

CNS Macroscopes are used by hundreds of thousands around the globe

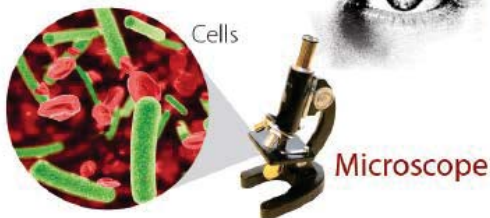
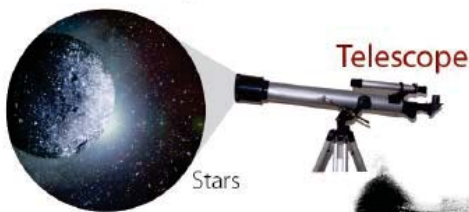


Our mission is to advance datasets, tools, and services for the study of biomedical, social and behavioral science, physics, and other networks. A specific focus is research on the structure and evolution of science and technology (S&T) and the communication of results via static and interactive maps of science. Learn more at cishell.org.

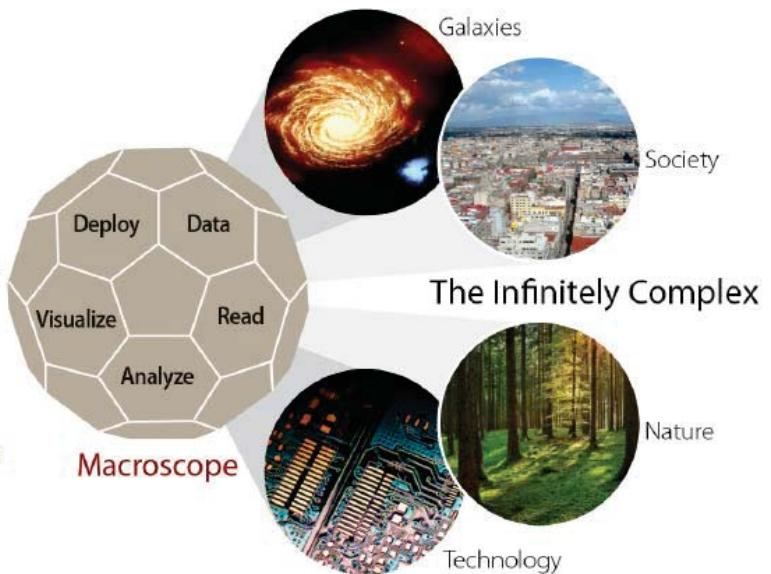


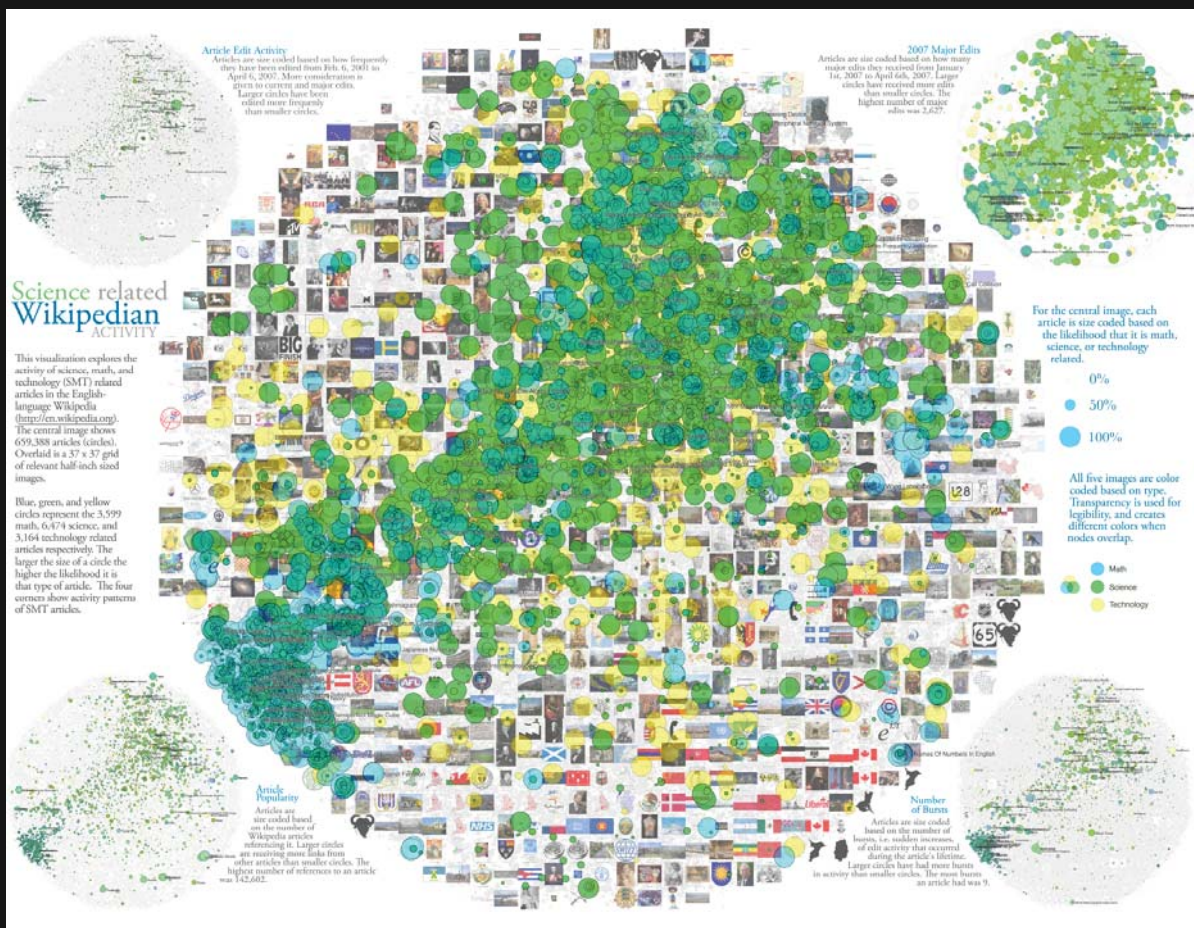
Microscopes, Telescopes, Macroscopes

The Infinitely Great

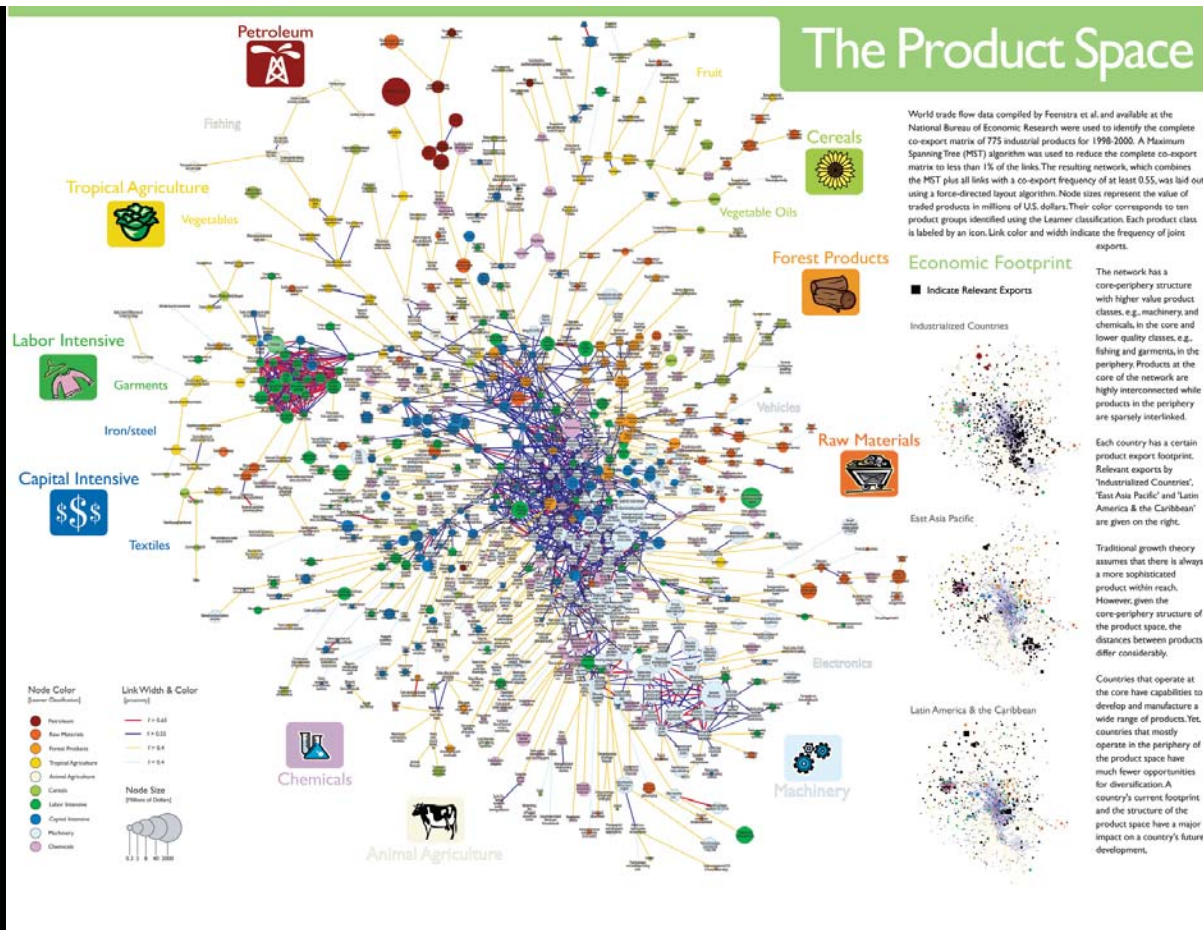


The Infinitely Small



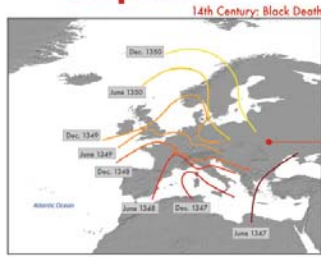


Science Related Wikipedian Activity - Herr II, Holloway, Borner, Hardy, Boyack - 2007



The Product Space - Cesar A. Hidalgo, Bailey Klinger, Albert-Laszlo Barabasi, Ricardo Hausmann - 2007

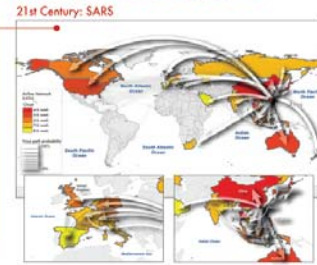
Impact of Air Travel on Global Spread of Infectious Diseases



Epidemic spreading pattern changed dramatically after the development of modern transportation systems.

In pre-industrial times disease spread was mainly a spatial diffusion phenomenon. During the spread of Black Deaths in the 14th century Europe, only few traveling means were available and typical trips were limited to relatively short distances on the time scale of one day. Historical studies confirm that the disease diffused smoothly generating an epidemic front traveling as a continuous wave through the continent at an approximate velocity of 200-400 miles per year.

The SARS outbreak on the other hand was characterized by a patchy and heterogeneous spatio-temporal pattern mainly due to the air transportation network identified as the major channel of epidemic diffusion and ability to connect far apart regions in a short time period. The SARS maps are obtained with a data-driven stochastic computational model aimed at the study of the SARS epidemic pattern and analysis of the accuracy of the model's predictions. Simulation results describe a spatio-temporal evolution of the disease (color coded countries) in agreement with the historical data. Analysis on the robustness of the model's forecasts leads to the emergence and identification of epidemic pathways as the most probable routes of propagation of the disease. Only few preferential channels are selected (arrows; width indicates the probability of propagation along that path) out of the huge number of possible paths the infection could take by following the complex nature of airline connections (light grey; source: IATA).



Forecasts of the Next Pandemic Influenza

Seasonal



Forecasts are obtained with a stochastic computational model which explicitly incorporates data on worldwide air travel and detailed census data to simulate the global spread of an influenza pandemic.

The modeling approach considers infection dynamics (i.e., virus transmission, onset of symptoms, infectiousness, recovery, etc.) among individuals living in urban areas around the world, and assumes that individuals are allowed to travel from one city to another by means of the airline transportation network.

Geographical

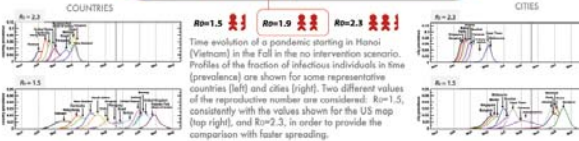
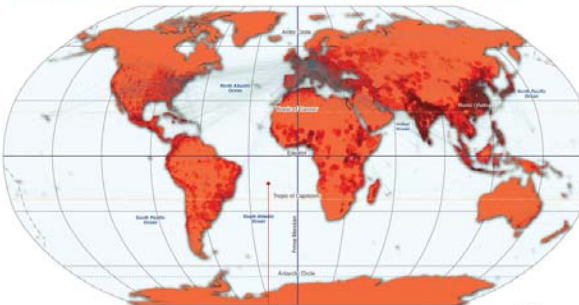


Numerical simulations provide results for the temporal and geographic evolution of the pandemic influenza in 3,100 urban areas located in 220 different countries. The model allows to study different spreading scenarios, characterized by different initial outbreak conditions, both geographical and seasonal.

The central map represents the cumulative number of cases in the world after the first year from the start of a pandemic influenza with $R_0=1.9$ originating in Hanoi (Vietnam) in the Spring.



The US maps focus on the situation in the US after one year, and show the effect of changes in the original scenario analyzed. Different color coding is used for the sake of visualization.



The model includes the worldwide air transportation network (source: IATA) composed of 3,100 airports in 220 countries and $E=17,182$ direct connections, each of them associated to the corresponding passenger flow. This dataset accounts for 99% of the worldwide traffic and is complemented by the census data of each large metropolitan area served by the corresponding airport.

Additional spreading scenarios can be obtained by modeling different levels of infectiousness of the virus, as expressed in terms of the reproductive number R_0 , representing the average number of infections generated by a sick person in a fully susceptible population.

Intervention strategies modeling the use of antiviral drugs can be considered. Two scenarios are compared: an uncooperative strategy in which countries only use their own stockpiles, and a cooperative intervention which envisions a limited worldwide sharing of the resources.

Reproductive Number (R_0)



Intervention

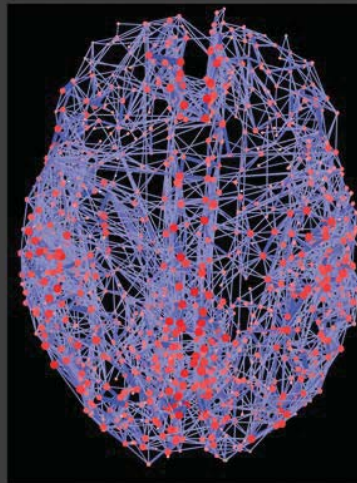


Impact of Air Travel on Global Spread of Infectious Diseases - Vittoria Colizza, Alessandro Vespignani - 2007

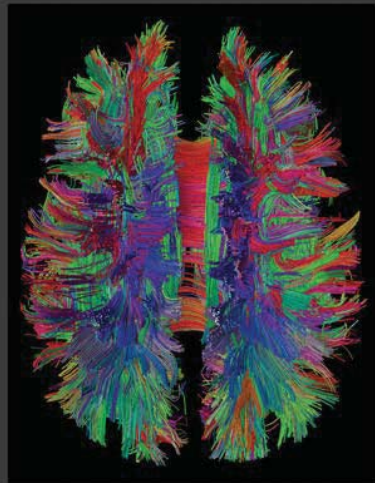
The Human Connectome



Anatomy
Klingler's method for fiber tract dissection uses freezing of brain matter to spread nerve fibers apart. Afterwards, tissue is carefully scratched away to reveal a relief-like surface in which the desired nerve tracts are naturally surrounded by their anatomical brain areas.



Connectome
Shown are the connections of brain regions together with "hubs" that connect signals among different brain areas and a central "core" or backbone of connections, which relays commands for our thoughts and behaviors.



Neuronal Pathways
A new MRI technique called diffusion spectrum imaging (DSI) analyzes how water molecules move along nerve fibers. DSI can show a brain's major neuron pathways and will help neurologists relate structure to function.

The Human Connectome - Eugen Ludvig, Josef Klingler, Patric Hagmann & Olaf Sporns - 1956, 2008

Labor Statistics

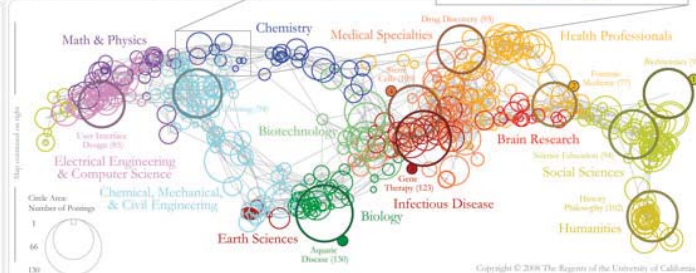
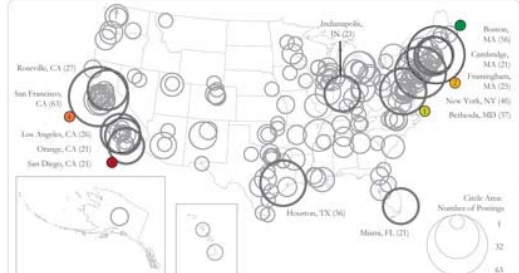
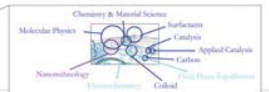
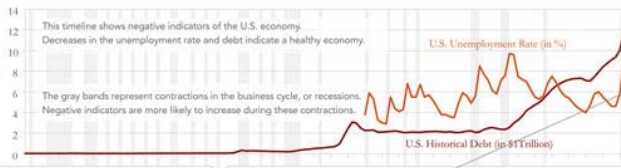
From the start of the recession in December 2007 through the end of 2009, more than 8 million jobs were lost in the United States. In October 2009, the U.S. unemployment rate peaked at 10.1 percent (after adjustment for seasonal variations). In April 2010, unemployment was still at 9.9 percent. In May 2010, about 4.8 million individuals, or 46 percent of those unemployed, had been unemployed for at least 27 weeks. Each month, 100,000 people enter the U.S. labor market—including high school and college graduates. They join 15 million Americans looking for work.

Unemployment rates are calculated and adjusted by the Bureau of Labor Statistics within the U.S. Department of Labor and reported in their monthly Economic News Release on the Employment Situation. Historical employment data, including unemployment rates with and without seasonal adjustment and divided by individual characteristics and labor sectors, are also available from the Bureau of Labor Statistics.

U.S. Job Market: Where are the Academic Jobs?

General Trends

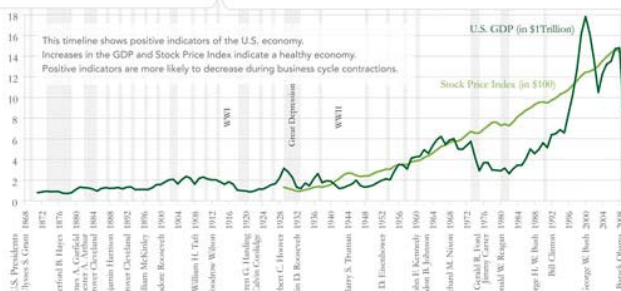
The charts to the left show annual national economic indicators. These indicators serve as background data; they flow beneath and around more specific analyses of the job market. Business cycle data come from the National Bureau of Economic Research. Historical debt data come from the U.S. Department of Treasury. Unemployment rates come from the Bureau of Labor Statistics. GDP data come from the Bureau of Economic Analysis. Stock Price Index data come from the research of Dr. Robert Shiller at Yale University Department of Economics. Individual conversion factors (compiled from Bureau of Labor Statistics Consumer Price Index by the Oregon State University Political Science Department) were applied where appropriate.



- Sample Jobs**
- Bioinformatics Programming Support NIH/NICHD (Bioinformatics, Bethesda, MD)
 - Boston Sea Level Rise/Manufacturing Director (Economic Medicine, Boston, MA)
 - Associate Scientist II Major State/Carverius (Gene Therapy, San Diego, CA)
 - Scientist Early Stage Cell Culture (Gene Cells, San Francisco, CA)
 - Post Doctoral Training in Materials Science (Applied Physics, San Antonio, TX)

Geospatial Map
Using U.S. city and state information, circles are placed over the location of the job postings and are sized in relation to the number of postings listed for that location. The top-10 cities with the highest number of postings are labeled, and the number of postings is given in parentheses.

Where are the Academic Jobs?
Over 3,500 jobs posted between July 2008 and February 2009 on Nature Jobs were collected and analyzed. The two maps above show the 1,037 job postings located in the U.S. and represent a directed study of the job market that sits on top of larger trends over time.



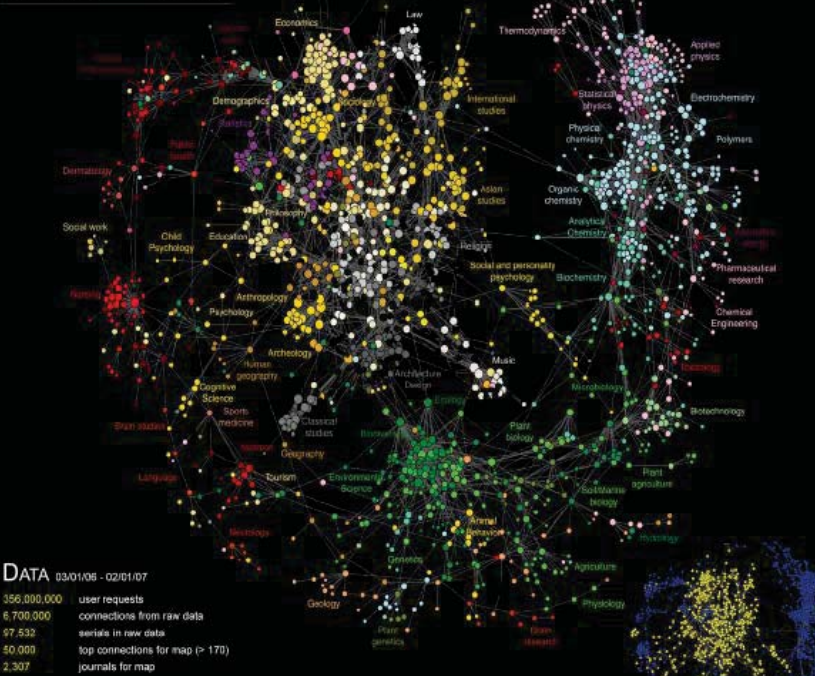
Topic Map
Using a hierarchical, multi-step clustering procedure, journals were grouped into 554 clusters based on common word usage and shared references (bibliographic coupling). In the map, each cluster is represented by a node, and links denote strong bibliographic coupling relations. The 554 clusters are further grouped into 13 color coded scientific disciplines.

The 1,037 jobs were overlaid based on word matches in their description and keywords associated with each of the 554 nodes. Like in the geospatial map, circle area sizes correspond to the number of jobs posted.

U.S. Job Market: Where are the Academic Jobs? - Angela M. Zoss & Katy Börner - 2010

LEGEND

- Physics
- Chemistry
- Biology
- Social Sciences
- Humanities
- Connection



CLICKSTREAM MAP OF SCIENCE

This is the first map created from large-scale, world-wide, scholarly usage data. It visualizes the collective flow of scientists' movements from one journal to another in their online navigation behavior.

The MESUR project (www.mesur.org) collected a database of nearly 1 billion user requests recorded by the web portals of some of the world's most significant publishers, aggregators and large university consortia, among them Thomson Scientific (Web of Science), Elsevier (BioRxiv), JSTOR, Ingenta, University of Texas (P databases), Health Institutions, and California State University (23 campuses). All usage logs acquired by the MESUR project contain session identifiers that identify the individual clickstreams of individual scientists navigating from one article to the next.

Pairs of journals are connected when they have a high probability of being followed by each other in users' clickstreams. The circles represent individual journals. A line between two circles indicates that they are strongly connected in either direction. The colors indicate the scientific domain a journal belongs to according to the Dewey, Doornik and JCR classification codes that were mapped into the Getty Research Center Arts and Architecture Taxonomy (AAT) to allow classifications at various levels of detail. The size of circles corresponds to the strength (degree centrality) of a journal's connections in the map. The map is arranged by the Fruchterman-Reingold algorithm that treats connections like springs: connected journals are drawn together, but they are not allowed to get too close.

This map is derived from usage data and therefore also reflects the actions of those who read the literature but rarely publish themselves, e.g. practitioners and laypersons. As a result practitioner-driven domains such as nursing, social work, and tourism studies are prominently featured. The natural sciences vs. the social sciences and humanities emerge as two distinct clusters that are connected via various topics: interdisciplinary spores. Most domains are highly interdisciplinary, but this is more so the case for the social sciences and humanities. Surprisingly, mathematics and computer science are not represented as one specific cluster, but spread-out through the map.

Like citation maps, this map is based upon a particular sample of the scientific community: albeit one that includes non-publishing scientists and practitioners and a much greater sample of publications. From MESUR's database of 1 billion user events, we extracted a matrix of 8 million connections between approximately 100,000 serials. From that matrix we selected only 50,000 connections with the highest number of observations, ranging from approximately 40,000 to 370 observations. The subset of connections pertained to the 2,307 most used journals. This procedure may introduce specific biases which require investigation. This map should therefore not be considered as a final map of scientific activity, but as a showcase for the feasibility of tracking scientific activity from usage data. We hope this methodology will provide unique insights into the real-time structure of scientific activity as it can be observed from scholarly clickstream data.

When we cut the AAT taxonomy at the top level, only two dimensions remain: natural science (blue nodes) vs. the social sciences and humanities (yellow nodes). Some journals along the spokes of the wheel have classifications (colors) that do not correspond to their location in the map. This indicates either the journal in question is highly interdisciplinary, and/or has been assigned a classification that does not correspond to how scientists actually use the particular journal.

DATA 03/01/08 - 02/01/07

356,000,000	user requests
6,700,000	connections from raw data
97,532	serials in raw data
50,000	top connections for map (> 170)
2,307	journals for map

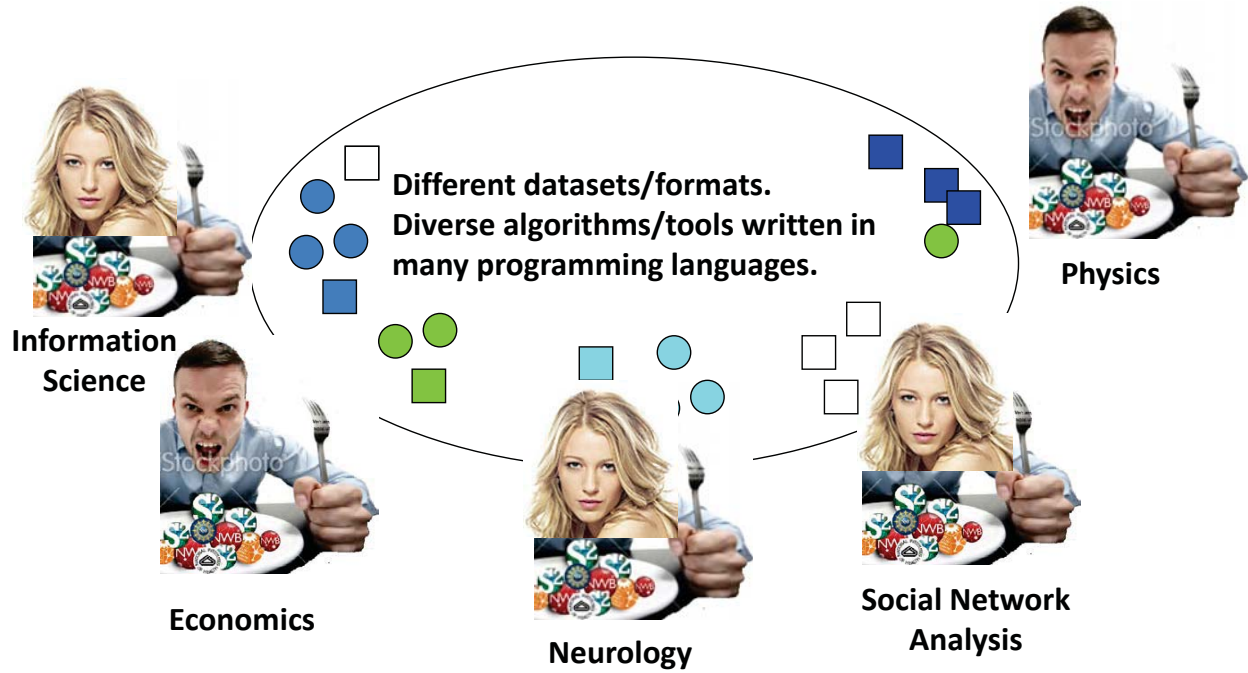


More information on this map can be found in Bollen J., Van de Sompel H., Hagberg A., Bettencourt L., Chute R., Rodriguez, M.A. and Balakireva, L. (2009) Clickstream Data Yields High-Resolution Maps of Science. *PLoS ONE* 4(3): e4903. doi:10.1371/journal.pone.0049003 (Freely available online)

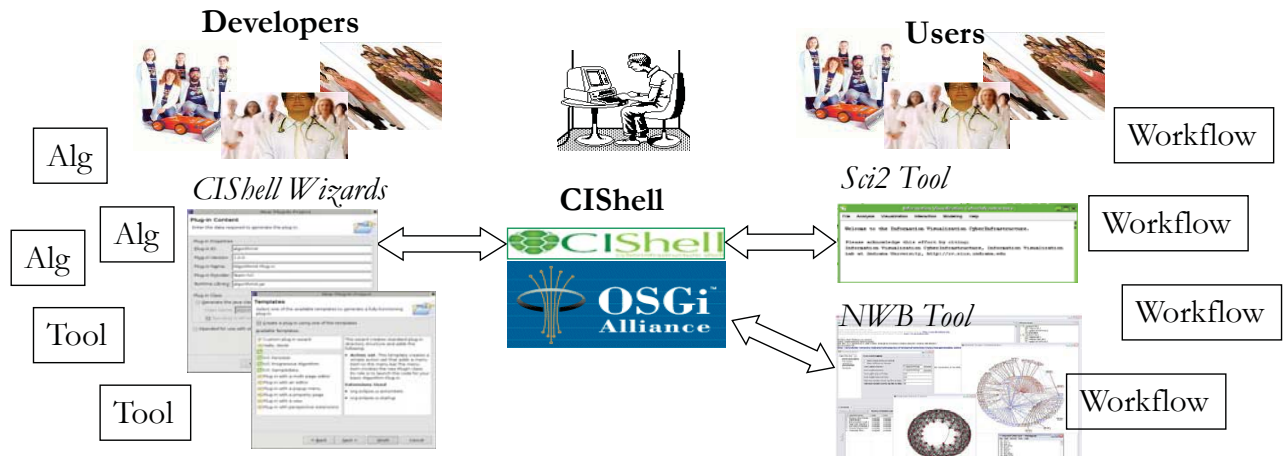
Design layout by: Jeremy D. Chace

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

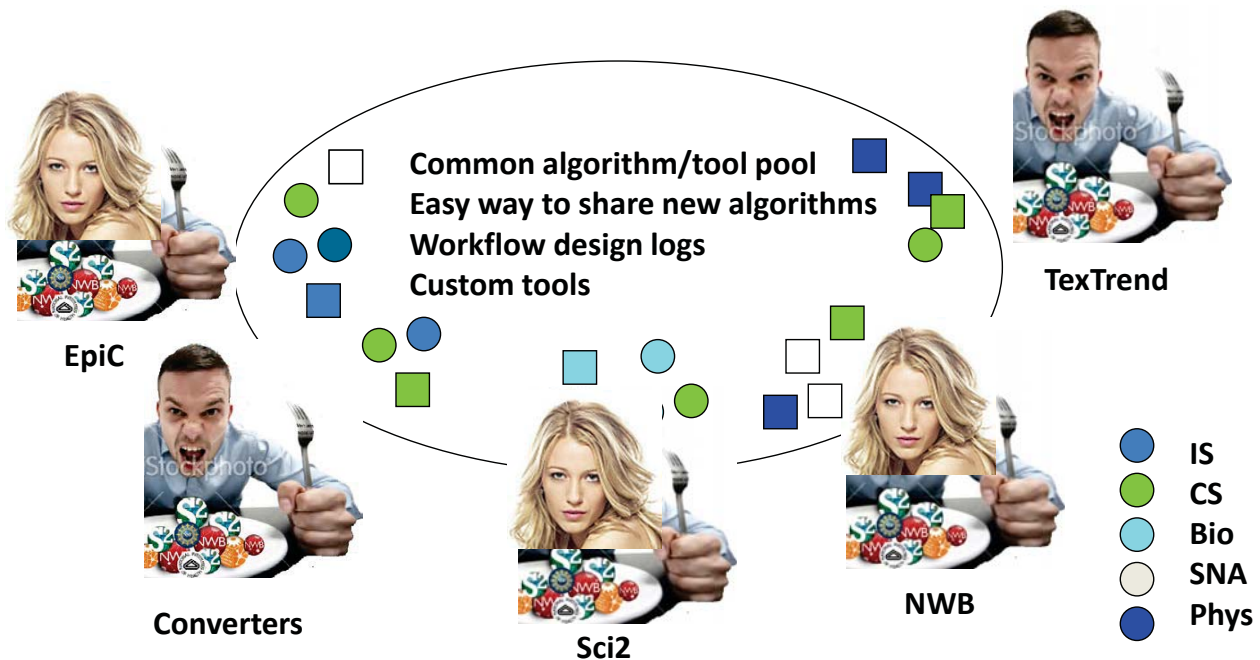
Plug-and-Play Macroscopes



Plug-and-Play Macroscopes



Plug-and-Play Macroscopes



11

Network Workbench Tool (<http://nwb.cns.iu.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.

The tool provides 180+ plugins that support the preprocessing, analysis, modeling, and visualization of networks.

It has been downloaded more than 130,000+ times.

NetworkWorkbench
 A Workbench for Network Scientists

Home People Research Publications Community Download Documentation Dev Zone About

Summary
 Network Workbench: A Large-Scale Network Analysis, Modeling and Visualization Toolkit for Biomedical, Social Science and Physics Research. This project will design, evaluate, and operate a unique distributed, shared resources environment for large-scale network analysis, modeling, and visualization, named Network Workbench (NWB). The envisioned data-code-computing resources environment will provide ...
[more](#)
[How to cite this project](#)

News & Updates

- 5.1.09 Kaelble, Steve. 2009. [Mapping the Future of Knowledge: Research & Creative Activity](#), 31, 2: 12-15. ([website](#) accessed 5/1/09)
- 3.23.09 [1.0.0 beta 5 Released](#)
- 1.23.09 Ann Meranie's [tutorial abstract](#) for Sunbelt 2009
- 11.4.08 [Two NWB Pls featured in "Connected—The Power of Six Degrees."](#) 2008. Anna Maria Talas, Director. Australian Broadcasting Corporation, Ltd. ([YouTube](#)) ([Full Video](#)) (300MB)

Download 1.0.0 beta 5 Release
 Note: save the download as .jar

Select Your Operating System
 Windows (XP & Vista) **DOWNLOAD**

Get Involved
[Getting Started](#)
 See more [documentation](#)

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Network Workbench Tool – Jetstream Edition

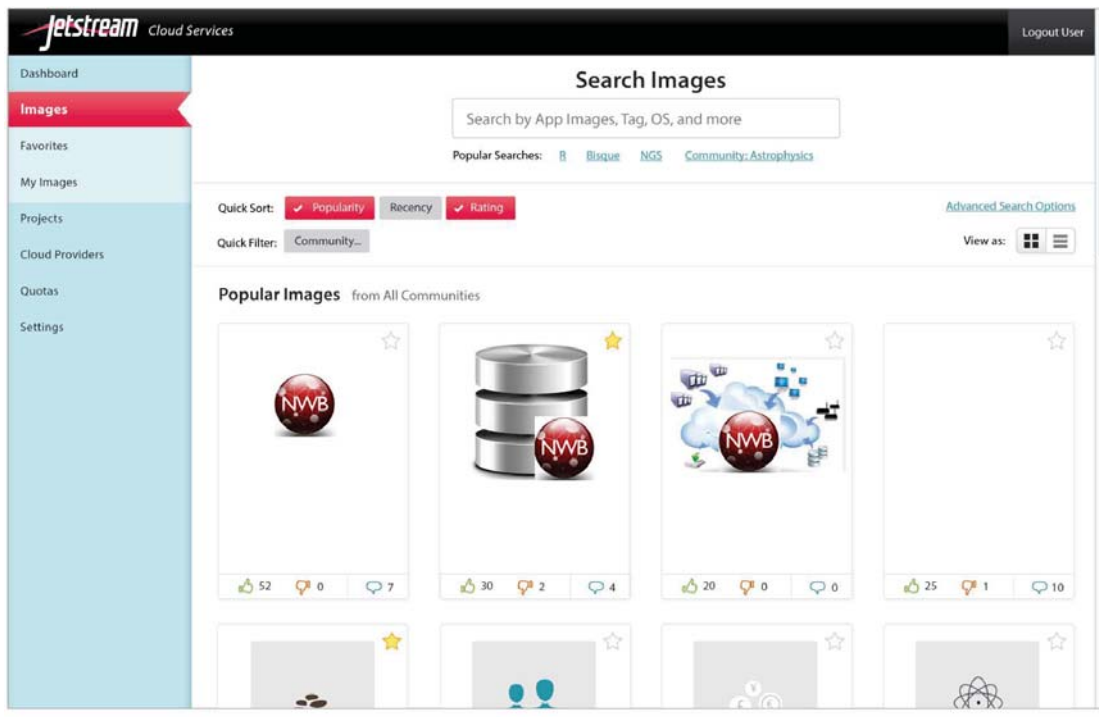
Exciting collaboration between the Cyberinfrastructure for Network Science Center (CNS), the Indiana University Network Science Institute (IUNI) and the Jetstream team at UITS, all at IUB.

Soon, network scientists around the globe will be able to use the computational power of XSEDE to study networks across domains and multiple scales.



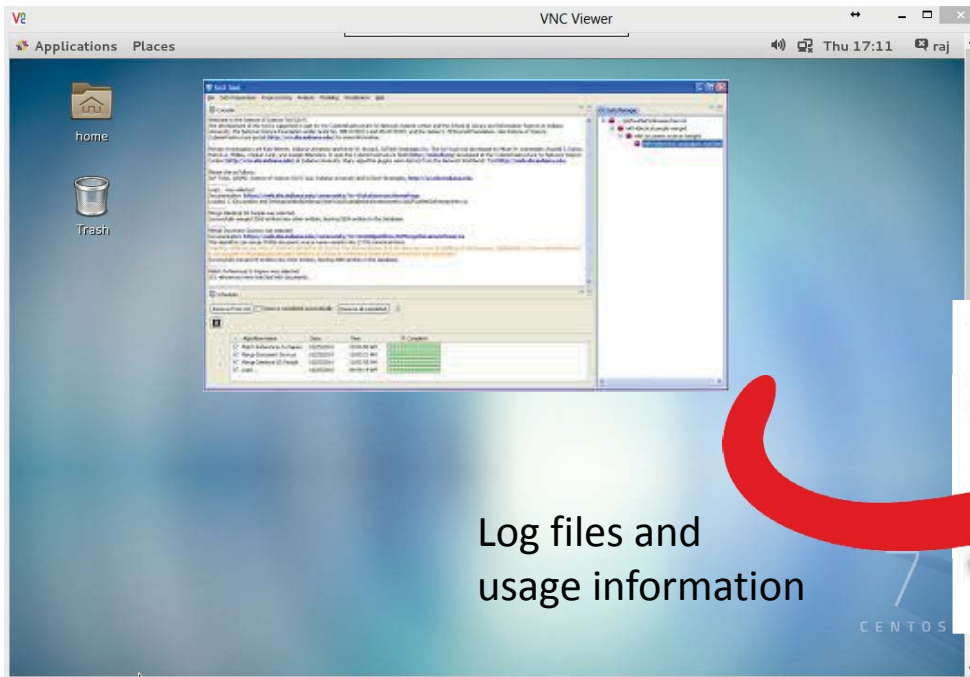
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NWB Tool – Jetstream Edition – Initial VM Approach



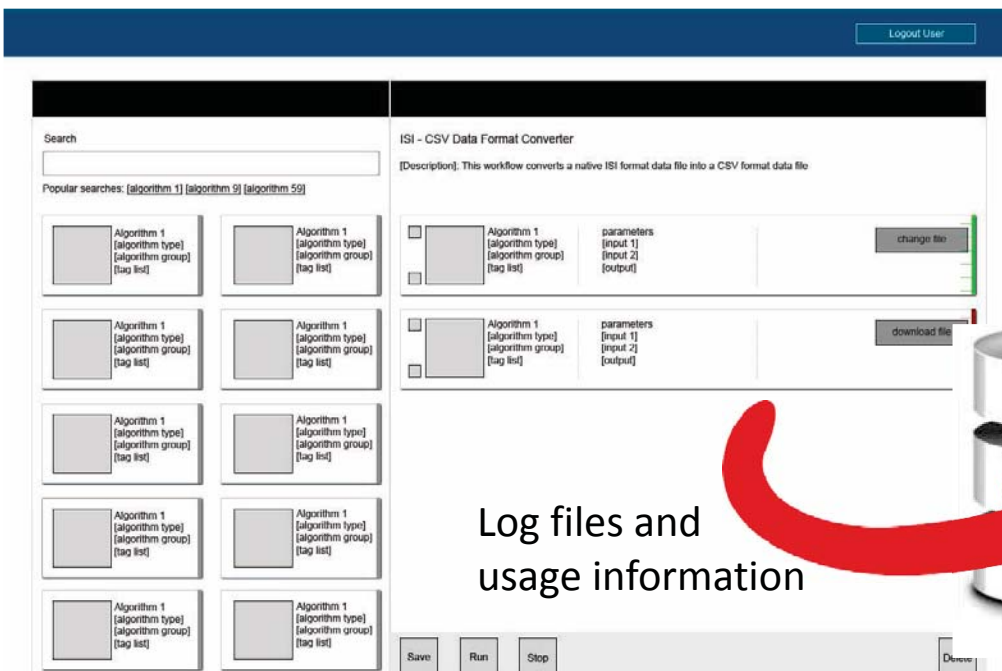
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NWB Tool – Jetstream Edition – Desktop Edition



15

NWB Tool – Jetstream Edition – Web Edition



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NWB Tool – Jetstream Edition – Web Edition

Ψ WEB SITE NAME Welcome John

Data / Results Visualization

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back to workflow download/save visualization

Log files and usage information

NWB

17

NWB Tool – Jetstream Edition – Empowering NetSci R&D

Scientist related
Wikipedia

21st Century: SARS

LEGEND
 Physics
 Chemistry
 Biology
 Earth Sciences
 Humanities

DATA: 10/10/07 12:00:00
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Chemistry
 Medical Operations
 Health Performance
 Brain Research
 Infectious Disease
 Earth Sciences

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