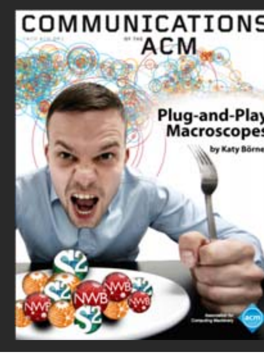
Building a Science Observatory

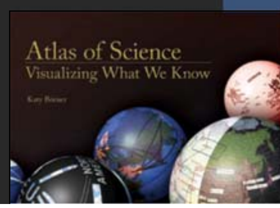
Katy Börner
Visiting Scientist in Dirk Helbing's Group, SOMS, ETHZ
Cyberinfrastructure for Network Science Center, Director
Information Visualization Laboratory, Director
School of Library and Information Science
Indiana University, Bloomington, IN
katy@indiana.edu

With special thanks to the members at the Cyberinfrastructure for Network Science Center, the NWB team, the Sci2 team, the EpiC team, and the VIVO Collaboration

Fidelity Investments
Boston, MA

July 21, 2011





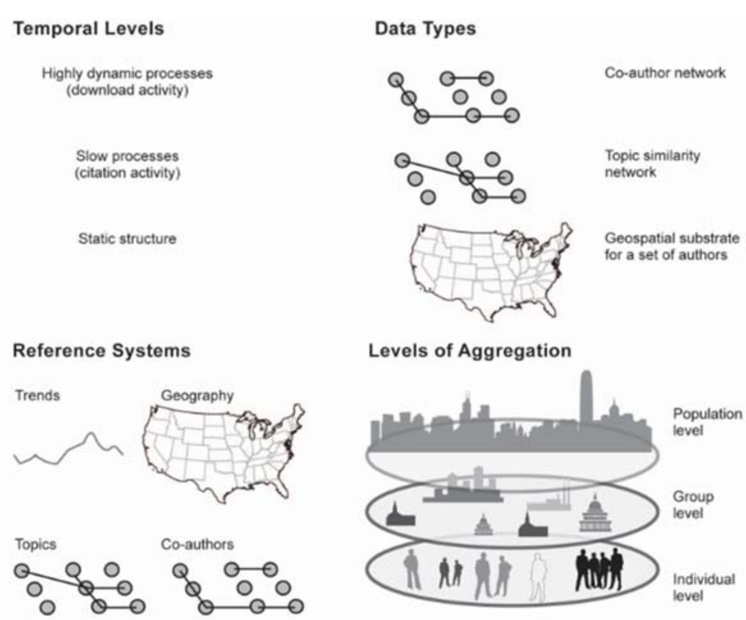
NSF Workshop Report on "Knowledge Management and Visualization Tools in Support of Discovery"
Börner, Bettencourt, Gerstein, and Uzzo (Eds.)
(*http://vw.cns.iu.edu/cdi2008/whitepaper.html*)
published in Dec 2009 argues for a

- A decentralized, free **"Scholarly Database"** to keep track, interlink, understand and improve the quality and coverage of Science and Technology (S&T) relevant data. (see also page 76 and 77 in Appendix D)
- A **"Science Marketplace"** that supports the sharing of expertise and resources and is fueled by the currency of science: scholarly reputation. (see page 74 in Appendix D) This marketplace might also be used by educators and the learning community to help bring science to the general public and out of the "ivory tower". (see page 89 in Appendix D)
- A **"Science Observatory"** that analyzes different datasets in real-time to assess the current state of S&T and to provide an outlook for their evolution under several (actionable) scenarios. (see page 72 in Appendix D)

- **"Validate Science [of Science Results and] Maps"** to understand and utilize their value for communicating science studies and models across scientific boundaries, but also to study and communicate the longitudinal (1980-today) impact of funding on the science system. (see page 81 in Appendix D)
- An easy to use, yet versatile, **"Science Telescope"** to communicate the structure and evolution of science to researchers, educators, industry, policy makers, and the general public at large. (see page 87 in Appendix D) The effect of this (and other science portals) on education and science perception needs to be studied in carefully controlled experiments. (see page 88 in Appendix D)
- **"Science of (Team) Science"** studies are necessary to increase our understanding and support the formation of effective research and development teams. (see page 78 and 82 in Appendix D).
- **"Success Criteria"** need to be developed that support a scientific calculation of S&T benefits for society. (see also page 88 in Appendix D)
- A **"Science Life"** (an analog to Second Life) should be created to put the scientist's face on their science. Portals to this parallel world would be installed in universities, libraries and science museums. (see page 80 in Appendix D)

Modeling Science Dynamics using
- multi-level,
- mixed methods, and
- multi-perspective models

Katy Börner, Kevin W. Boyack, Staša Milojević, Steven Morris. (2011) An introduction to modeling science: Basic model types, key definitions, and a general framework for the comparison of process models. In *Scharnhorst, Andrea, Börner, van den Besselaar (Eds) Models of Science Dynamics. Springer Verlag.*



Descriptive Models of Science

- Detect advances of scientific knowledge via "longitudinal mapping" (Garfield, 1994).
- Synthesis of specialty narratives from co-citation clusters (Small, 1986).
- Identify cross-disciplinary fertilization via "passages through science" (Small, 1999, 2000).
- Understand scholarly information foraging (Sandstrom, 2001).
- Knowledge discovery in un-connected terms (Swanson & Smalheiser, 1997).
- Determine areas of expertise for specific researcher, research group via "invisible colleges" (note that researchers self definition might differ from how field defines him/her) (Crane, 1972).
- Identify profiles of authors, also called CAMEOS, to be used to for document retrieval or to map an author's subject matter and studying his/her publishing career, or to map the social and intellectual networks evident in citations to and from authors and in co-authorships (White, 2001).

Descriptive Models of Science cont.

- Identification of scientific frontiers http://www.science-frontiers.com/.
- *ISI's Essential Science Indicators* http://essentialscience.com/
- Import-export studies (Stigler, 1994).
- Evaluation of 'big science' facilities using 'converging partial indicators' (Martin, 1996; Martin & Irvine, 1983).
- Input (levels of funding, expertise of scientists, facilities used) - output (publications, patents, Nobel prices, improved health, reduced environment insults, etc. - influenced by political, economic, financial, and legal factors studies (Kostroff & DelRio, 2001).
- Determine influence of funding on research output (Boyack & Borner, 2002).

- How to write highly influential paper (van Dalen & Henkens, 2001).

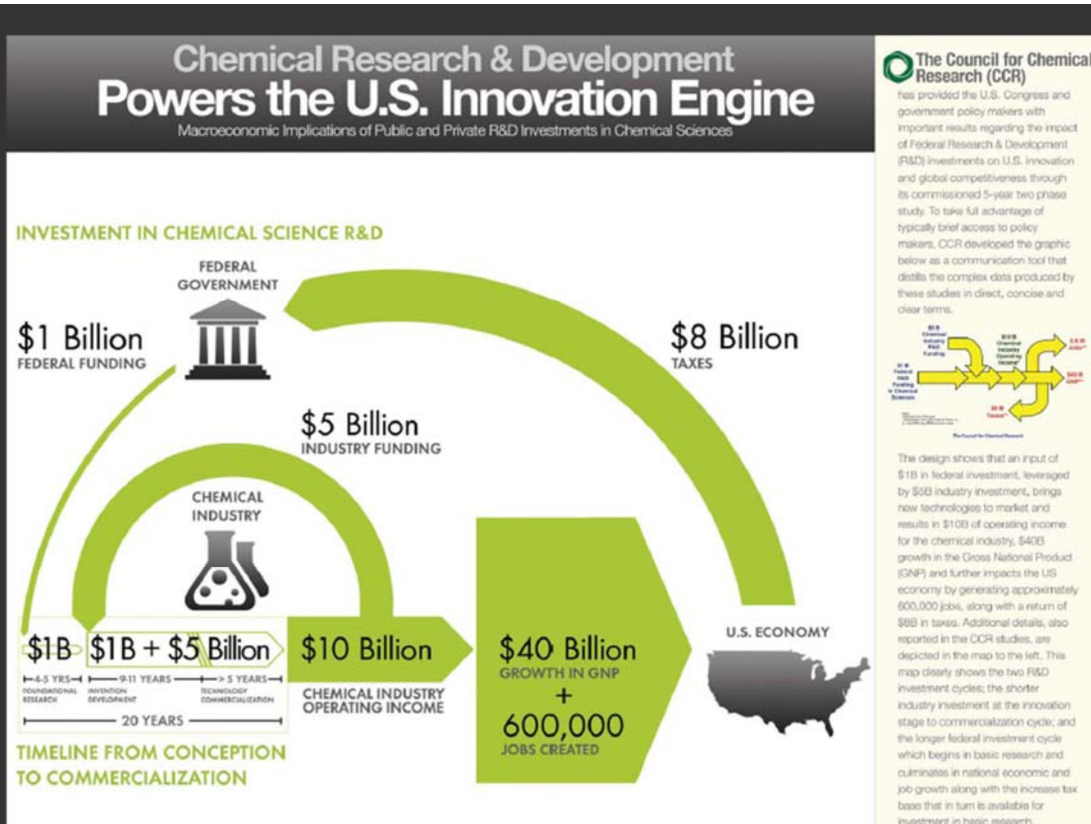
Process Models of Science

Can be used to predict the effects of

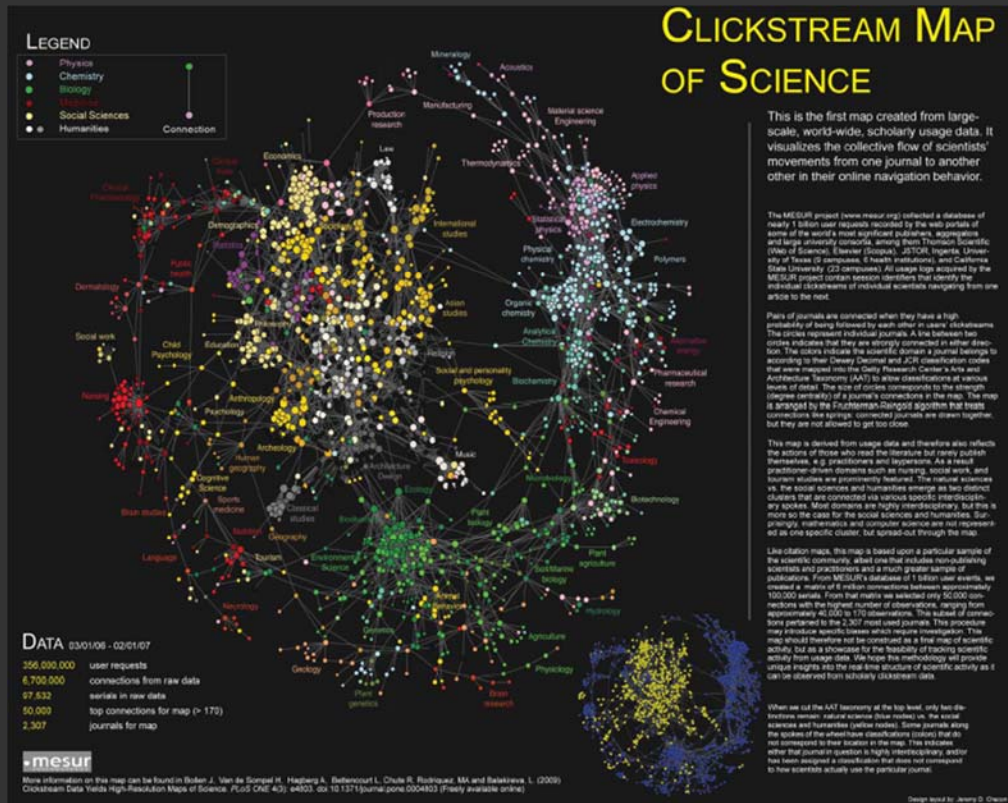
- Large collaborations vs. single author research on information diffusion.
- Different publishing mechanisms, e.g., E-journals vs. books on co-authorship, speed of publication, etc.
- Supporting disciplinary vs. interdisciplinary collaborations.
- Many small vs. one large grant on # publications, Ph.D. students, etc.
- Resource distribution on research output.
- …

In general, process model provide a means to analyze the structure and dynamics of science -- to study science using the scientific methods of science as suggested by Derek J. deSolla Price about 40 years ago.

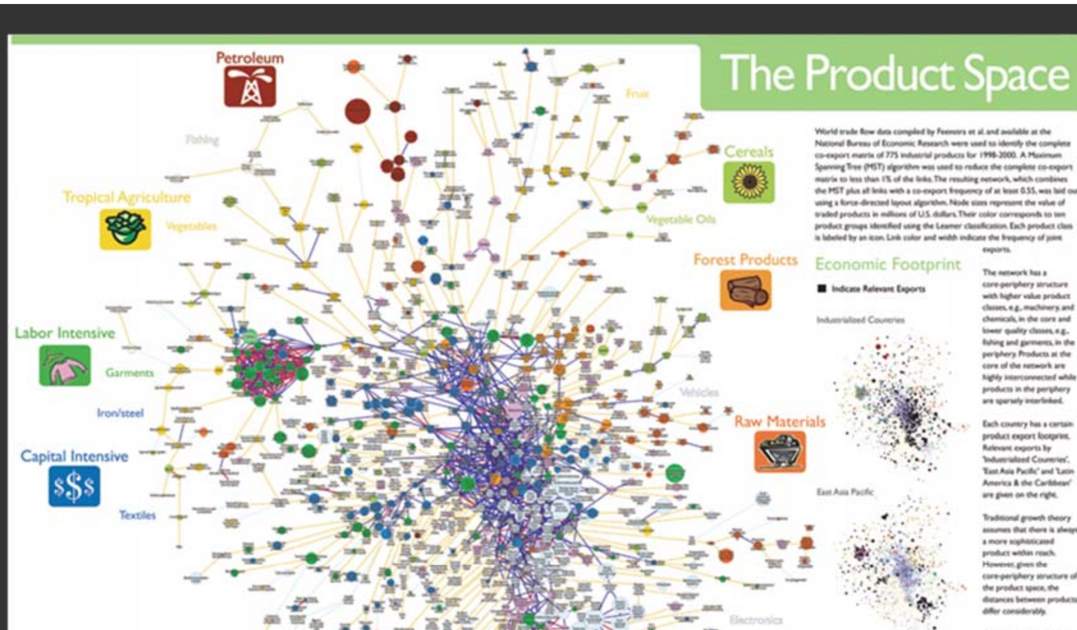
INDIANA UNIVERSITY



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



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.



Cesar A. Hidalgo, Bailey Klinger, Albert-László Barabási , Ricardo Hausmann . 2007. The Product Space

Adrian White and the National Geographic EarthPulse Team. 2008.
A Global Projection of Subjective Well-being

Different Stakeholder Groups and Their Needs

Funding Agencies

- Need to monitor (long-term) money flow and research developments, identify areas for future development, stimulate new research areas, evaluate funding strategies for different programs, decide on project durations, funding patterns.

Scholars

- Want easy access to research results, relevant funding programs and their success rates, potential collaborators, competitors, related projects/publications **(research push).**

Industry

- Is interested in fast and easy access to major results, experts, etc. Influences the direction of research by entering information on needed technologies **(industry-pull)**.

Advantages for Publishers

- Need easy to use interfaces to massive amounts of interlinked data. Need to communicate data provenance, quality, and context.

Society

- Needs easy access to scientific knowledge and expertise.

Scholars Have Different Roles/Needs

Researchers and Authors—need to select promising research topics, students, collaborators, and publication venues to increase their reputation. They benefit from a global view of competencies, reputation and connectivity of scholars; hot and cold research topics and bursts of activity, and funding available per research area.

Editors—have to determine editorial board members, assign papers to reviewers, and ultimately accept or reject papers. Editors need to know the position of their journals in the evolving world of science. They need to advertise their journals appropriately and attract high-quality submissions, which will in turn increase the journal's reputation and lead to higher quality submissions.

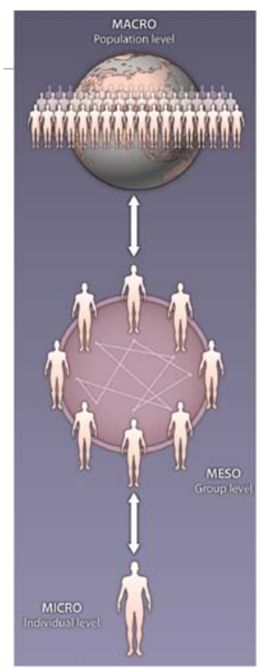
Reviewers—read, critique, and suggest changes to help improve the quality of papers and funding proposals. They need to identify related works that should be cited or complementary skills that authors might consider when selecting project collaborators.

Teachers—teach classes, train doctoral students, and supervise postdoctoral researchers. They need to identify key works, experts, and examples relevant to a topic area and teach them in the context of global science.

Inventors—create intellectual property and obtain patents, thus needing to navigate and make sense of research spaces as well as intellectual property spaces.

Investigators—scholars acquire funding to support students, hire staff, purchase equipment, or attend conferences. Here, research interests and proposals have to be matched with existing federal and commercial funding opportunities, possible industry collaborators and sponsors.

Team Leads and Science Administrators—many scholars direct multiple research projects simultaneously. Some have full-time staff, research scientists, and technicians in their laboratories and centers. Leaders need to evaluate performance and provide references for current or previous members; report the progress of different projects to funding agencies.



TEAM SCIENCE

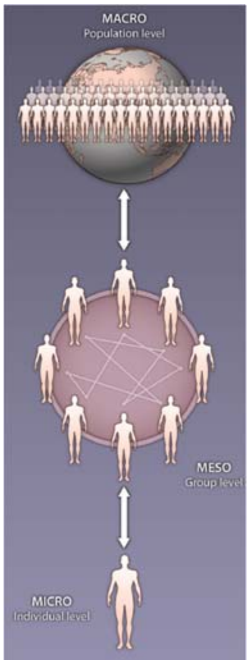
A Multi-Level Systems Perspective for the Science of Team Science

Katy Börner,[1*] Noshir Contractor,[2] Holly J. Falk-Krzesinski,[3] Stephen M. Fiore,[4] Kara L. Hall,[5] Joann Keyton,[6] Bonnie Spring,[7] Daniel Stokols,[8] William Trochim,[9] Brian Uzzi[10]

Published 15 September 2010; Volume 2 Issue 49 49cm24

This Commentary describes recent research progress and professional developments in the study of scientific teamwork, an area of inquiry termed the "science of team science" (SciTS, pronounced "sahyts"). It proposes a systems perspective that incorporates a mixed-methods approach to SciTS that is commensurate with the conceptual, methodological, and translational complexities addressed within the SciTS field. The theoretically grounded and practically useful framework is intended to integrate existing and future lines of SciTS research to facilitate the field's evolution as it addresses key challenges spanning macro, meso, and micro levels of analysis.

Science of (team) science research and practice requires an interdisciplinary, multi-level, mixed-methods approach. Expertise, theories, methods, data, and tools from diverse research fields need to be applied and advanced to arrive at a holistic understanding of the science system.

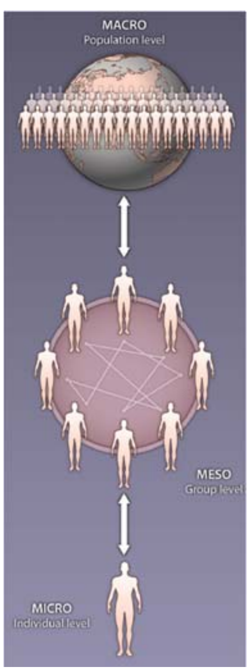


Mixed-Methods, Multi-Level Science of Science (or Team Science or SciSIP) studies need:

Expertise – identify and access it at the perfect moment using, e.g., Facebook, LinkedIn, Academia, VIVO, Harvard Profiles, Elsevier's Collexis, Loki, Stanford's CAP, or other systems.

Data – find, interlink, unify, merge, reformat, share them, e.g., using web sites analogous to http://www.diggingintodata.org/Repositories/tabid/167/Default.aspx, SDB, or LOD.

Tools – identify, learn, advance, share code, e.g., via Plug-and-Play Macroscopes, to arrive at a holistic understanding of the science system.

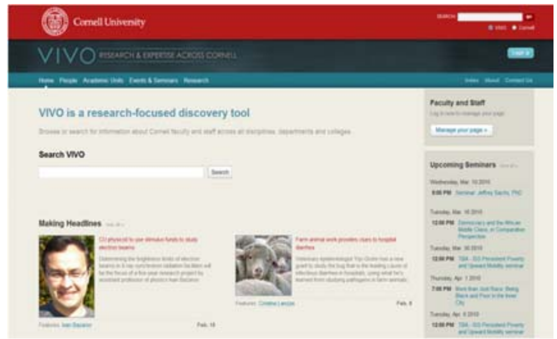


Expertise – identify and access it at the perfect moment using, e.g., Facebook, LinkedIn, Academia, VIVO, Harvard Profiles, Elsevier's Collexis, Loki, Stanford's CAP, or other systems.

VIVO
Enabling a National Network of Scientists

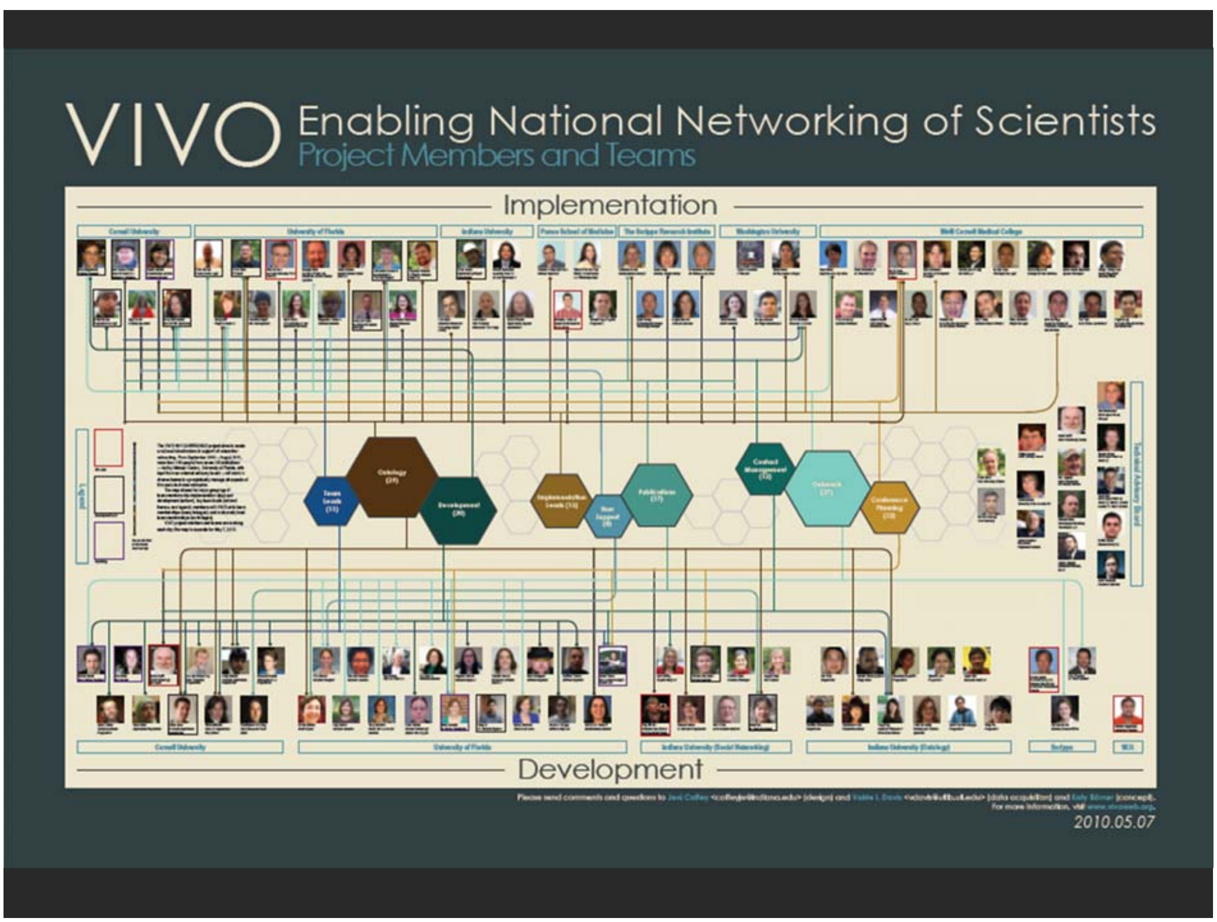
VIVO: A Semantic Approach to Creating a National Network of Researchers (http://vivoweb.org)

- 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.

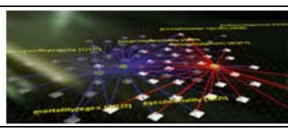


Funded by $12 million NIH award.

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.

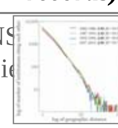


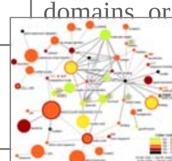
UF | Clinical and Translational Science Institute
UNIVERSITY of FLORIDA

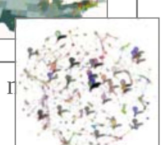


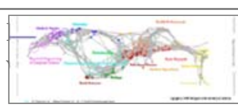
Type of Analysis vs. Level of Analysis

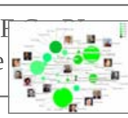
	Micro/Individual (1-100 records)	*Meso/Local (101–10,000 records)*	*Macro/Global (10,000 < records)*
Statistical Analysis/Profiling	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NS SA, all of scie
Temporal Analysis (When)	Funding portfolio of one individual	ic bursts of PNAS	113 Years of P Research
Geospatial Analysis (Where)	Career trajectory of one individual	Mapping a st intellectual la	PNAS p
Topical Analysis (What)	s.	e flows in research	VxOrd/Topic m NIH funding
Network Analysis (With Whom?)	NSF Co-PI network of one	C k	NIH's core competency

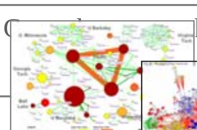


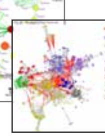


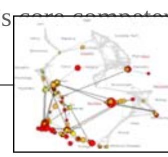


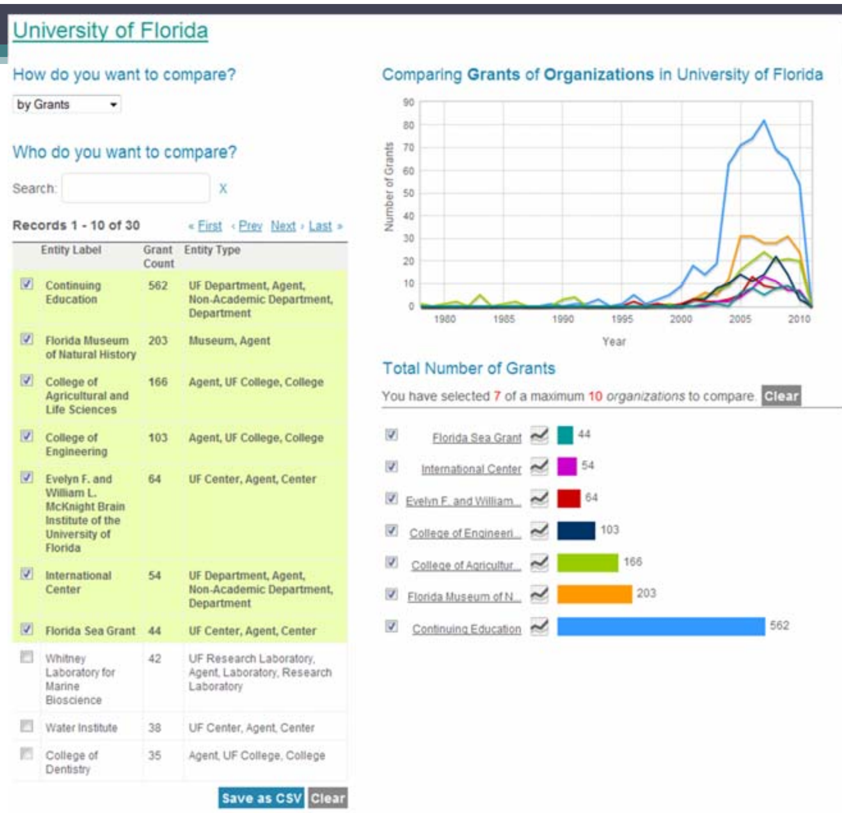




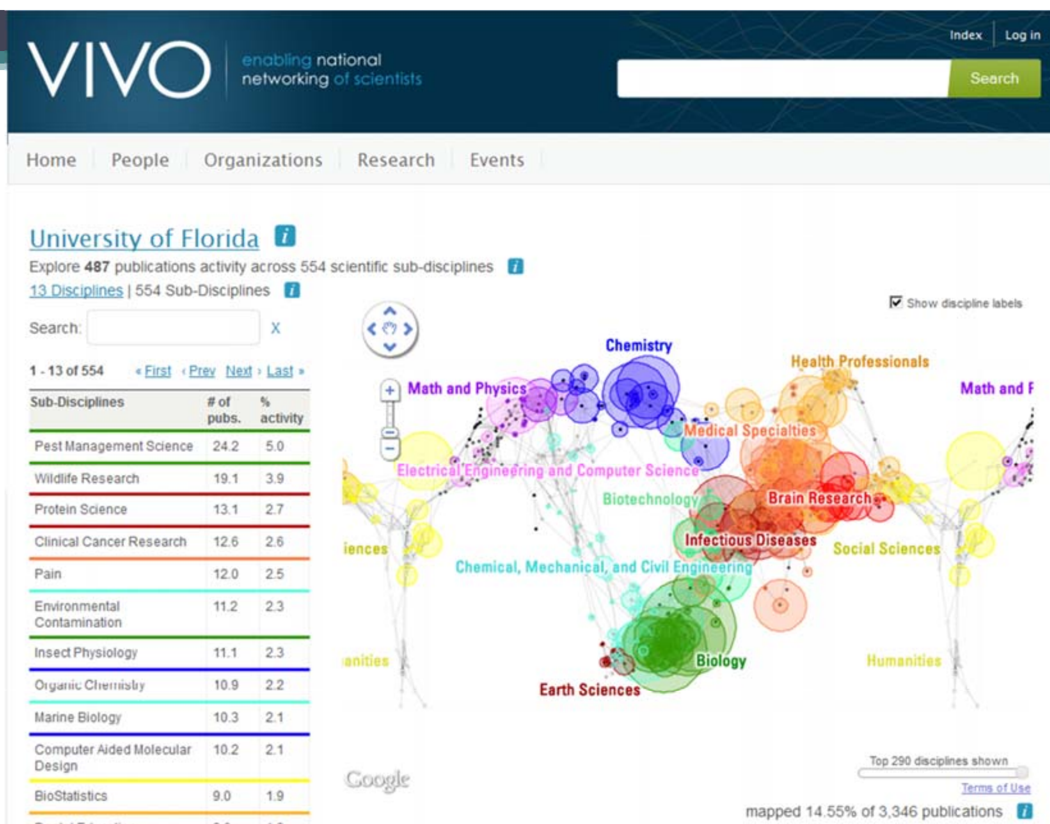




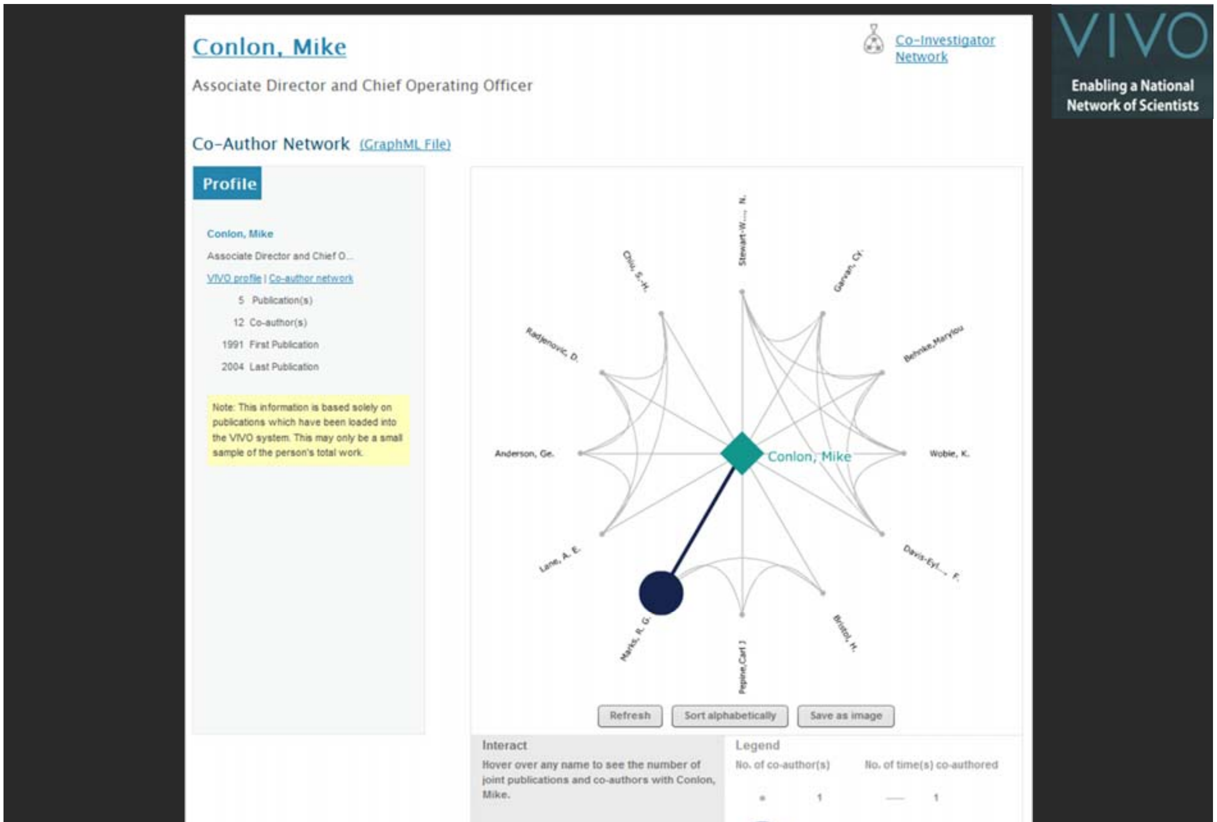




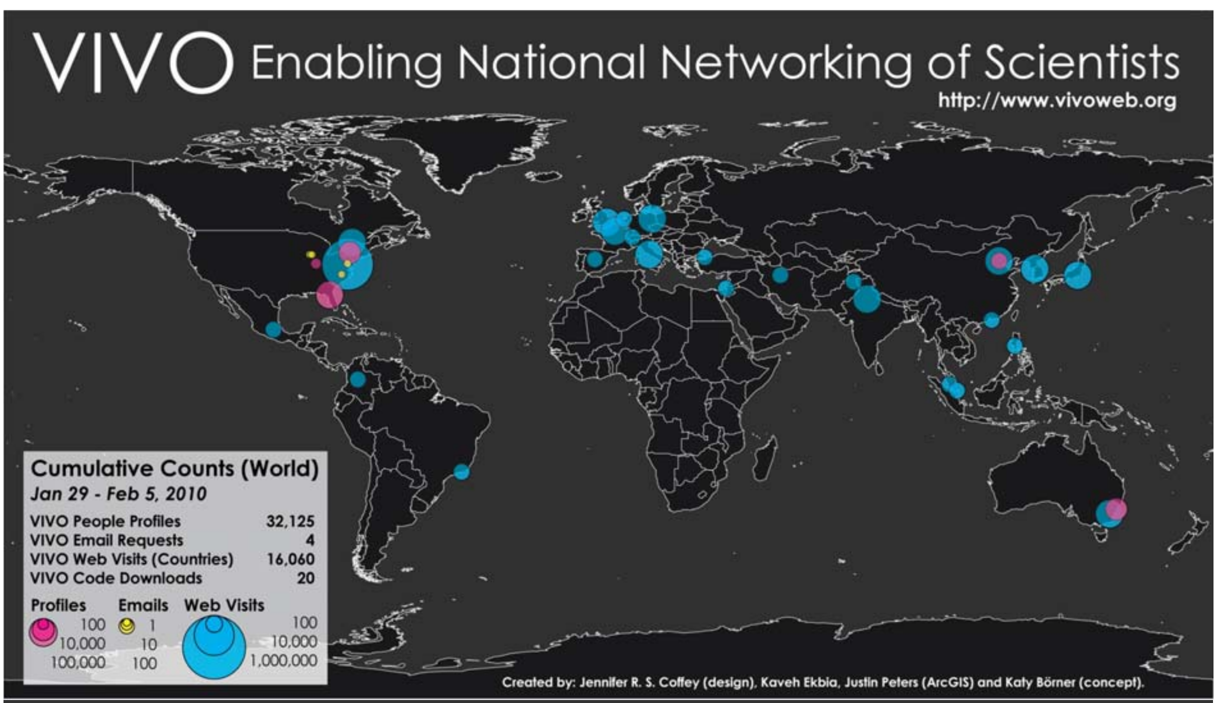
Temporal Analysis (When) Temporal visualizations of the number of papers/funding award at the institution, school, department, and people level



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

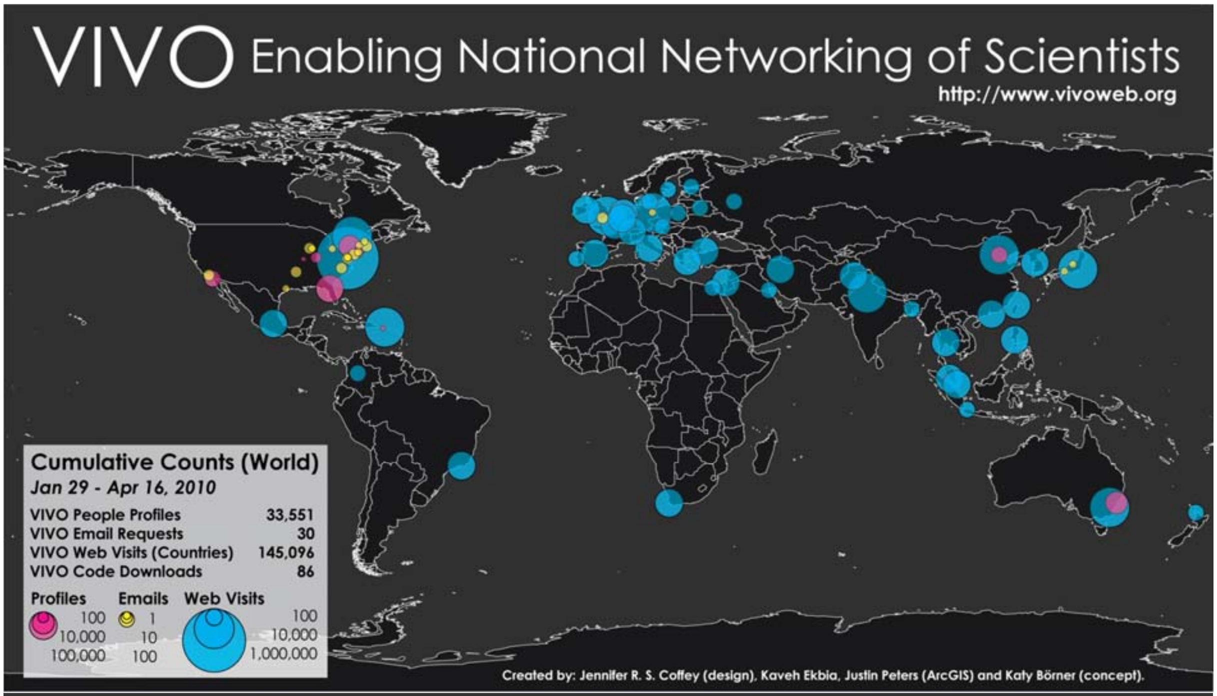


Network Analysis (With Whom?) Who is co-authoring, co-investigating, co-inventing with whom? What teams are most productive in what projects?



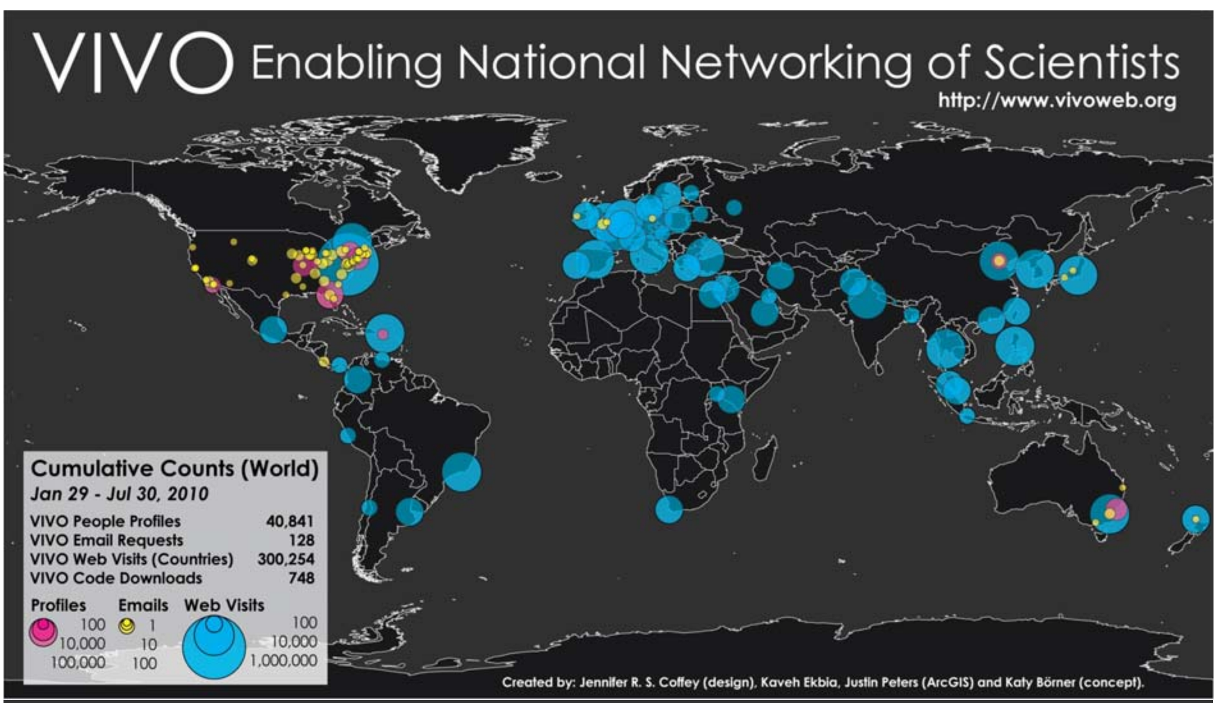
Science is global. World view of VIVO activity.
Web site visits are aggregated at the country level.

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



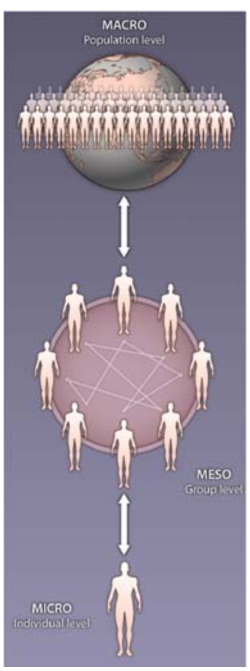
Shown are the
- Number of people profiles in the 7 different VIVO installation sites plus CAS and U Melbourne.
- Email contacts by data and service providers as well as institutions interested to adopt VIVO.
- The number of visitors on http://vivoweb.org

Circles are area size coded using a logarithmic scale.

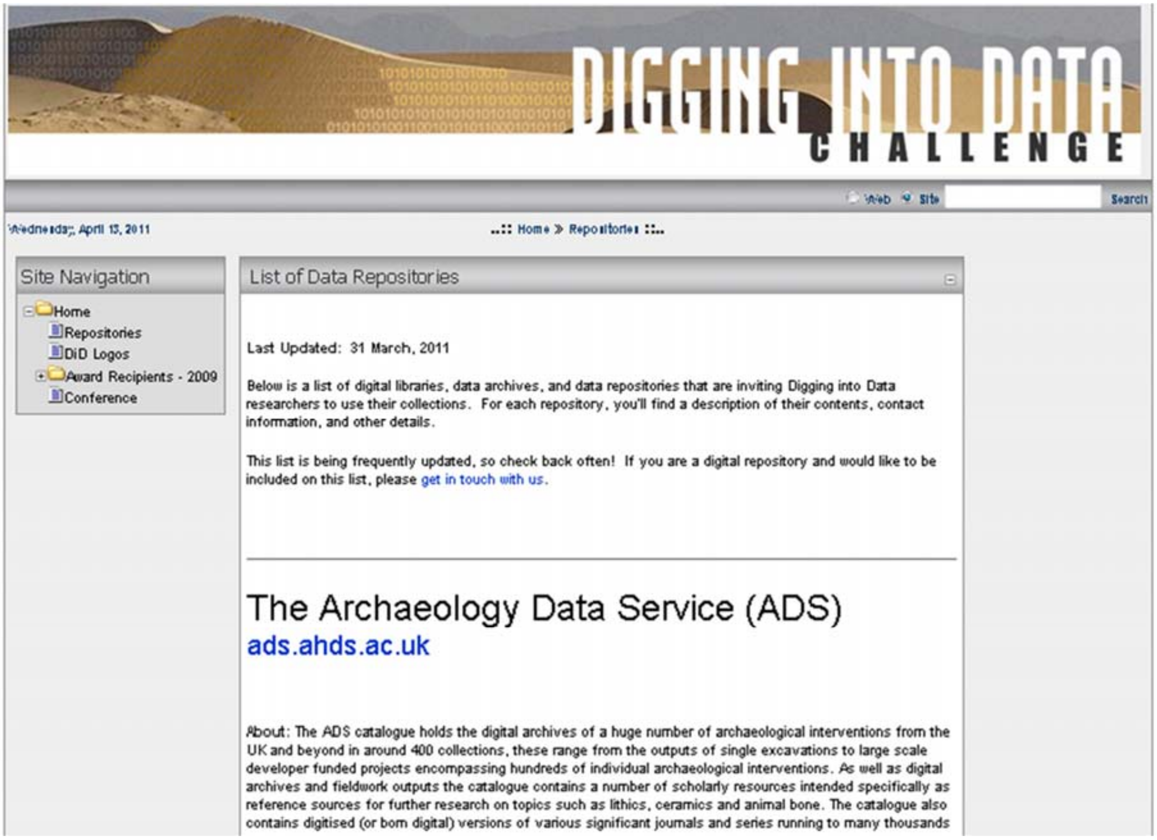


VIVO 1.0 source code was publicly released on April 14, 2010
87 downloads by June 11, 2010.
The more institutions adopt VIVO, the more high quality data will be available to understand, navigate, manage, utilize, and communicate progress in science and technology.

http://vivo-netsci.cns.iu.edu



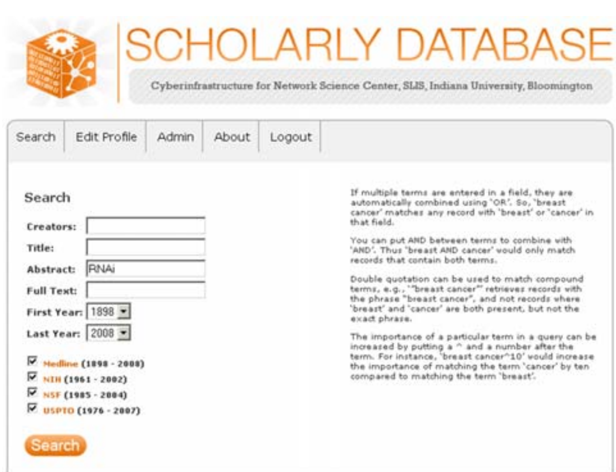
Data – find, access, interlink, unify, merge, reformat, share them, e.g., using web sites analogous to http://www.diggingintodata.org/Repositories/tabid/167/Default.aspx, SDB, or LOD.



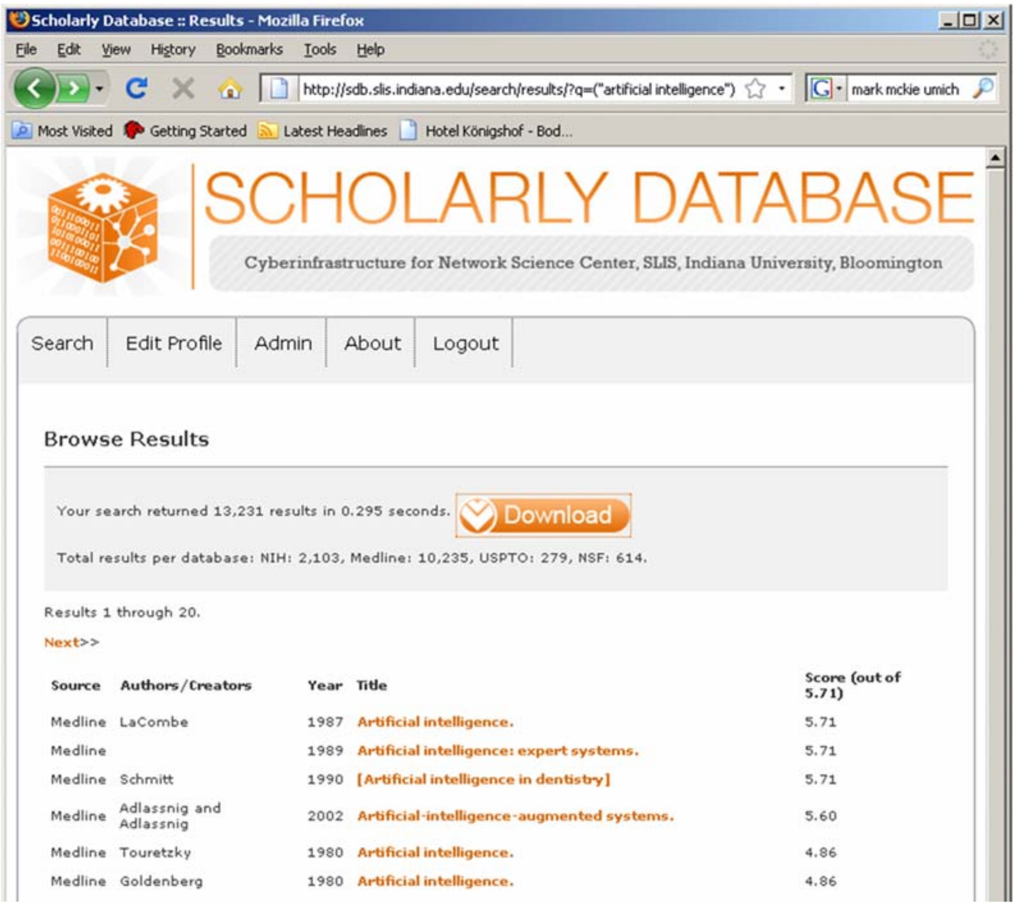
http://www.diggingintodata.org/Repositories/tabid/167/Default.aspx

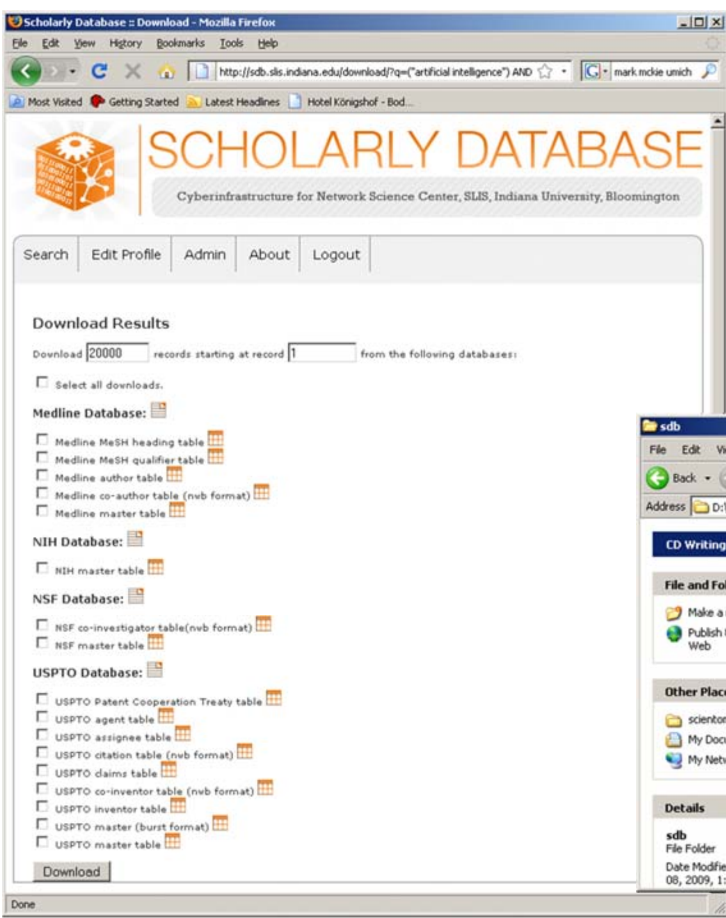
Scholarly Database at Indiana University
http://sdb.wiki.cns.iu.edu

Supports federated search of 25 million publication, patent, grant records.
Results can be downloaded as data dump and (evolving) co-author, paper-citation networks.



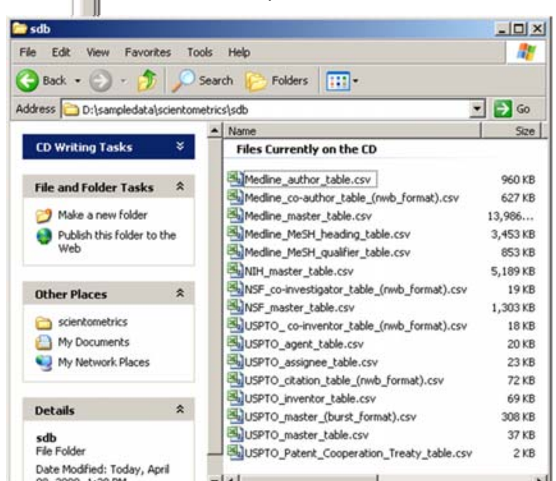
Register for free access at http://sdb.cns.iu.edu

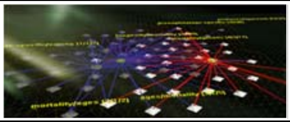




Since March 2009:
Users can download networks:
- Co-author
- Co-investigator
- Co-inventor
- Patent citation

and tables for
burst analysis in NWB.





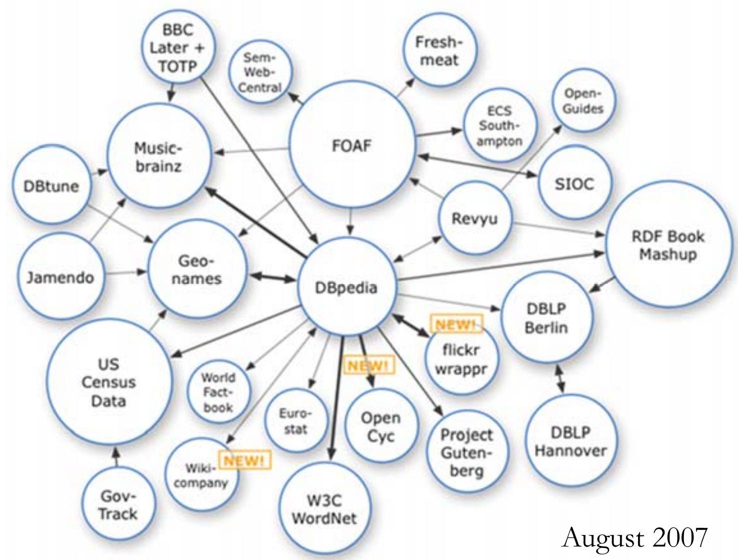
Semantic Web: Linked Open Data

- Interlinking existing data silos and
- Exposing them as structured data
- Adding new high quality data relevant for S&T studies

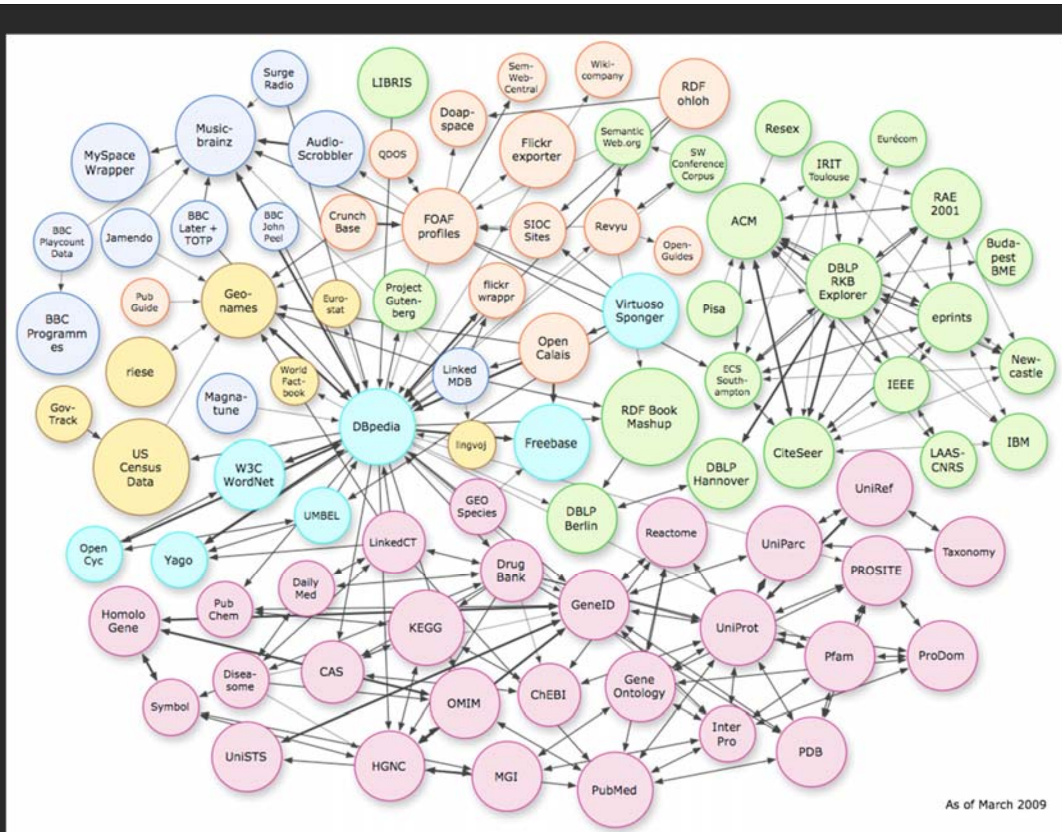
http://linkeddata.org

Save Data.gov, sign the petition at http://om.ly/BRPRE

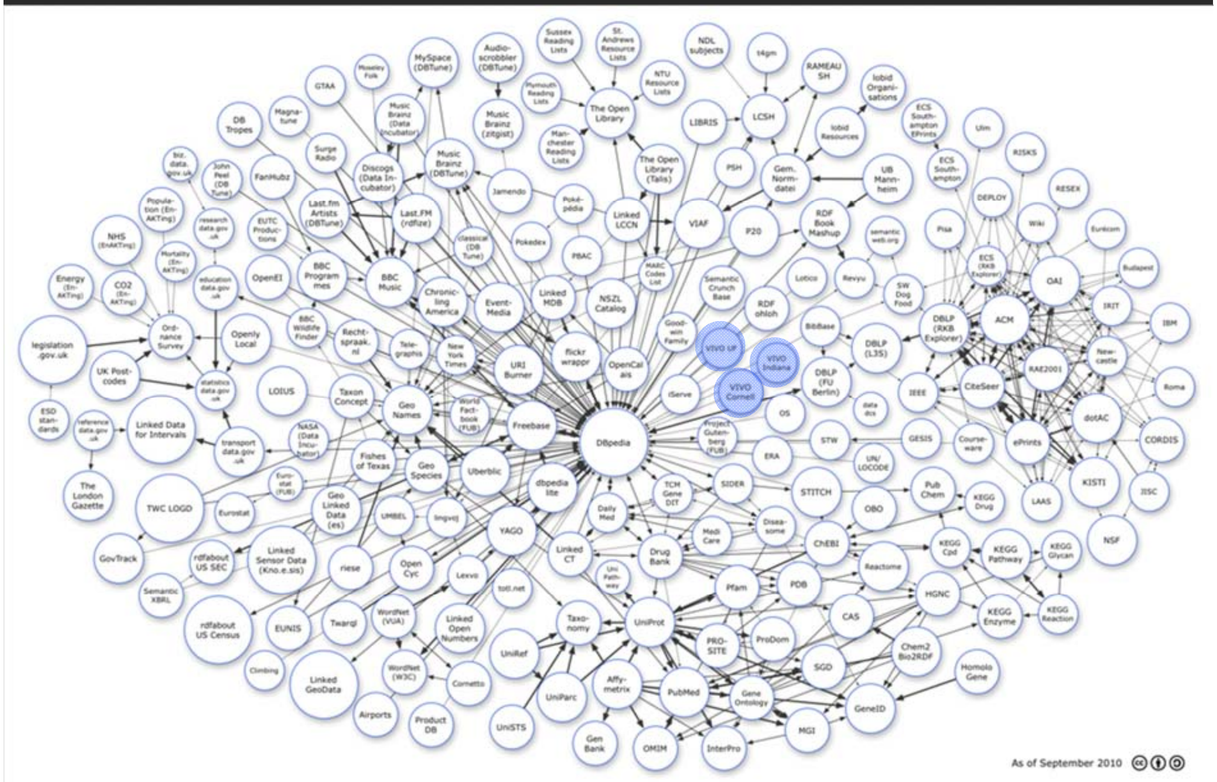
Twitter #savethedata



August 2007

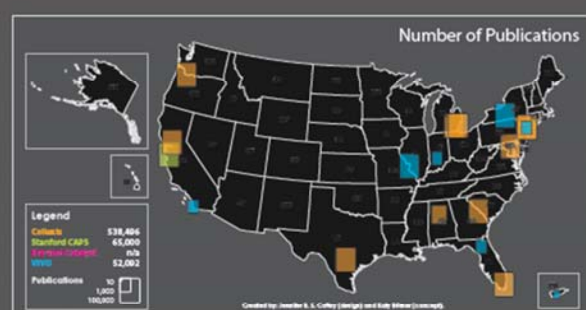


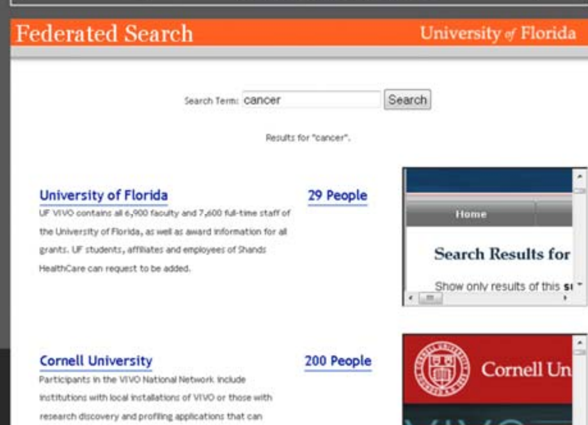
http://www4.wiwiss.fu-berlin.de/bizer/pub/lod-datasets_2009-03-05_colored.png



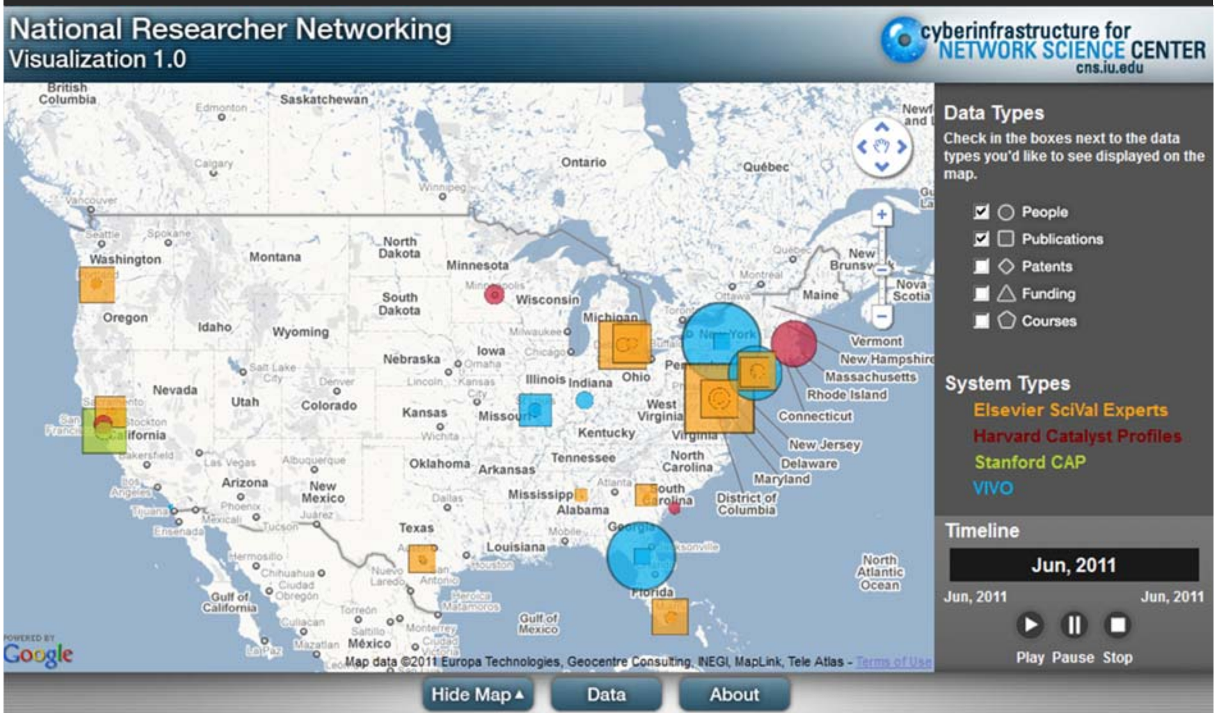
National Research Networking (NRN) Activity Visualization

VIVO
Enabling a National Network of Scientists

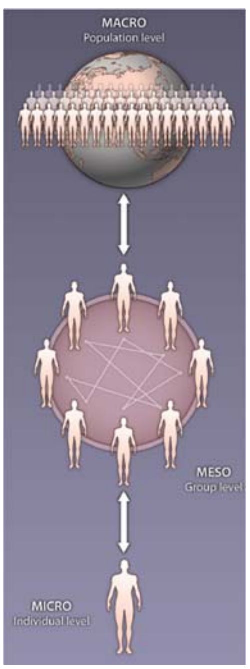




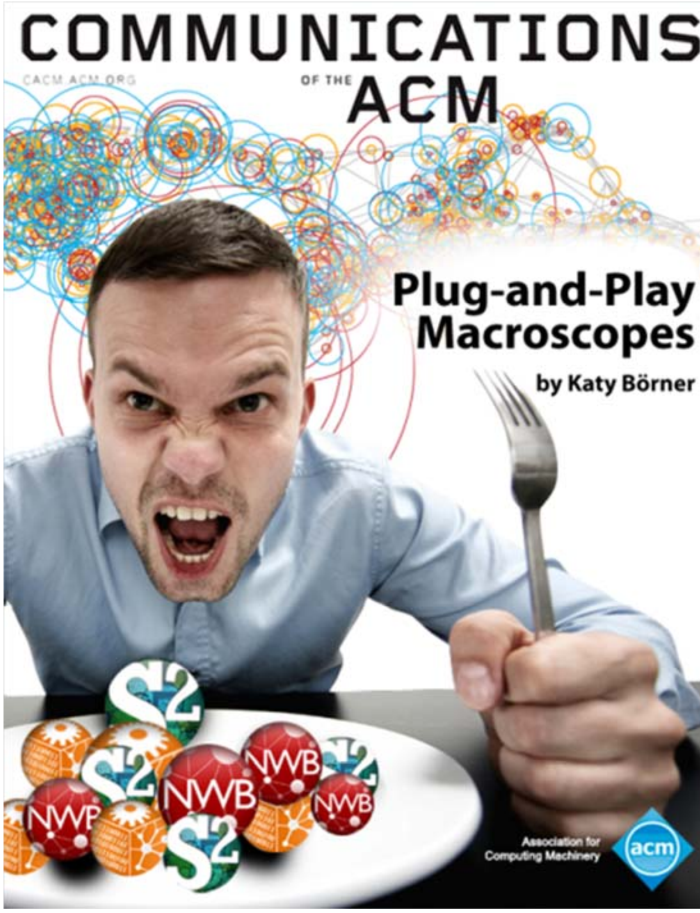
http://vivoexperts.ctsi.ufl.edu



http://nrn.cns.iu.edu



Tools – continuously identify, learn, advance, share code, e.g., via Plug-and-Play Macroscopes



Börner, Katy. (March 2011). Plug-and-Play Macroscopes. *Communications of the ACM, 54(3), 60-69.*

Video and paper are at
http://www.scivee.tv/node/27704

Designing "Dream Tools"

Many of the best micro-, tele-, and macroscopes are designed by **scientists keen to observe and comprehend what no one has seen or understood before.** Galileo Galilei (1564–1642) recognized the potential of a spyglass for the study of the heavens, ground and polished his own lenses, and used the improved optical instruments to make discoveries like the moons of Jupiter, providing quantitative evidence for the Copernican theory.

Today, scientists **repurpose, extend, and invent new hardware and software** to create **"macroscopes"** that may solve both local and global challenges.

Plug-and-play macroscopes **empower** me, my students, colleagues, and 100,000 others that downloaded them.

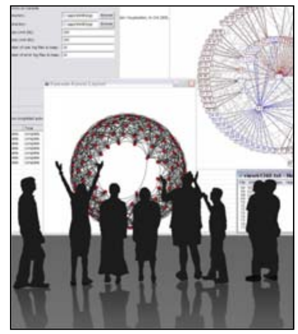
Macroscopes

Decision making in science, industry, and politics, as well as in daily life, requires that we make sense of data sets representing the structure and dynamics of complex systems. Analysis, navigation, and management of these continuously evolving data sets require a new kind of data-analysis and visualization tool we call a macroscope (from the Greek macros, or "great," and skopein, or "to observe") inspired by de Rosnay's futurist science writings.

Macroscopes provide a "vision of the whole," helping us "synthesize" the related elements and enabling us to detect patterns, trends, and outliers while granting access to myriad details. Rather than make things larger or smaller, **macroscopes let us observe what is at once too great, slow, or complex for the human eye and mind to notice and comprehend.**

Microscopes

Telescopes



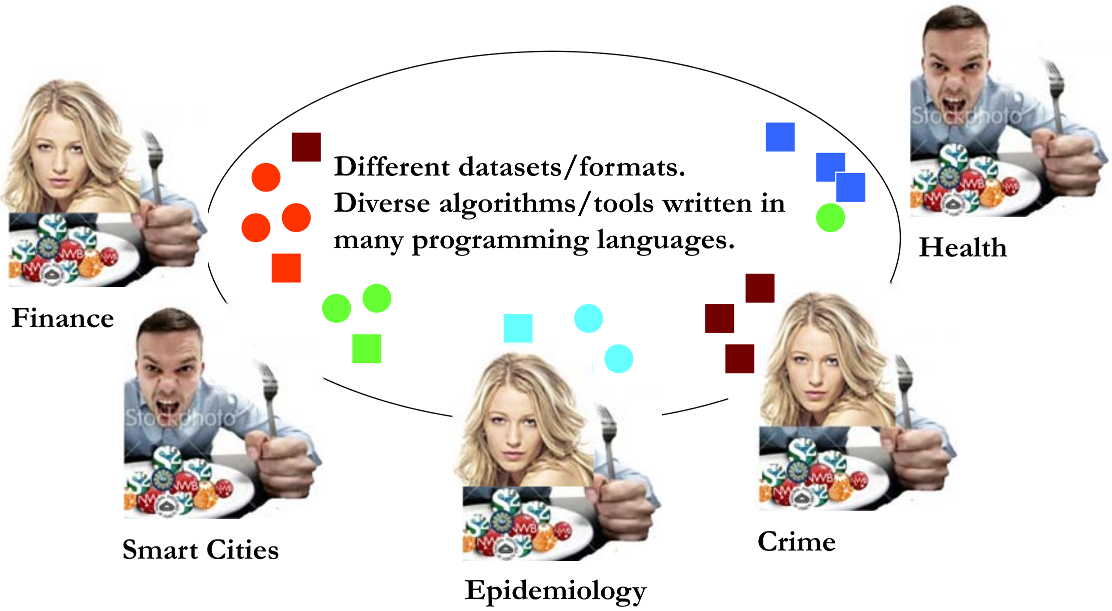
Macroscopes

Macroscopes cont.

While microscopes and telescopes are physical instruments, **macroscopes resemble continuously changing bundles of software plug-ins.** Macroscopes make it easy to select and combine algorithm and tool plug-ins but also interface plug-ins, workflow support, logging, scheduling, and other plug-ins needed for scientifically rigorous yet effective work.

They make it easy to share plug-ins via email, flash drives, or online. To use new plugins, simply copy the files into the plug-in directory, and they appear in the tool menu ready for use. No restart of the tool is necessary. **Sharing algorithm components, tools, or novel interfaces becomes as easy as sharing images on Flickr or videos on YouTube. Assembling custom tools is as quick as compiling your custom music collection.**

Macroscopes Serve the Changing Scientific Landscape



Related Work

Google Code and SourceForge.net provide special means for developing and distributing software

- In August 2009, SourceForge.net hosted more than 230,000 software projects by two million registered users (285,957 in January 2011);
- In August 2009 ProgrammableWeb.com hosted 1,366 application programming interfaces (APIs) and 4,092 mashups (2,699 APIs and 5,493 mashups in January 2011)

Cyberinfrastructures serving large biomedical communities

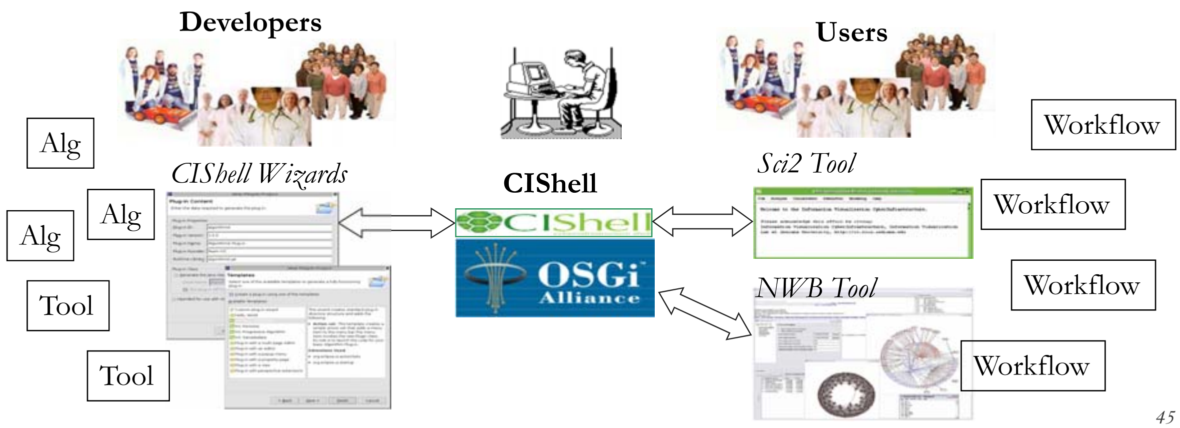
- Cancer Biomedical Informatics Grid (caBIG) (http://cabig.nci.nih.gov)
- Biomedical Informatics Research Network (BIRN) (http://nbirn.net)
- Informatics for Integrating Biology and the Bedside (i2b2) (https://www.i2b2.org)
- HUBzero (http://hubzero.org) platform for scientific collaboration uses
- myExperiment (http://myexperiment.org) supports the sharing of scientific workflows and other research objects.

Missing so far is a **common standard** for

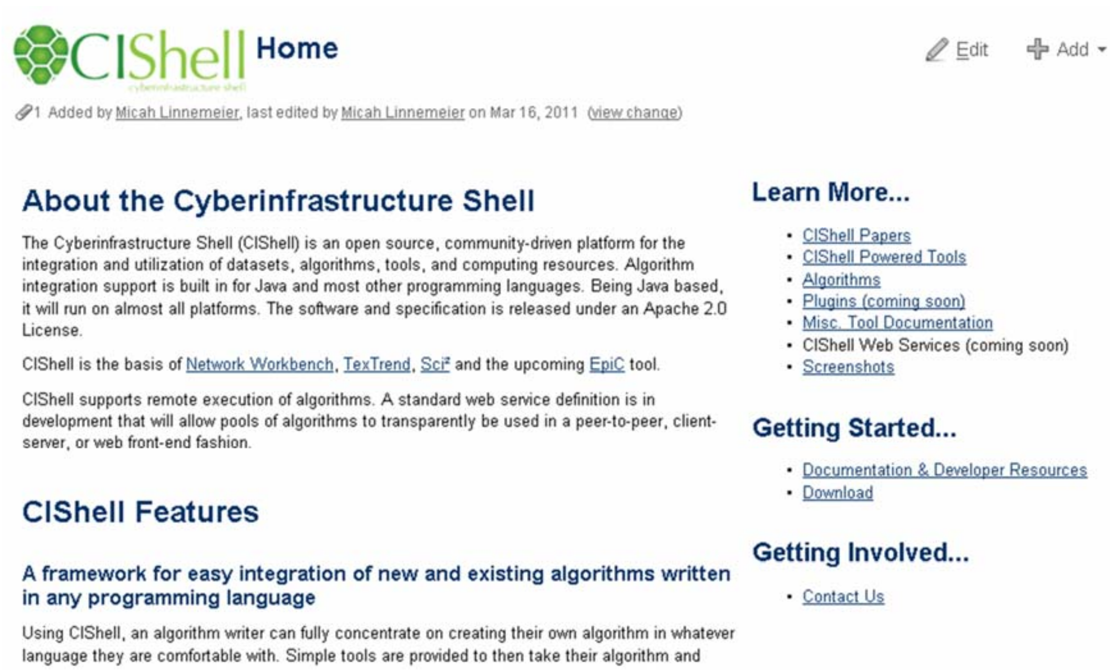
- the design of **modular, compatible algorithm and tool plug-ins** (also called "modules" or "components")
- that can be **easily combined into scientific workflows** ("pipeline" or "composition"),
- and packaged as **custom tools.**

OSGi & CIShell

- CIShell (http://cishell.org) is an open source software specification for the integration and utilization of datasets, algorithms, and tools.
- It extends the Open Services Gateway Initiative (OSGi) (http://osgi.org), a standardized, component oriented, computing environment for networked services widely used in industry since more than 10 years.
- Specifically, CIShell provides "sockets" into which existing and new datasets, algorithms, and tools can be plugged using a wizard-driven process.



CIShell Developer Guide
(http://cishell.wiki.cns.iu.edu)


Home

Edit Add

1 Added by Micah Linnemeier, last edited by Micah Linnemeier on Mar 16, 2011 (view change)

About the Cyberinfrastructure Shell

The Cyberinfrastructure Shell (CIShell) is an open source, community-driven platform for the integration and utilization of datasets, algorithms, tools, and computing resources. Algorithm integration support is built in for Java and most other programming languages. Being Java based, it will run on almost all platforms. The software and specification is released under an Apache 2.0 License.

CIShell is the basis of Network Workbench, TexTrend, Sci² and the upcoming EpiC tool.

CIShell supports remote execution of algorithms. A standard web service definition is in development that will allow pools of algorithms to transparently be used in a peer-to-peer, client-server, or web front-end fashion.

CIShell Features

A framework for easy integration of new and existing algorithms written in any programming language

Using CIShell, an algorithm writer can fully concentrate on creating their own algorithm in whatever language they are comfortable with. Simple tools are provided to then take their algorithm and

Learn More...

- CIShell Papers
- CIShell Powered Tools
- Algorithms
- Plugins (coming soon)
- Misc. Tool Documentation
- CIShell Web Services (coming soon)
- Screenshots

Getting Started...

- Documentation & Developer Resources
- Download

Getting Involved...

- Contact Us

CIShell Portal (http://cishell.org)

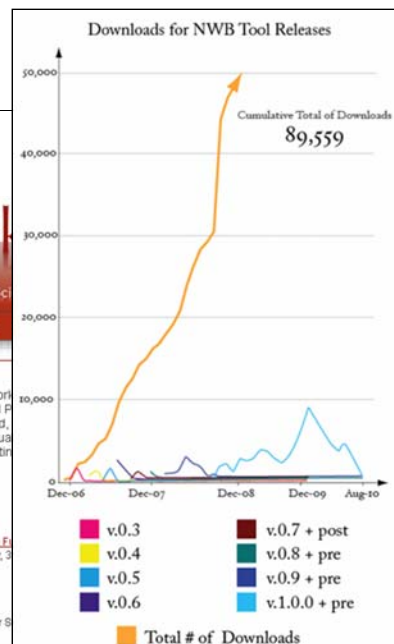
Network Workbench Tool
http://nwb.cns.edu

The Network Workbench (NWB) tool supports researchers, educators, and practitioners interested in the study of biomedical, social and behavioral science, physics, and other networks.

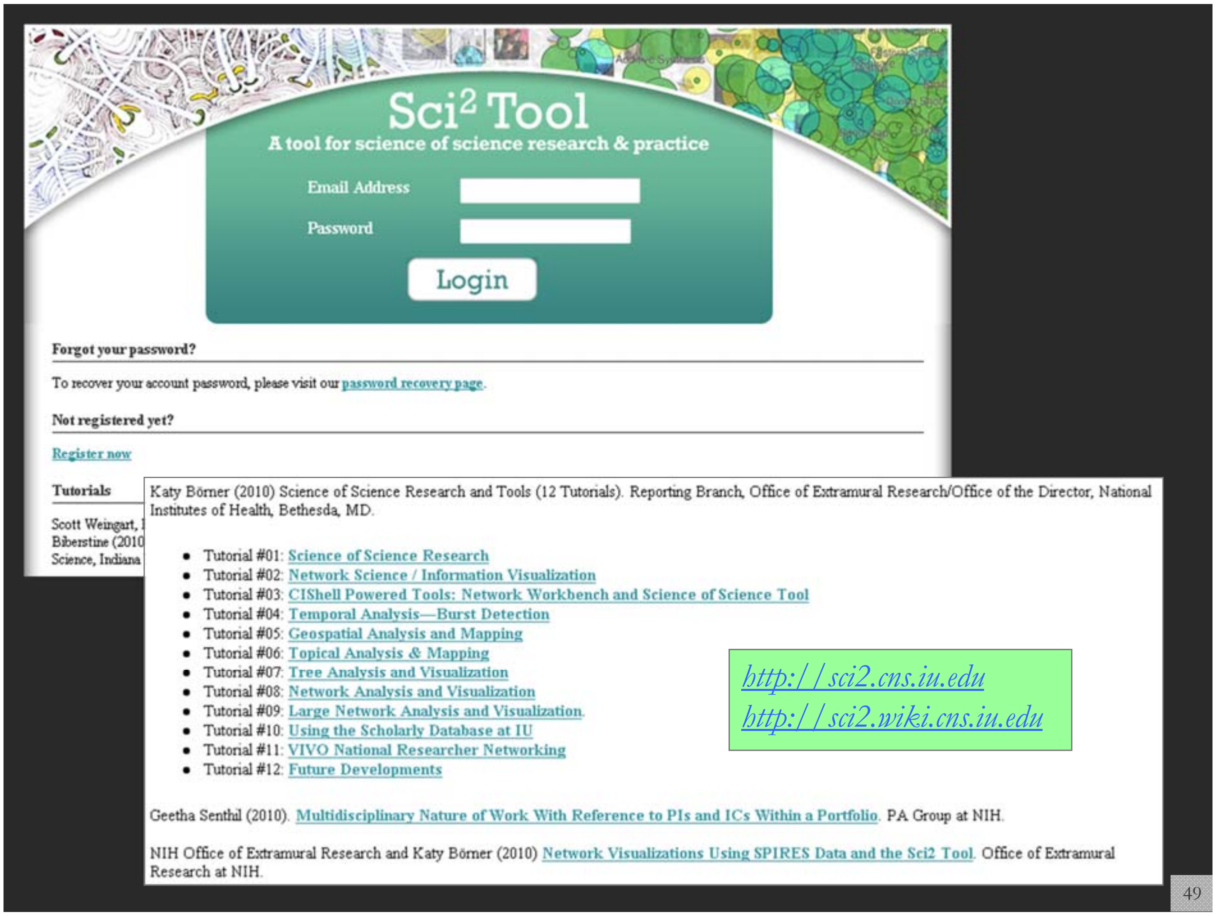
In February 2009, the tool provides more 169 plugins that support the preprocessing, analysis, modeling, and visualization of networks.

More than 50 of these plugins can be applied or were specifically designed for S&T studies.

It has been downloaded more than 65,000 times since December 2006.

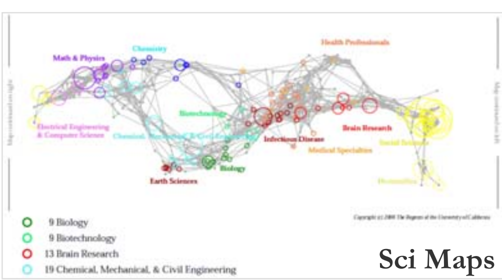


Herr II, Bruce W., Huang, Weixia (Bonnie), Penumarthy, Shashikant & Börner, Katy. (2007). Designing Highly Flexible and Usable Cyberinfrastructures for Convergence. In Bainbridge, William S. & Roco, Mihail C. (Eds.), Progress in Convergence - Technologies for Human Wellbeing (Vol. 1093, pp. 161-179), Annals of the New York Academy of Sciences, Boston, MA.

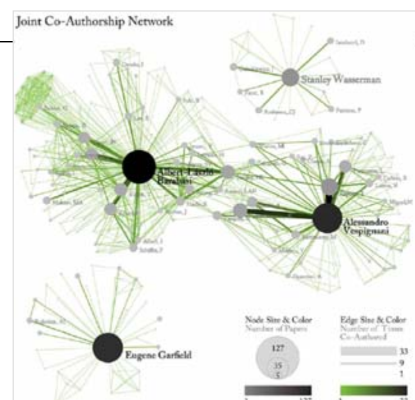


Sci² Tool – "Open Code for S&T Assessment"

OSGi/CIShell powered tool with NWB plugins and many new scientometrics and visualizations plugins.

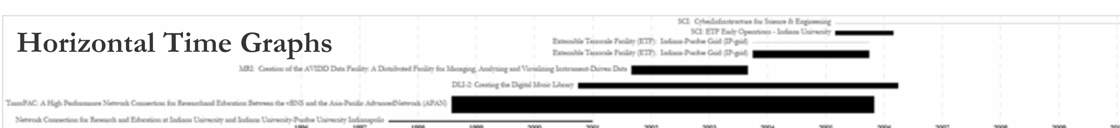


Sci Maps



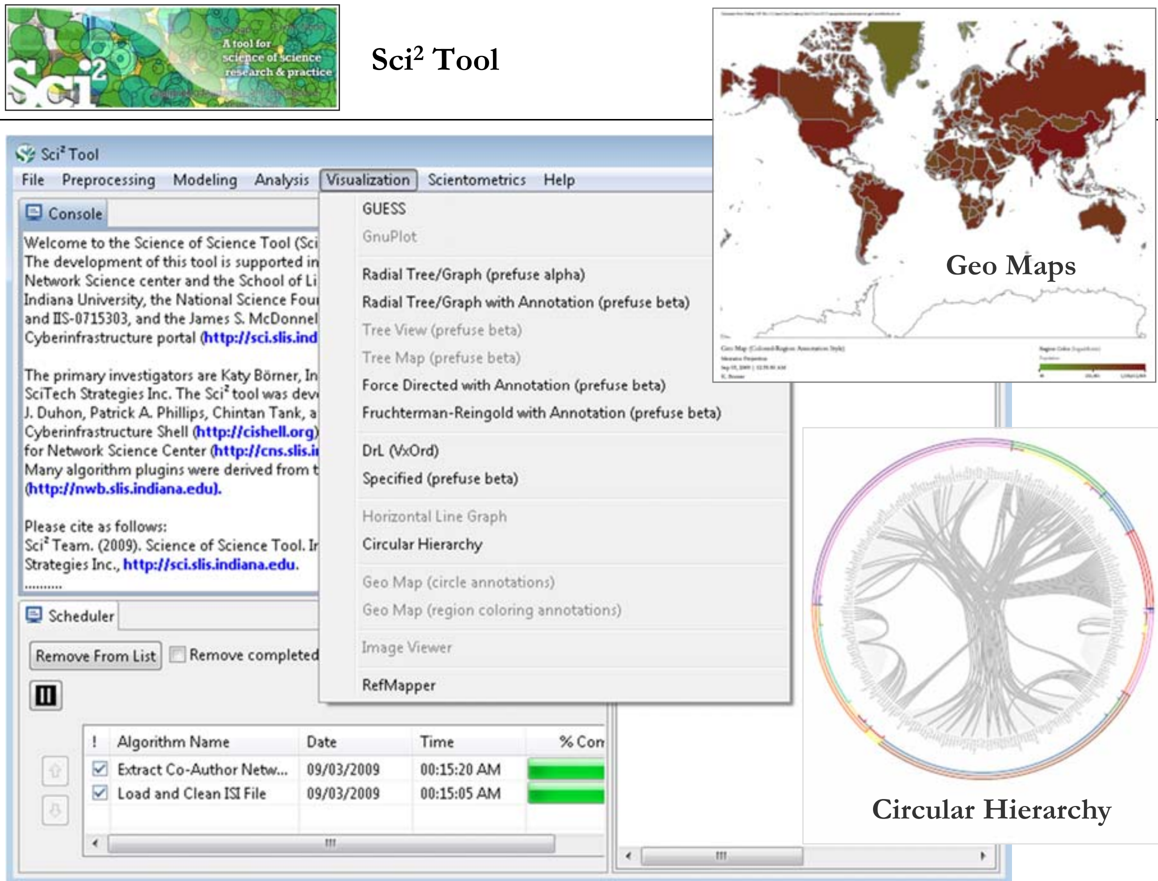
GUESS Network Vis

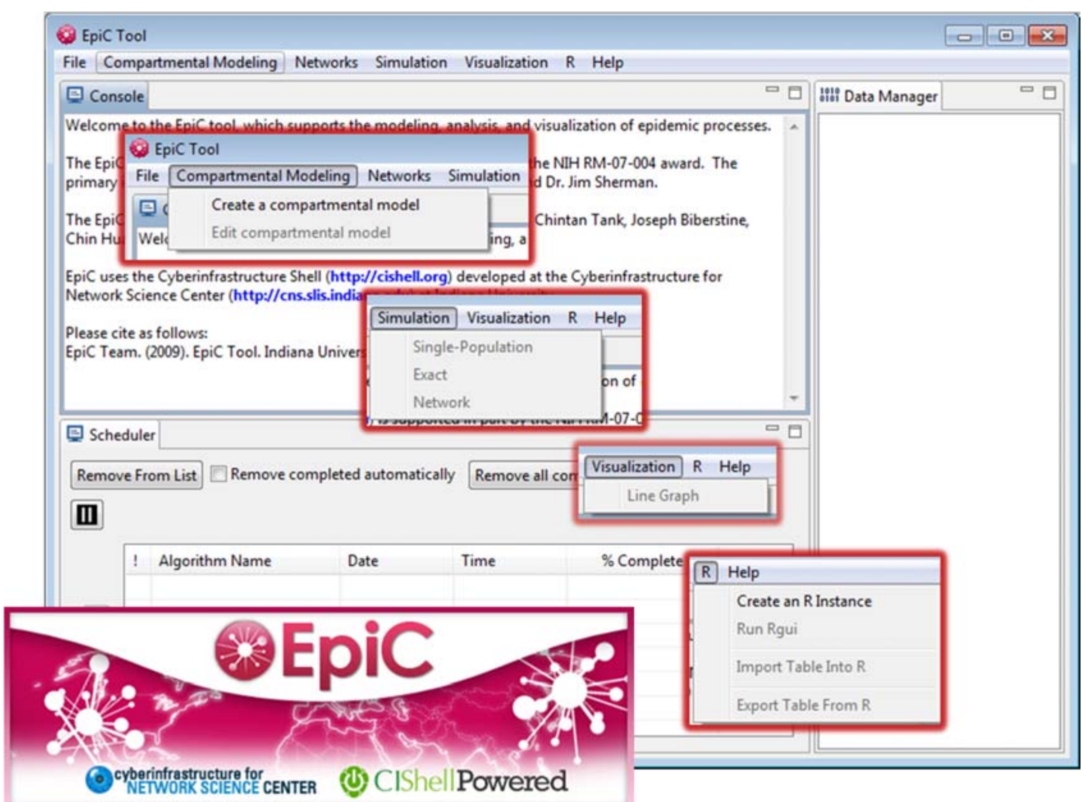
Horizontal Time Graphs



Börner, Katy, Huang, Weixia (Bonnie), Linnemeier, Micah, Duhon, Russell Jackson, Phillips, Patrick, Ma, Nianli, Zoss, Angela, Guo, Hanning & Price, Mark. (2009). Rete-Netzwerk-Red: Analyzing and Visualizing Scholarly Networks Using the Scholarly Database and the Network Workbench Tool. Proceedings of ISSI 2009: 12th International Conference on Scientometrics and Informetrics, Rio de Janeiro, Brazil, July 14-17 . Vol. 2, pp. 619-630.

Sci² Tool


Sci² Tool
File Preprocessing Modeling Analysis Visualization Scientometrics Help
Console
Welcome to the Science of Science Tool (Sci
The development of this tool is supported in
Network Science center and the School of Li
Indiana University, the National Science Fou
and IIS-0715303, and the James S. McDonnel
Cyberinfrastructure portal (http://sci.slis.ind
The primary investigators are Katy Börner, In
SciTech Strategies Inc. The Sci² tool was dev
J. Duhon, Patrick A. Phillips, Chintan Tank, a
Cyberinfrastructure Shell (http://cishell.org)
for Network Science Center (http://cns.slis.i
Many algorithm plugins were derived from t
(http://nwb.slis.indiana.edu).
Please cite as follows:
Sci² Team. (2009). Science of Science Tool. I
Strategies Inc., http://sci.slis.indiana.edu.
GUESS
GnuPlot
Radial Tree/Graph (prefuse alpha)
Radial Tree/Graph with Annotation (prefuse beta)
Tree View (prefuse beta)
Tree Map (prefuse beta)
Force Directed with Annotation (prefuse beta)
Fruchterman-Reingold with Annotation (prefuse beta)
DrL (VxOrd)
Specified (prefuse beta)
Horizontal Line Graph
Circular Hierarchy
Geo Map (circle annotations)
Geo Map (region coloring annotations)
Image Viewer
RefMapper
Scheduler
Remove From List
Remove completed
Algorithm Name
Date
Time
% Con
Extract Co-Author Netw...
09/03/2009
00:15:20 AM
Load and Clean ISI File
09/03/2009
00:15:05 AM
Geo Maps
Circular Hierarchy


EpiC Tool
File Compartmental Modeling Networks Simulation Visualization R Help
Console
Data Manager
Welcome to the EpiC tool, which supports the modeling, analysis, and visualization of epidemic processes.
he NIH RM-07-004 award. The
d Dr. Jim Sherman.
Chintan Tank, Joseph Biberstine,
EpiC uses the Cyberinfrastructure Shell (http://cishell.org) developed at the Cyberinfrastructure for
Network Science Center (http://cns.slis.india
Please cite as follows:
EpiC Team. (2009). EpiC Tool. Indiana Univer
Create a compartmental model
Edit compartmental model
Single-Population
Exact
Network
Line Graph
Create an R Instance
Run Rgui
Import Table Into R
Export Table From R
Scheduler
Remove From List
Remove completed automatically
Algorithm Name
Date
Time
% Complete
EpiC
cyberinfrastructure for NETWORK SCIENCE CENTER
CIShell Powered

OSGi/CIShell Adoption

A number of other projects recently adopted OSGi and/or CIShell:

USA

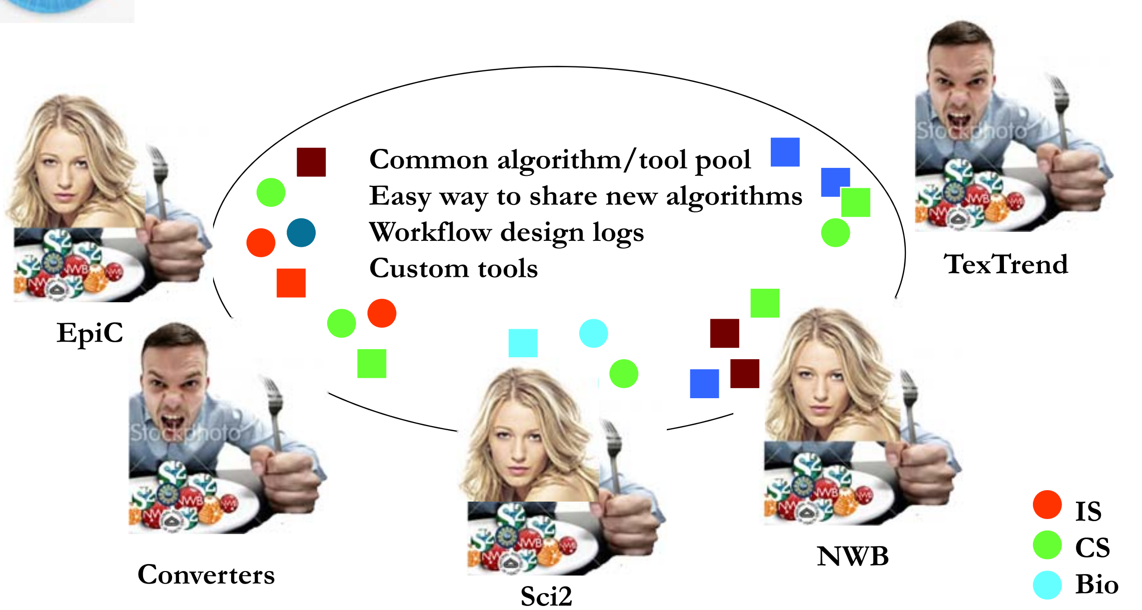
- *Cytoscape* (*http://cytoscape.org*) Led by Trey Ideker at the University of California, San Diego is an open source bioinformatics software platform for visualizing molecular interaction networks and integrating these interactions with gene expression profiles and other state data (Shannon et al., 2002).
- *MAEviz* (*https://wiki.ncsa.uiuc.edu/display/MAE/Home*) Managed by Jong Lee at NCSA is an open-source, extensible software platform which supports seismic risk assessment based on the Mid-America Earthquake (MAE) Center research.

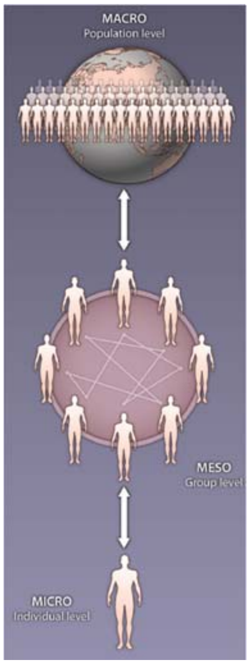
Europe

- *Taverna Workbench* (*http://taverna.org.uk*) Developed by the myGrid team (http://mygrid.org.uk) led by Carol Goble at the University of Manchester, U.K. is a free software tool for designing and executing workflows (Hull et al., 2006). Taverna allows users to integrate many different software tools, including over 30,000 web services.
- *TEXTrend* (*http://textrend.org*) Led by George Kampis at Eötvös Loránd University, Budapest, Hungary supports natural language processing (NLP), classification/mining, and graph algorithms for the analysis of business and governmental text corpuses with an inherently temporal component.
- *DynaNets* (*http://www.dynanets.org*) Coordinated by Peter M.A. Sloot at the University of Amsterdam, The Netherlands develops algorithms to study evolving networks.
- *SISOB* (*http://sisob.lcc.uma.es*) An Observatory for Science in Society Based in Social Models.

As the functionality of OSGi-based software frameworks improves and the number and diversity of dataset and algorithm plugins increases, the capabilities of custom tools will expand.

Embrace the Changing Scientific Landscape





Mixed-methods, multi-level SciTS needs:

Expertise – identify and access it at the perfect moment using, e.g., Facebook, LinkedIn, Academia, VIVO, Harvard Profiles, Elsevier's Collexis, Loki, Stanford's CAP, or other systems.

Data – find, interlink, unify, merge, reformat, share them, e.g., using web sites analogous to http://www.diggingintodata.org/Repositories/tabid/167/Default.aspx, SDB, or LOD.

Tools – identify, learn, advance, share code, e.g., via Plug-and-Play Macroscopes, to arrive at a holistic understanding of the science system.

Few have access to or time to visit
"Visualization Domes"

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

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

Science Maps in "Expedition Zukunft" science train visiting 62 cities in 7 months, 12 coaches, 300 m long. *http://www.expedition-zukunft.de*

Science & Technology Forecasts @ Times Square in 2016

References

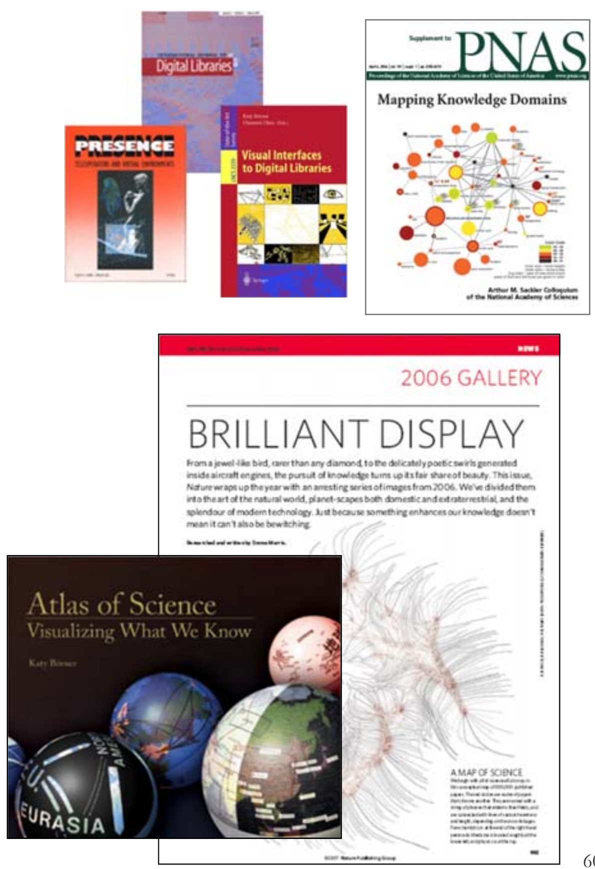
Börner, Katy, Chen, Chaomei, and Boyack, Kevin. (2003). **Visualizing Knowledge Domains.** In Blaise Cronin (Ed.), *ARIST*, Medford, NJ: Information Today, Volume 37, Chapter 5, pp. 179-255. http://ivl.slis.indiana.edu/km/pub/2003-borner-arist.pdf

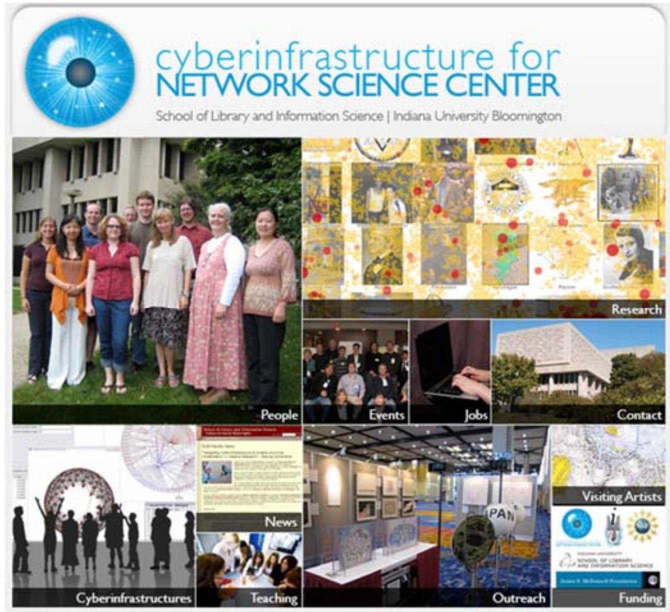
Shiffrin, Richard M. and Börner, Katy (Eds.) (2004). **Mapping Knowledge Domains**. *Proceedings of the National Academy of Sciences of the United States of America*, 101(Suppl_1). http://www.pnas.org/content/vol101/suppl_1/

Börner, Katy, Sanyal, Soma and Vespignani, Alessandro (2007). **Network Science.** In Blaise Cronin (Ed.), *ARIST*, Information Today, Inc., Volume 41, Chapter 12, pp. 537-607. http://ivl.slis.indiana.edu/km/pub/2007-borner-arist.pdf

Börner, Katy (2010) **Atlas of Science**. MIT Press. http://scimaps.org/atlas

Scharnhorst, Andrea, Börner, Katy, van den Besselaar, Peter (2011) **Models of Science Dynamics**. Springer Verlag.





All papers, maps, tools, talks, press are linked from http://cns.iu.edu

CNS Facebook: http://www.facebook.com/cnscenter
Mapping Science Exhibit Facebook: http://www.facebook.com/mappingscience