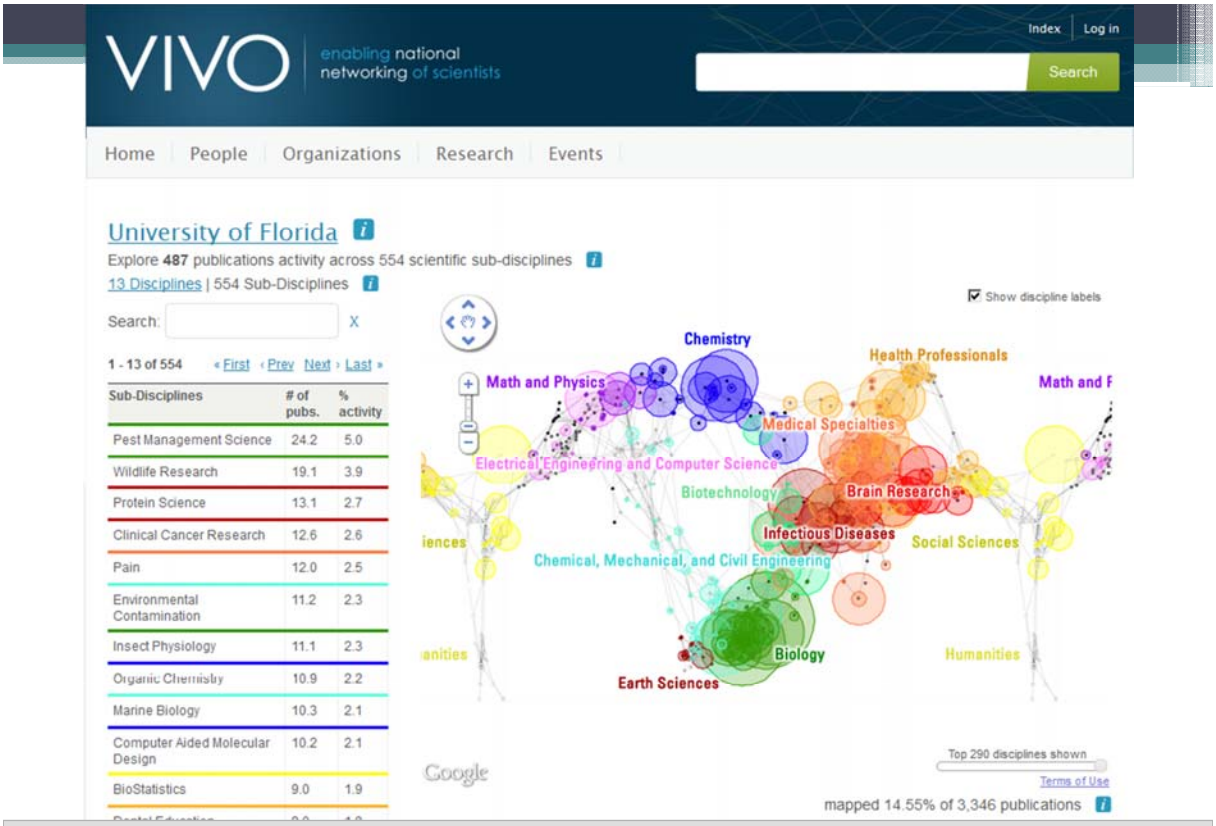
Funded by $12 million NIH award.

Cornell University: Dean Krafft (Cornell PI), Manolo Bevia, Jim Blake, Nick Cappadona, Brian Caruso, Jon Corson-Rikert, Elly Cramer, Medha Devare, John Fereira, Brian Lowe, Stella Mitchell, Holly Mistlebauer, Anup Sawant, Christopher Westling, Rebecca Younes. **University of Florida:** Mike Conlon (VIVO and UF PI), Cecilia Botero, Kerry Britt, Erin Brooks, Amy Buhler, Ellie Bushhousen, Chris Case, Valrie Davis, Nita Ferree, Chris Haines, Rae Jesano, Margeaux Johnson, Sara Kreinest, Yang Li, Paula Markes, Sara Russell Gonzalez, Alexander Rockwell, Nancy Schaefer, Michele R. Tennant, George Hack, Chris Barnes, Narayan Raum, Brenda Stevens, Alicia Turner, Stephen Williams. **Indiana University**: Katy Borner (IU PI), William Barnett, Shanshan Chen, Ying Ding, Russell Duhon, Jon Dunn, Micah Linnemeier, Nianli Ma, Robert McDonald, Barbara Ann O'Leary, Mark Price, Yuyin Sun, Alan Walsh, Brian Wheeler, Angela Zoss. **Ponce School of Medicine:** Richard Noel (Ponce PI), Ricardo Espada, Damaris Torres. **The Scripps Research Institute:** Gerald Joyce (Scripps PI), Greg Dunlap, Catherine Dunn, Brant Kelley, Paula King, Angela Murrell, Barbara Noble, Cary Thomas, Michaeleen Trimarchi. **Washington University, St. Louis**: Rakesh Nagarajan (WUSTL PI), Kristi L. Holmes, Sunita B. Koul, Leslie D. McIntosh. **Weill Cornell Medical College:** Curtis Cole (Weill PI), Paul Albert, Victor Brodsky, Adam Cheriff, Oscar Cruz, Dan Dickinson, Chris Huang, Itay Klaz, Peter Michelini, Grace Migliorisi, John Ruffing, Jason Specland, Tru Tran, Jesse Turner, Vinay Varughese.

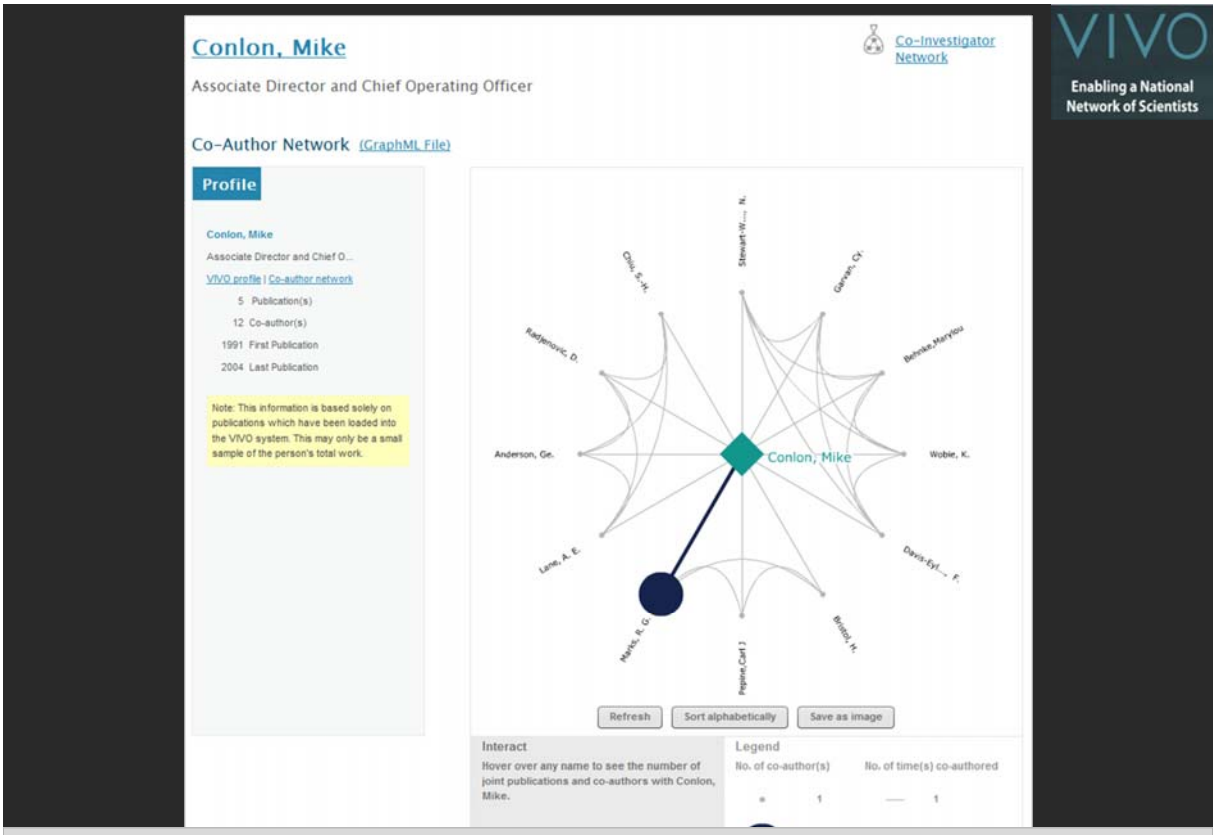
UF Clinical and Translational Science Institute
UNIVERSITY of FLORIDA



Temporal Analysis (When) Temporal visualizations of the number of papers/funding award at the institution, school, department, and people level



Topical Analysis (What) Science map overlays will show where a person, department, or university publishes most in the world of science. (in work)



Network Analysis (With Whom?) Who is co-authoring, co-investigating, co-inventing with whom? What teams are most productive in what projects?

http://nrn.cns.iu.edu

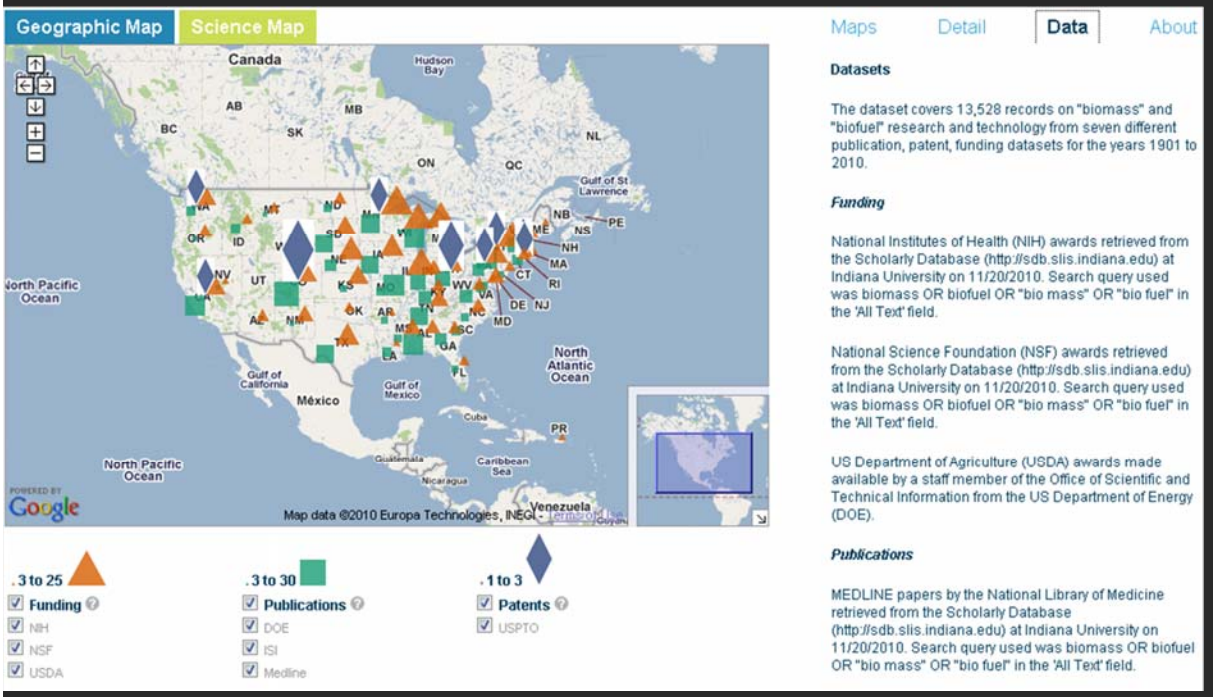
Geospatial Analysis (Where) Where is what science performed by whom? Science is global and needs to be studied globally.

VIVO
Enabling a National Network of Scientists

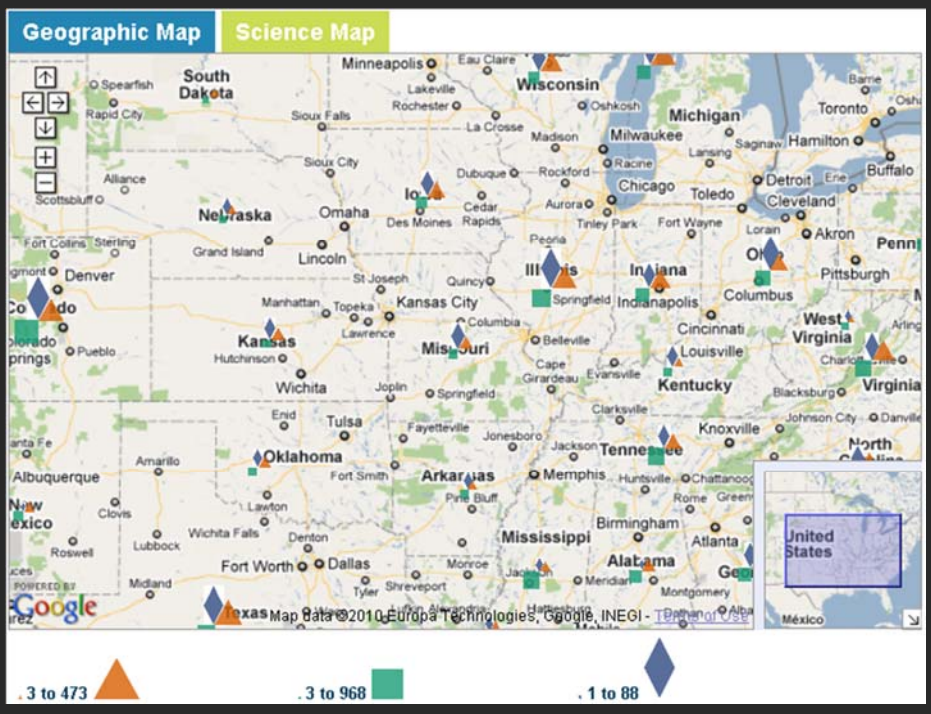
VIVO On-The-Go

Overview, Interactivity, Details on Demand
come to commonly used devices and environments

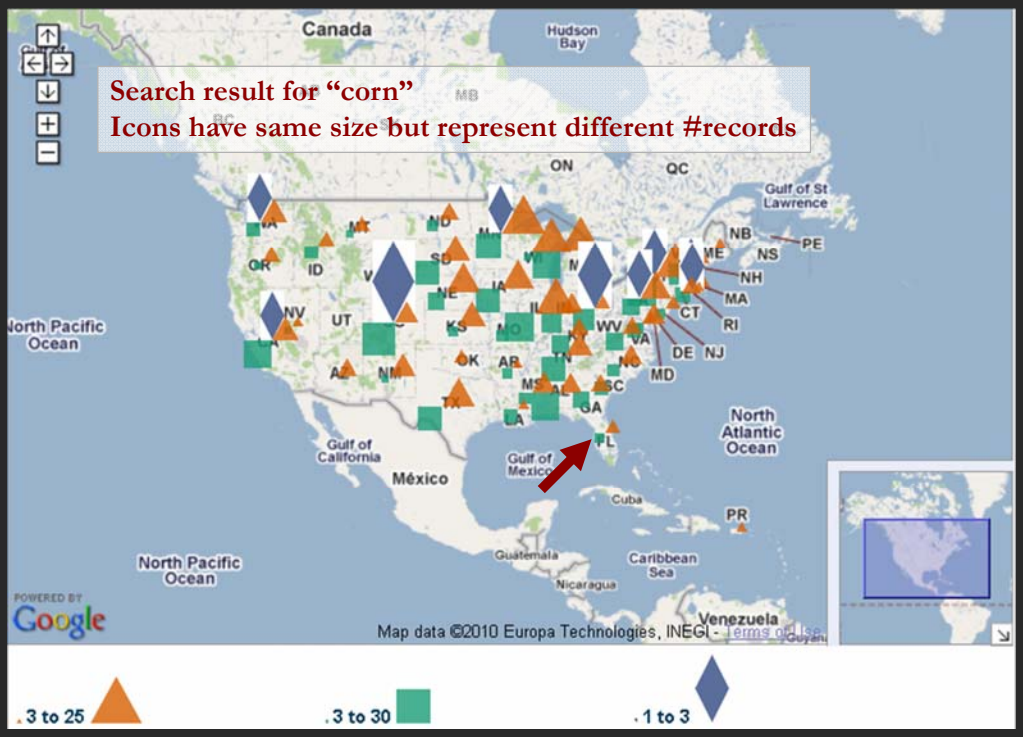
Online Interactive Maps for Sustainability Research and NIH

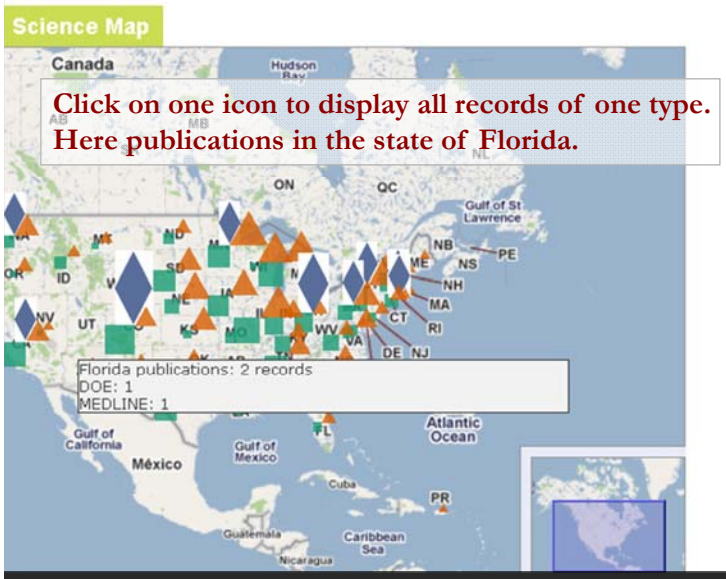


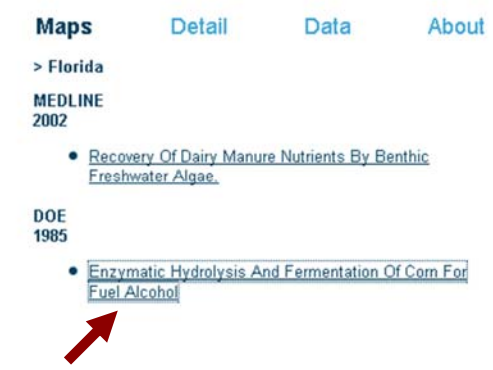
The geographic map at **state level**.

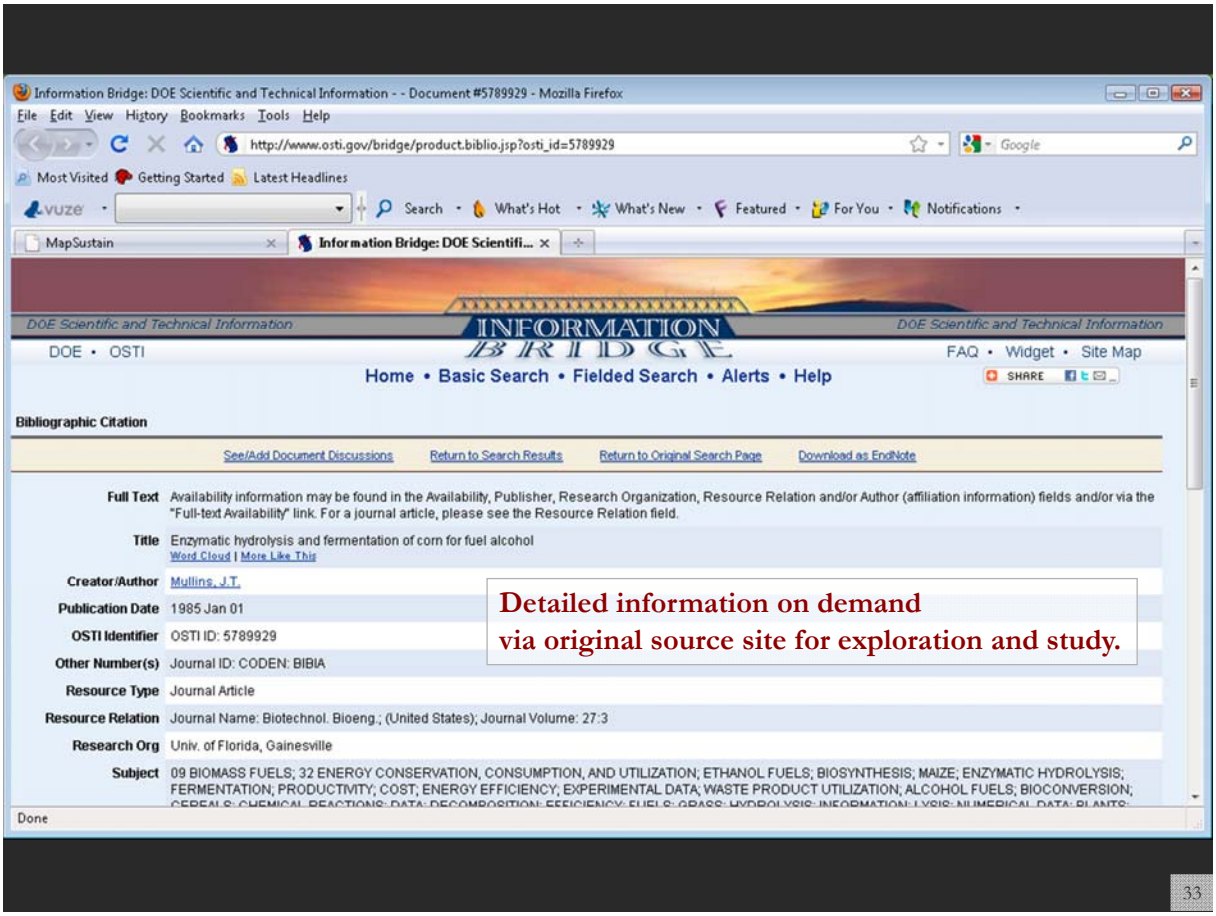


The geographic map at **city level**.

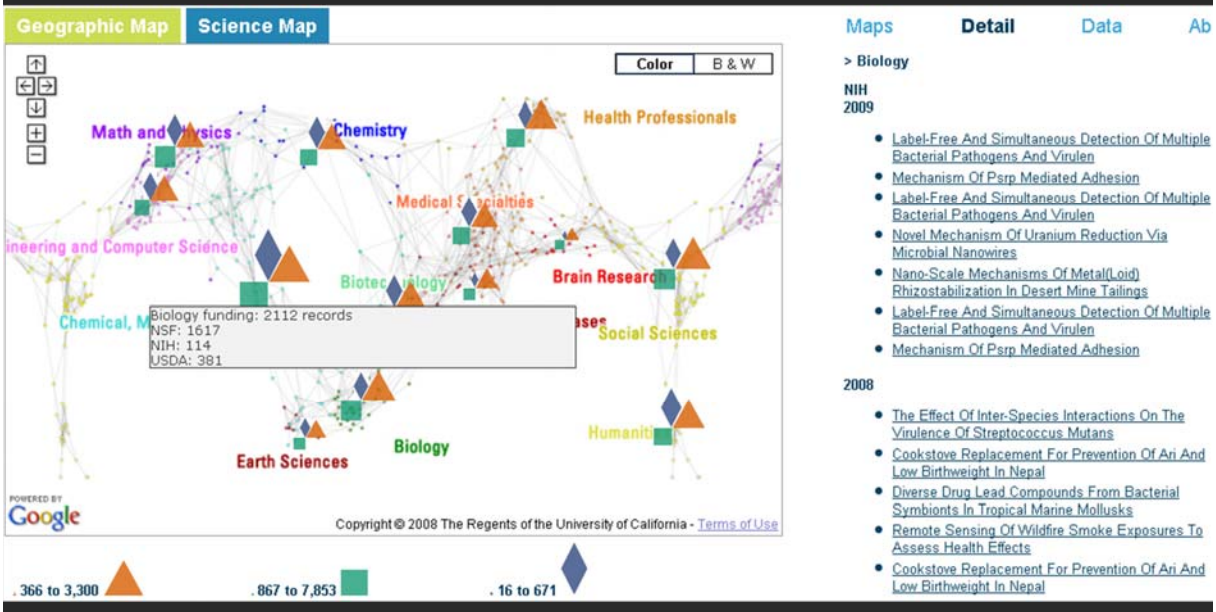

Search result for "corn"
Icons have same size but represent different #records
Canada
Hudson Bay
North Pacific Ocean
North Atlantic Ocean
Gulf of California
Gulf of Mexico
México
Cuba
PR
Guatemala
Caribbean Sea
Nicaragua
Venezuela
Map data ©2010 Europa Technologies, INEGI
.3 to 25
.3 to 30
.1 to 3


Science Map
Click on one icon to display all records of one type.
Here publications in the state of Florida.
Florida publications: 2 records
DOE: 1
MEDLINE: 1

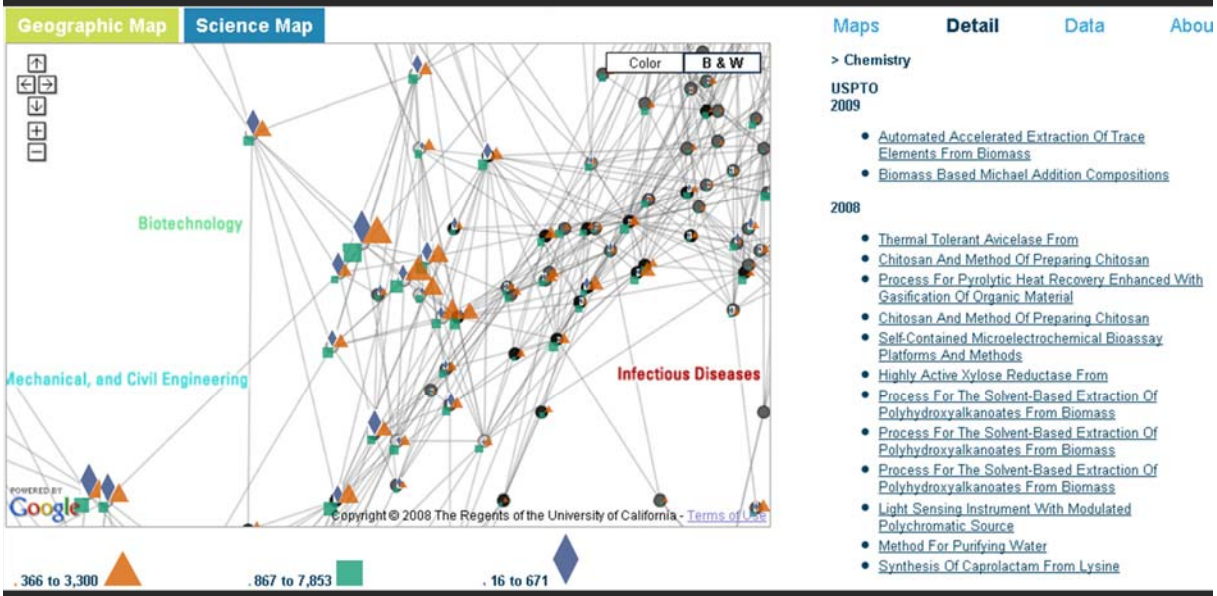

Maps
Detail
Data
About
> Florida
MEDLINE
2002
Recovery Of Dairy Manure Nutrients By Benthic Freshwater Algae.
DOE
1985
Enzymatic Hydrolysis And Fermentation Of Corn For Fuel Alcohol



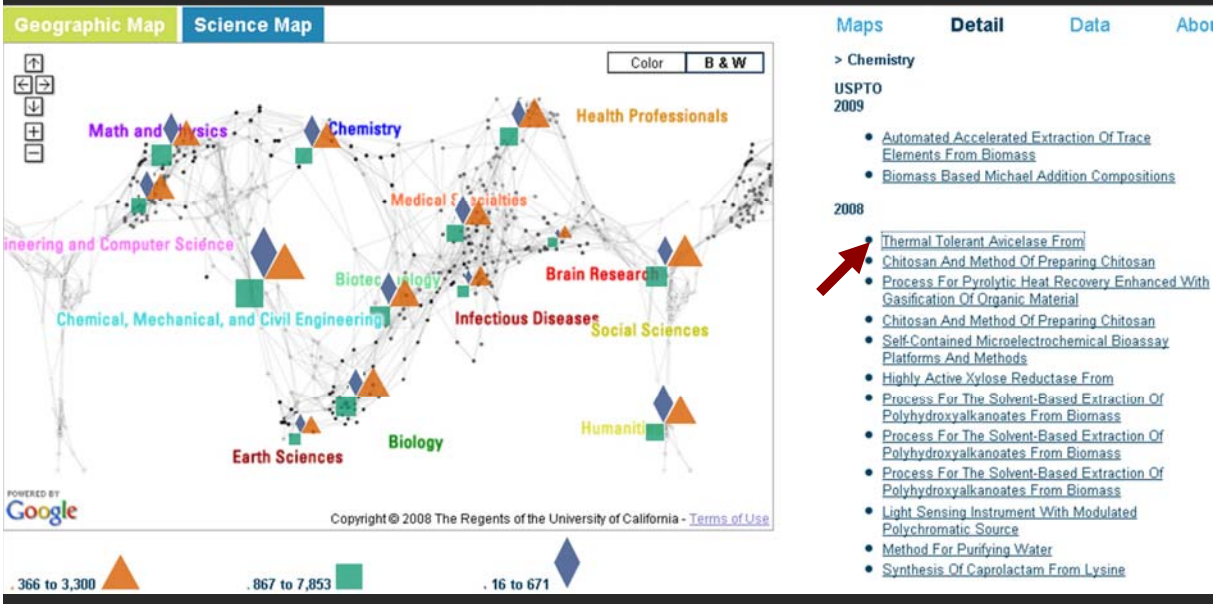
Detailed information on demand via original source site for exploration and study.

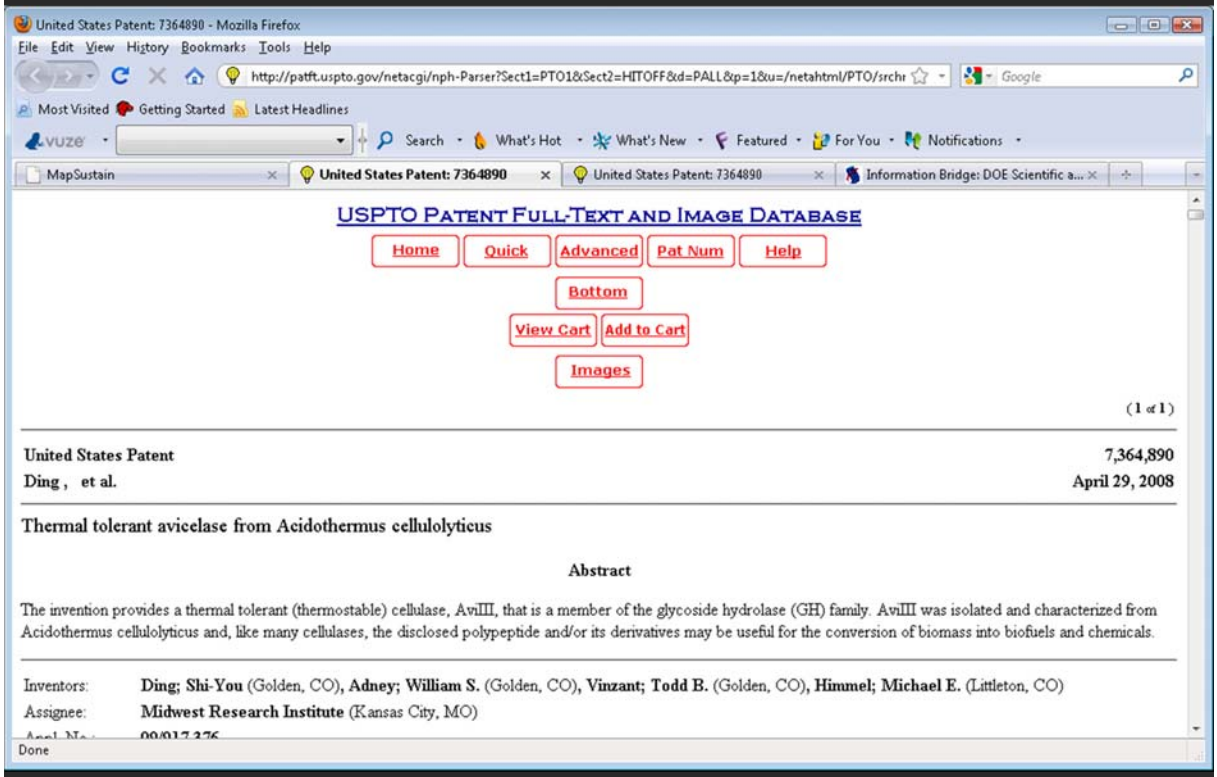


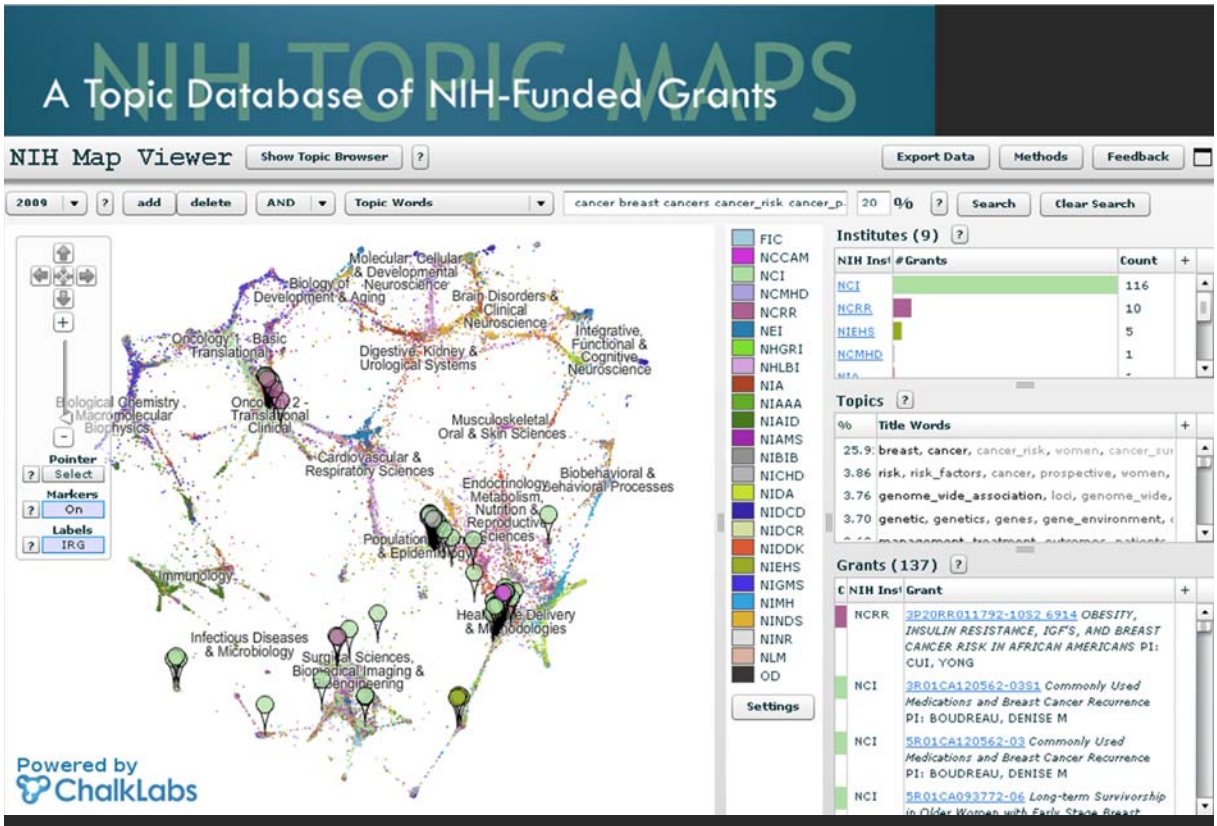
The science map at 13 top-level scientific **disciplines level**.



The science map at 554 **sub-disciplines level**.

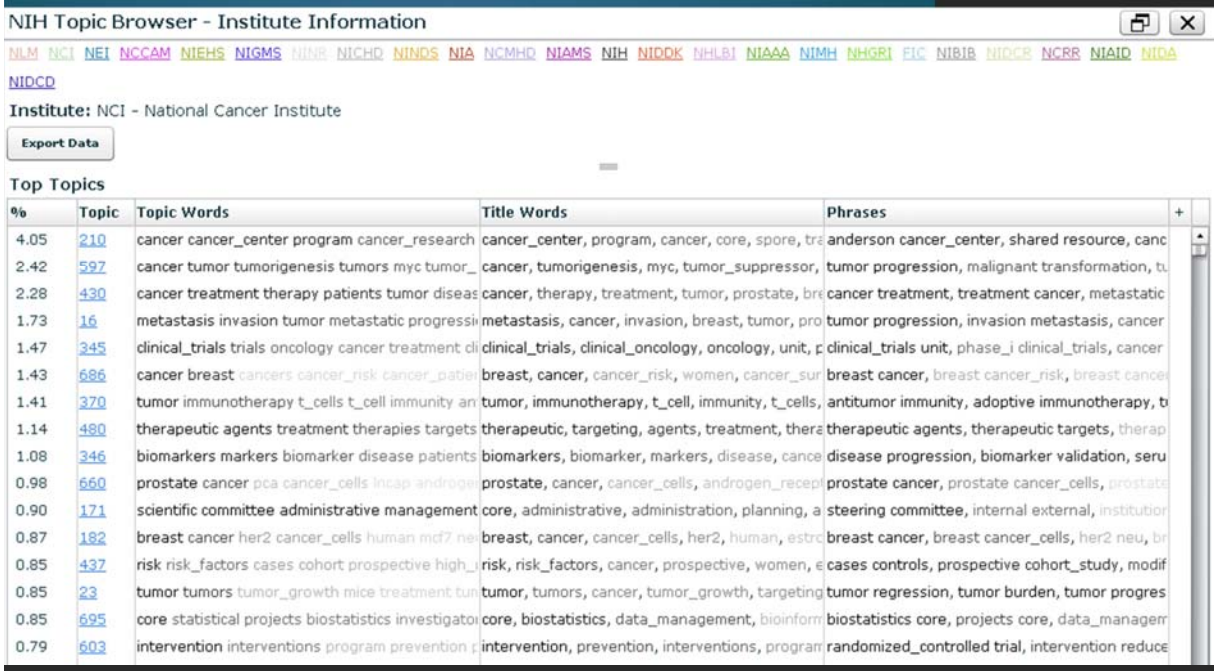






https://app.nihmaps.org

A Topic Database of NIH-Funded Grants



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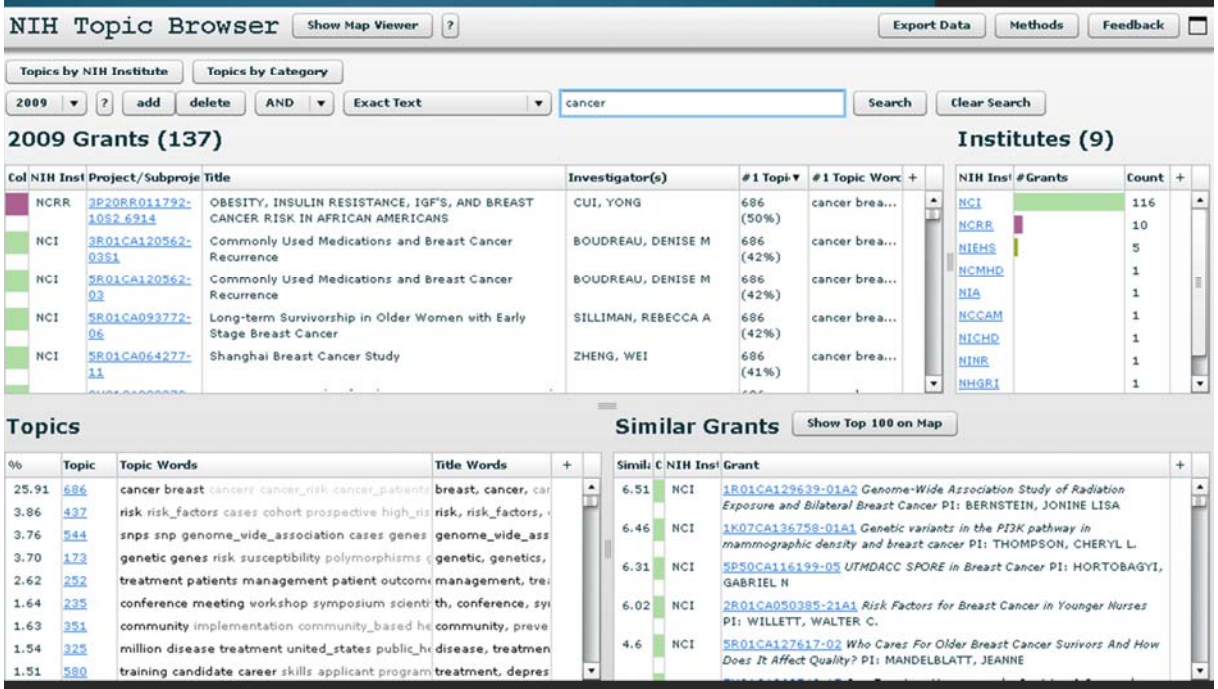

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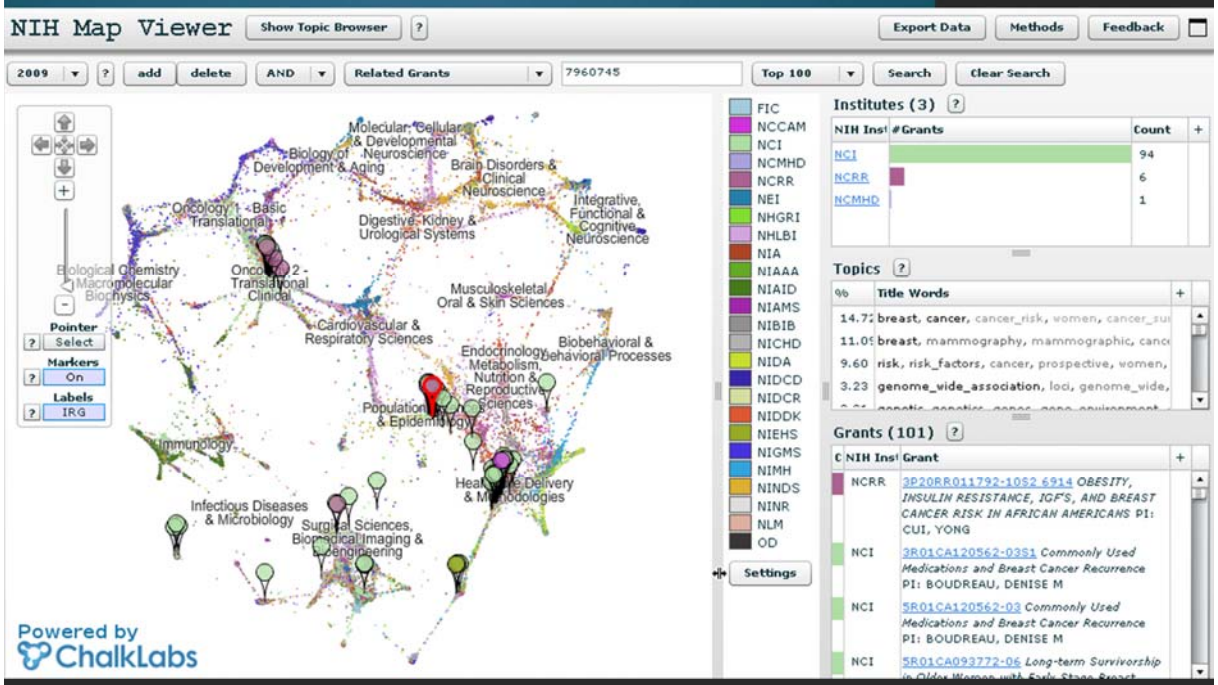
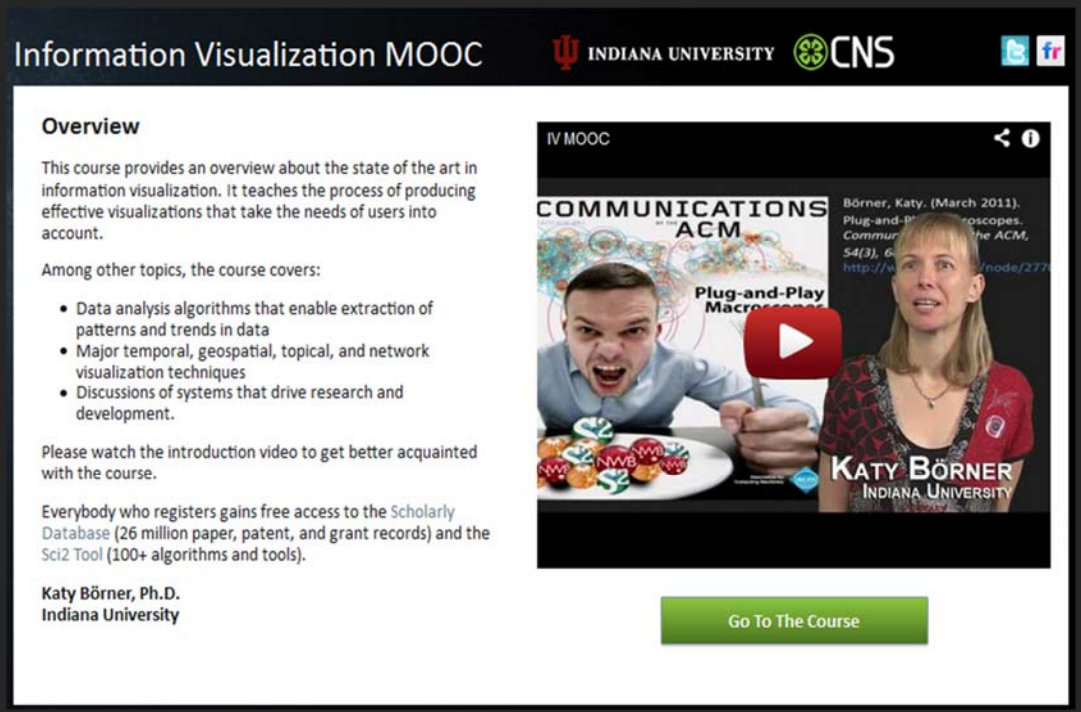


https://app.nihmaps.org

Anyone Can Cook

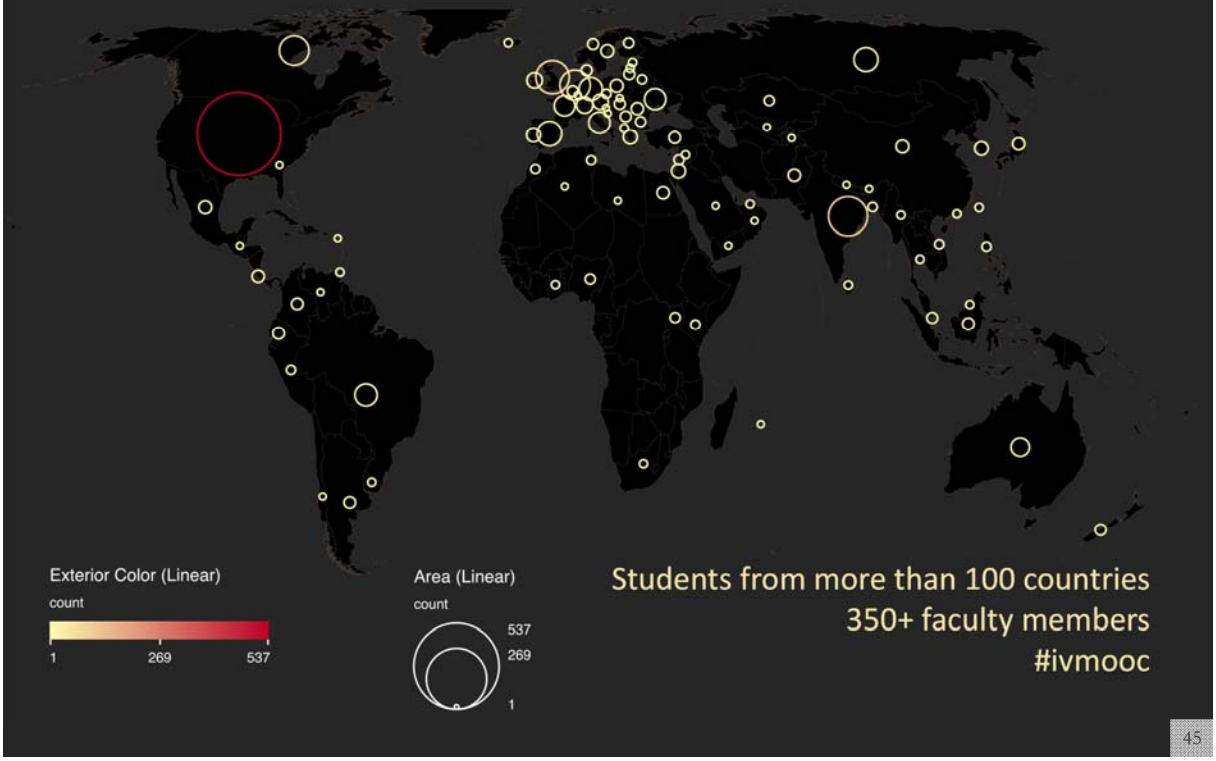
&

Anyone Can Map



ivmooc.cns.iu.edu

The Information Visualization MOOC
ivmooc.cns.iu.edu



45

Instructors

Katy Börner – Theory Parts
Instructor, Professor at SLIS

David E. Polley – Hands-on Parts
CNS Staff, Research Assistant with MIS/MLS
Teaches & Tests Sci2 Tool

Scott B. Weingart – Client Work
Assistant Instructor, SLIS PhD student

Course Schedule

- **Session 1** – Workflow design and visualization framework
- **Session 2** – "When:" Temporal Data
- **Session 3** – "Where:" Geospatial Data
- **Session 4** – "What:" Topical Data

Mid-Term

Students work in teams with clients.

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

Final Exam

Grading

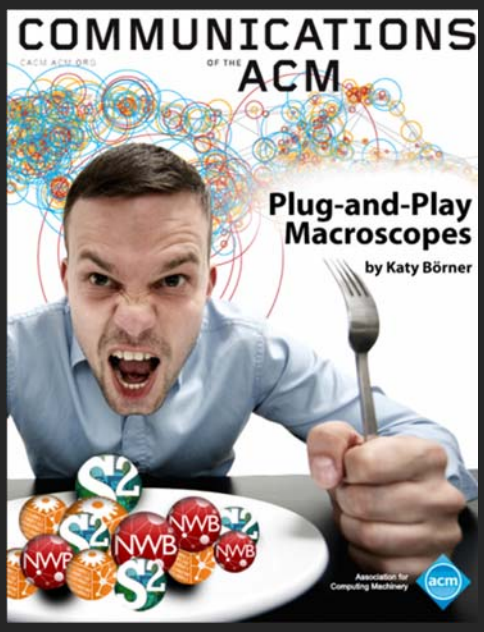
All students are asked to create a personal profile to support working in teams.

Final grade is based on Midterm (**30%**), Final (**40%**), Client Project (**30%**).

- Weekly self-assessments are not graded.
- Homework is graded automatically.
- Midterm and Final test materials from theory and hands-on sessions are graded automatically.
- Client work is peer-reviewed via online forum.

All students that receive more than **80%** of all available points get an official certificate/badge.

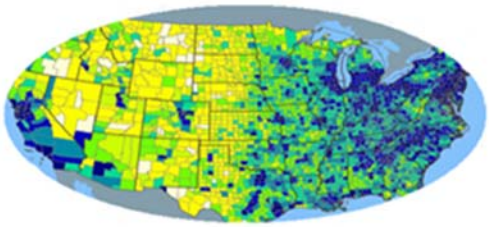
Plug-and-Play Macroscopes
cishell.org



Börner, Katy. (March 2011). Plug-and-Play Macroscopes. *Communications of the ACM, 54(3), 60-69.* http://www.scivee.tv/node/27704

Different Levels of Abstraction/Analysis

Macro/Global
Population Level



Meso/Local
Group Level

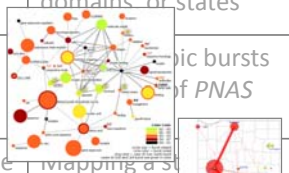
Micro/Individual
Individual Level

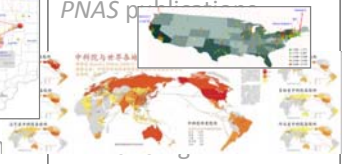
Type of Analysis vs. Level of Analysis

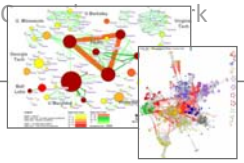
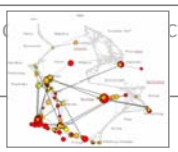
	Micro/Individual (1-100 records)	***Meso/Local (101–10,000 records)***	***Macro/Global (10,000 < records)***
Statistical Analysis/Profiling	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NSF, all of USA, all of science.
Temporal Analysis (When)	Funding portfolio of one individual	Mapping topic bursts in 20 years of *PNAS*	113 years of physics research
Geospatial Analysis (Where)	Career trajectory of one individual	Mapping a state's intellectual landscape	*PNAS* publications
Topical Analysis (What)	Base knowledge from which one grant draws.	Knowledge flows in chemistry research	VxOrd/Topic maps of NIH funding
Network Analysis (With Whom?)	NSF Co-PI network of one individual	Co-author network	NIH's core competency

Type of Analysis vs. Level of Analysis

	Micro/Individual (1-100 records)	***Meso/Local (101–10,000 records)***	***Macro/Global (10,000 < records)***
Statistical Analysis/Profiling	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NSF, all of scienc
Temporal Analysis (When)	Funding portfolio of one individual	ic bursts f *PNAS*	113 years of p research
Geospatial Analysis (Where)	Career trajectory of one individual	Mapping a s intellectual la	*PNAS* p
Topical Analysis (What)	s.	Knowledge fl chemistry research	
Network Analysis (With Whom?)	NSF ork of one	k	NIH's cy





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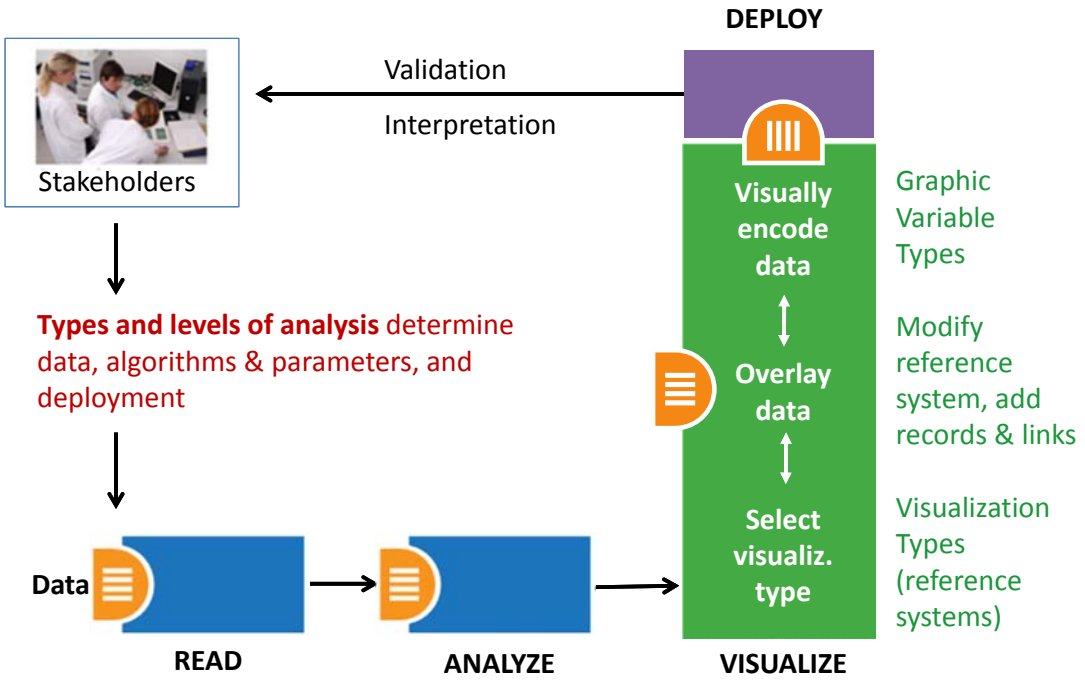

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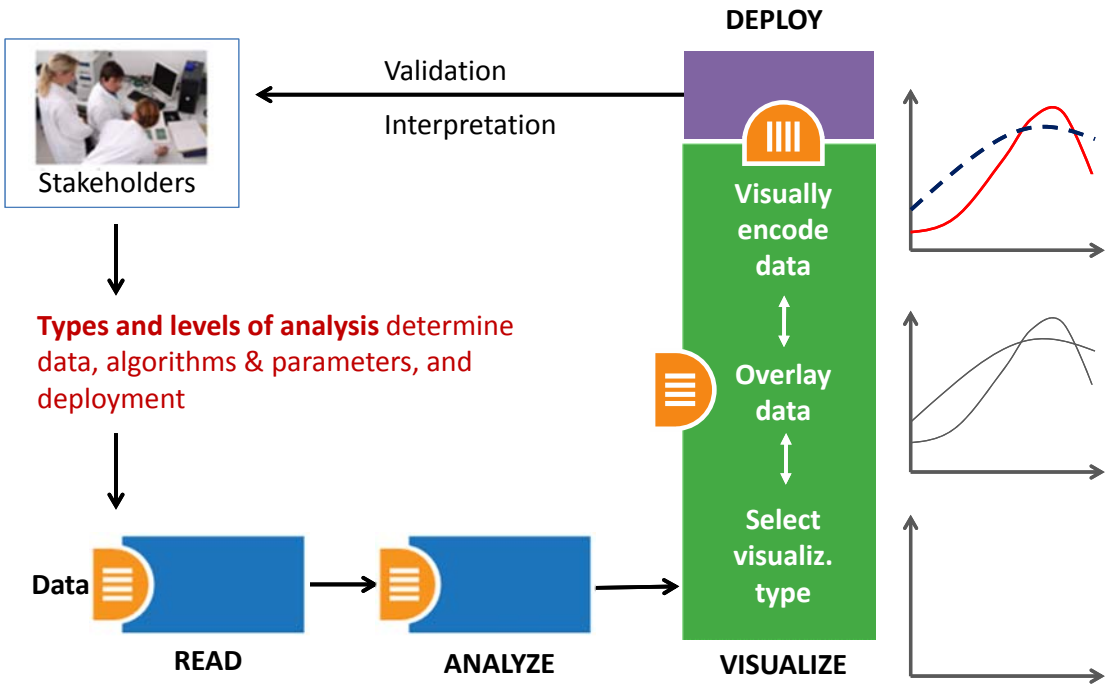

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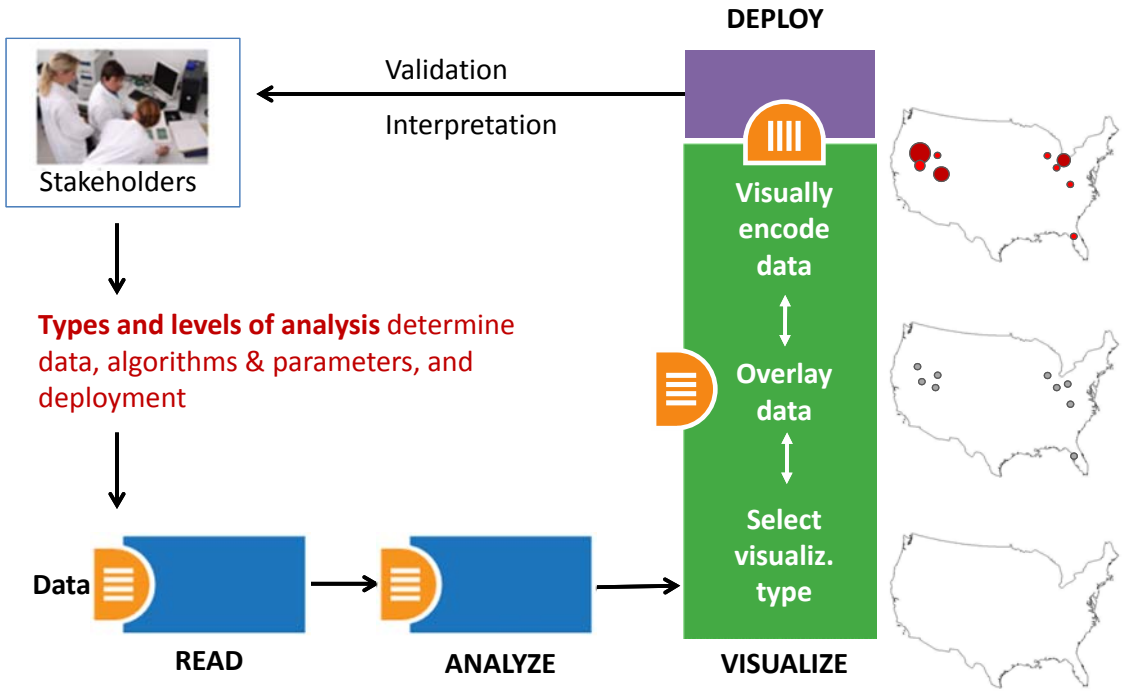
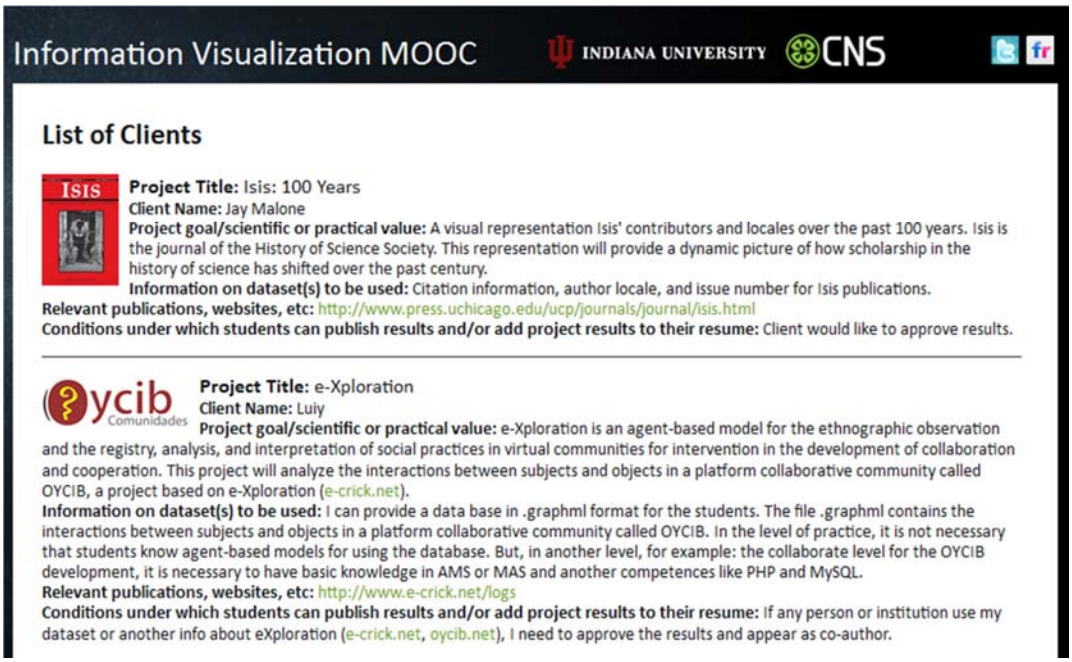
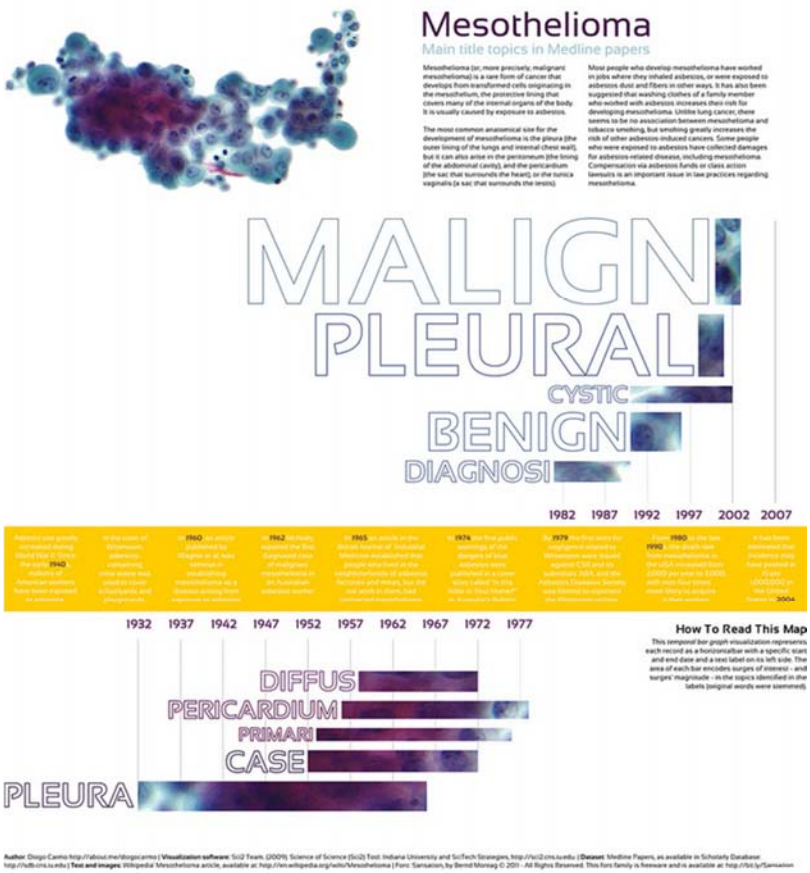


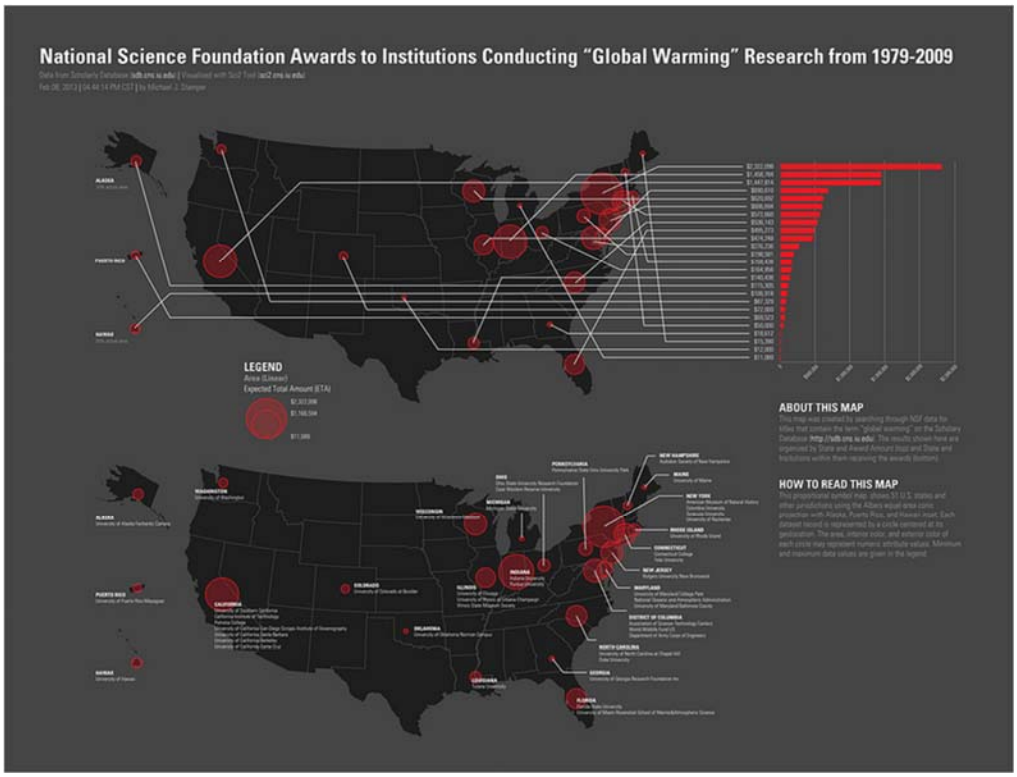
Clients



http://ivmooc.cns.iu.edu/ivmooc_clientprojects.html

Diogo Carmo





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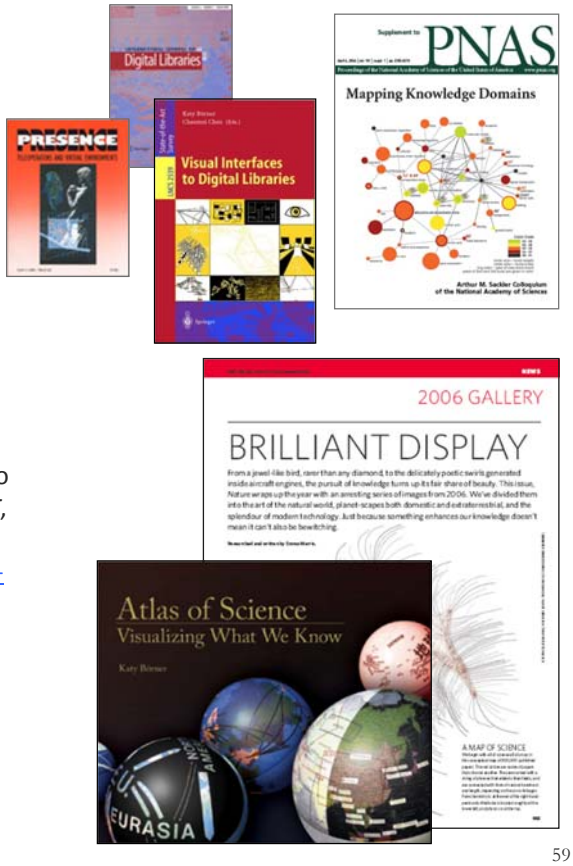

Acknowledgments

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