# Sci2: A Tool of Science of Science Research and Practice

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http://cns.iu.edu

With special thanks to Kevin W. Boyack, Chin Hua Kong, Micah Linnemeier, Russell J. Duhon, Patrick Phillips, Joseph Biberstine, Chintan Tank Nianli Ma, Scott Weingart, Hanning Guo, Mark A. Price, Angela M. Zoss, Ted Polley, and Sean Lind

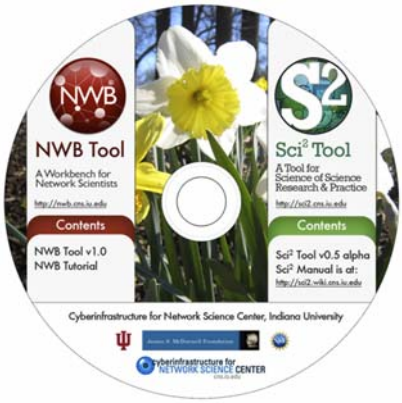
*13th International Society for Scientometrics and Informetrics (ISSI) Conference*
*Durban, South Africa*

*Monday, July 4, 2011 • 1.30pm – 5.00pm*

## Online Resources

- These slides
  http://sci2.cns.iu.edu/docs/2011-borner-ISSI-Tutorial.pdf
- Sci2 Tool Manual v0.5.1 Alpha
  http://sci2.wiki.cns.iu.edu
- Sci2 Tool v0.5.1 Alpha (May 4, 2011)
  http://sci2.cns.iu.edu

- Additional Datasets
  http://sci2.wiki.cns.iu.edu/2.5+Sample+Datasets
- Additional Plugins
  http://sci2.wiki.cns.iu.edu/3.2+Additional+Plugins




Or copy them from the DVD or memory stick.

## Workshop Overview

**1:30 Macroscope Design and Usage & CIShell Powered Tools: NWB & Sci2**

**1:45 Sci2 Tool Basics**

- **Download and run the tool.**

**2:00 Sci2 Sample Workflow: Padgett's Florentine Families - Prepare, load, analyze, and visualize family and business networks from 15th century Florence.**

**2:30 Sci2 Sample Workflow: Studying Four Major NetSci Researchers.**

- **Load and clean a dataset as text file; process raw data into networks.**
- **Find basic statistics and run various algorithms over the network.**
- **Visualize as either a circular hierarchy or network**

***3:30 Break***

**4:00 Sci2 Demo I: Geospatial maps with congressional districts**

**4:30 Sci2 Demo II: Evolving collaboration networks**

**4:45 Outlook and Discussion**

***5:00 Adjourn***

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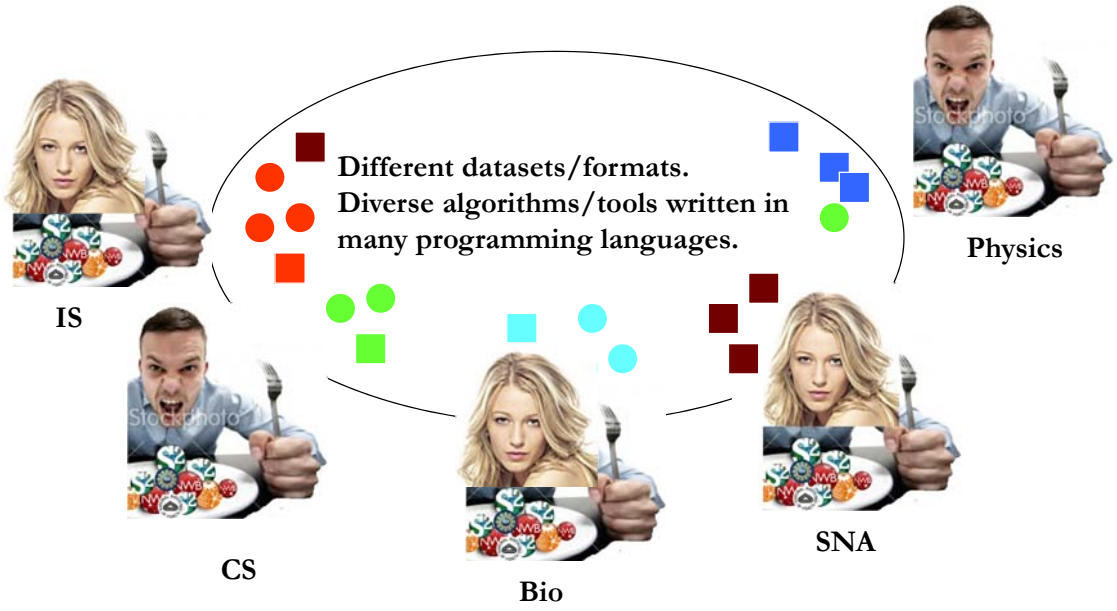
## Macroscopes Serve the Changing Scientific Landscape






## The Changing Scientific Landscape

***Star Scientist -> Research Teams:*** In former times, science was driven by key scientists. Today, science is driven by effectively collaborating co-author teams often comprising expertise from multiple disciplines and several geospatial locations (Börner, Dall'Asta, Ke, & Vespignani, 2005; Shneiderman, 2008).

***Users -> Contributors:*** Web 2.0 technologies empower anybody to contribute to Wikipedia or to exchange images and videos via Fickr and YouTube. WikiSpecies, WikiProfessionals, or WikiProteins combine wiki and semantic technology in support of real time community annotation of scientific datasets (Mons et al., 2008).

***Cross-disciplinary:*** The best tools frequently borrow and synergistically combine methods and techniques from different disciplines of science and empower interdisciplinary and/or international teams of researchers, practitioners, or educators to fine-tune and interpret results collectively.

***One Specimen -> Data Streams:*** Microscopes and telescopes were originally used to study one specimen at a time. Today, many researchers must make sense of massive streams of multiple types of data with different formats, dynamics, and origin.

***Static Instrument -> Evolving Cyberinfrastructure (CI):*** The importance of hardware instruments that are rather static and expensive decreases relative to software infrastructures that are highly flexible and continuously evolving according to the needs of different sciences. Some of the most successful services and tools are decentralized increasing scalability and fault tolerance.

## Macroscope Design

**Custom Tools for Different Scientific Communities**

Information Visualization Cyberinfrastructure
http://iv.cns.iu.edu

**Network Workbench Tool** + Community Wiki
http://nwb.cns.iu.edu

**Science of Science (Sci²) Tool** and Portal
http://sci2.cns.iu.edu

Epidemics Cyberinfrastructure
Coming soon

**180+ Algorithm Plugins and Branded GUIs**
**+**
**Core Architecture**

Open Services Gateway Initiative (OSGi) Framework.
http://orgi.org

Cyberinfrastructure Shell (CIShell)
http://cishell.org

# CIShell Powered Tools: Network Workbench (NWB)

## Network Workbench Tool

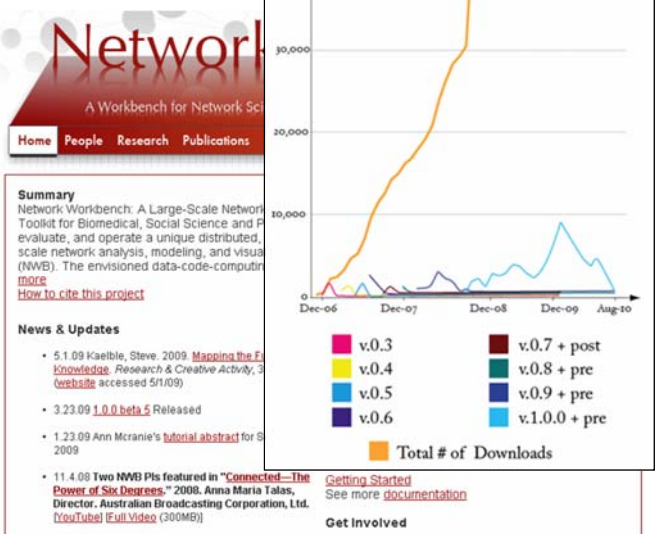
http://nwb.slis.indiana.edu

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.*



## Project Details

**Investigators:** Katy Börner, Albert-Laszlo Barabasi, Santiago Schnell, Alessandro Vespignani & Stanley Wasserman, Eric Wernert

**Software Team:** Lead: Micah Linnemeier

Members: Patrick Phillips, Russell Duhon, Tim Kelley & Ann McCranie

Previous Developers: Weixia (Bonnie) Huang, Bruce Herr, Heng Zhang, Duygu Balcan, Bryan Hook, Ben Markines, Santo Fortunato, Felix Terkhorn, Ramya Sabbineni, Vivek S. Thakre & Cesar Hidalgo

**Goal:** Develop a large-scale network analysis, modeling and visualization toolkit for physics, biomedical, and social science research.

**Amount:** $1,120,926, NSF IIS-0513650 award

**Duration:** Sept. 2005 - Aug. 2009

**Website:** http://nwb.slis.indiana.edu

## Project Details (cont.)

**NWB Advisory Board:**

James Hendler (Semantic Web) http://www.cs.umd.edu/~hendler/
Jason Leigh (CI) http://www.evl.uic.edu/spiff/
Neo Martinez (Biology) http://online.sfsu.edu/~webhead/
Michael Macy, Cornell University (Sociology) http://www.soc.cornell.edu/faculty/macy.shtml
Ulrik Brandes (Graph Theory) http://www.inf.uni-konstanz.de/~brandes/
Mark Gerstein, Yale University (Bioinformatics) http://bioinfo.mbb.yale.edu/
Stephen North (AT&T) http://public.research.att.com/viewPage.cfm?PageID=81
Tom Snijders, University of Groningen http://stat.gamma.rug.nl/snijders/
Noshir Contractor, Northwestern University http://www.spcomm.uiuc.edu/nosh/

## Computational Proteomics

What relationships exist between protein targets of all drugs and all disease-gene products in the human protein–protein interaction network?

*Yildrüm, Muhammed A., Kwan-Il Goh, Michael E. Cusick, Albert-László Barabási, and Marc Vidal. (2007). Drug-target Network. Nature Biotechnology 25 no. 10: 1119-1126.*

**Figure 2** Drug–target network (DT network). The DT network is generated by using the known associations between FDA-approved drugs and their target proteins. Circles and rectangles correspond to drugs and target proteins, respectively. A link is placed between a drug node and a target node if the protein is a known target of that drug. The area of the drug (protein) node is proportional to the number of targets that the drug has (the number of drugs targeting the protein). Color codes are given in the legend. Drug nodes (circles) are colored according to their Anatomical Therapeutic Chemical Classification, and the target proteins (rectangular boxes) are colored according to their cellular component obtained from the Gene Ontology database.

**Computational Economics**
Does the type of product that a country exports matter for subsequent economic performance?

*C. A. Hidalgo, B. Klinger, A.-L. Barabási, R. Hausmann (2007) The Product Space Conditions the Development of Nations. Science 317, 482 (2007).*

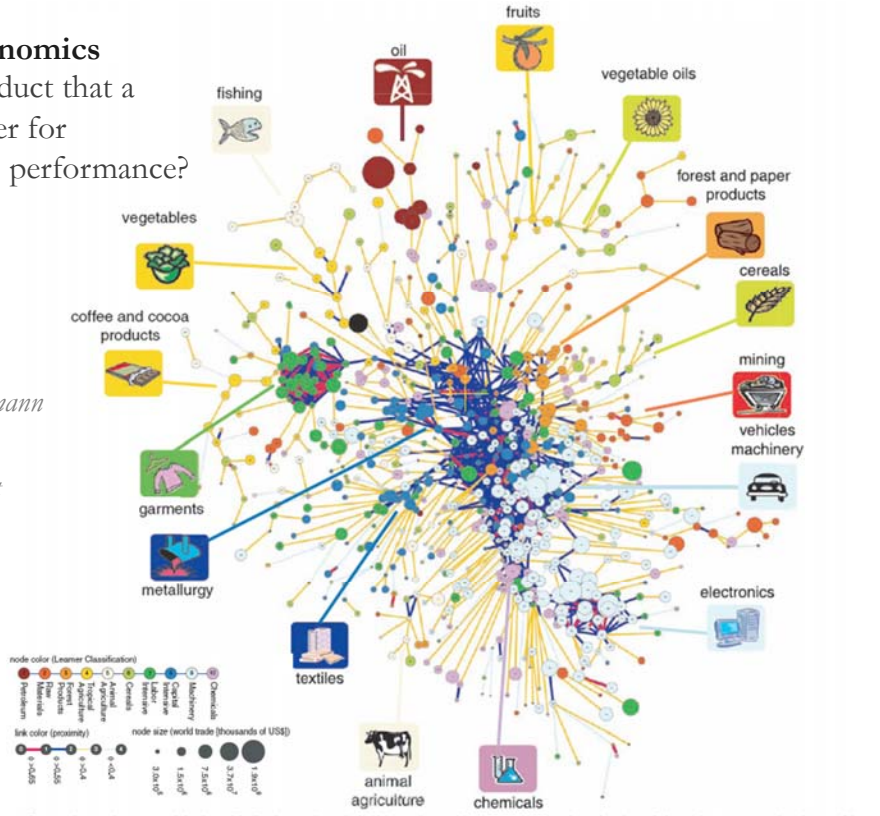



**Fig. 1.** The product space. **(A)** Hierarchically clustered proximity (φ) matrix representing the 775 SITC-4 product classes exported in the 1998–2000 period. **(B)** Network representation of the product space. Links are color coded with their proximity value. The sizes of the nodes are proportional to world trade, and their colors are chosen according to the classification introduced by Leamer.



**Computational Social Science**
Studying large scale social networks such as Wikipedia

*Second Sight: An Emergent Mosaic of Wikipedian Activity, The NewScientist, May 19, 2007*

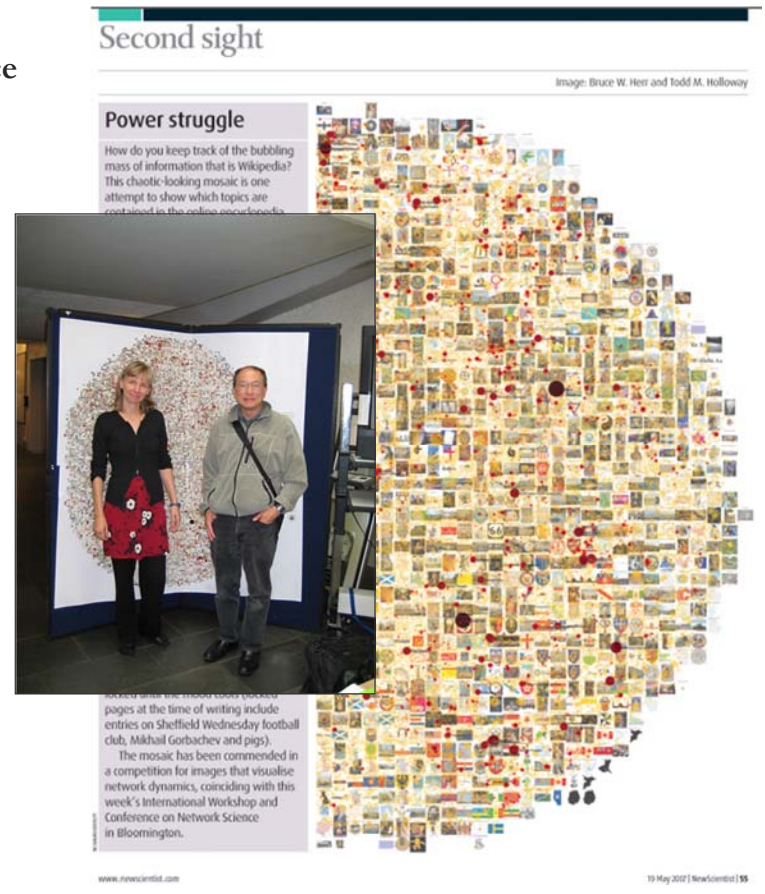

Second sight

Image: Bruce W. Herr and Todd M. Holloway

**Power struggle**

How do you keep track of the bubbling mass of information that is Wikipedia? This chaotic-looking mosaic is one attempt to show which topics are

pages at the time of writing include entries on Sheffield Wednesday football club, Mikhail Gorbachev and pigs).

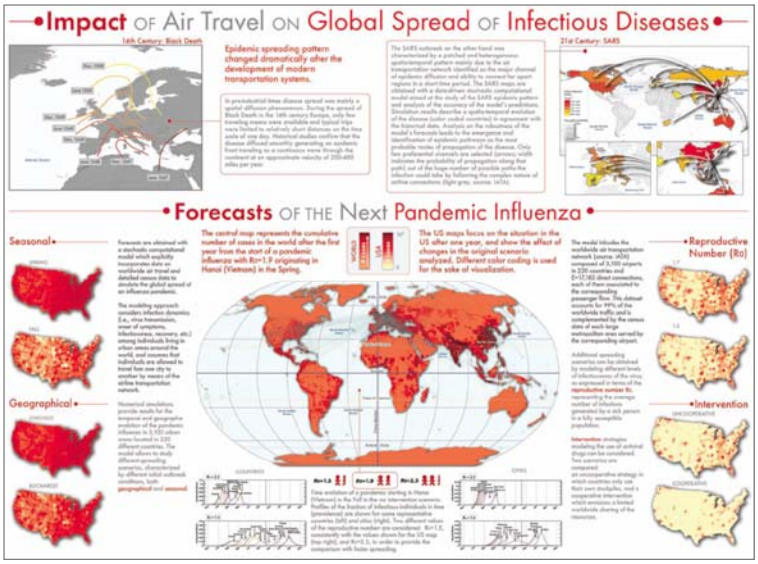
The mosaic has been commended in a competition for images that visualise network dynamics, coinciding with this week's International Workshop and Conference on Network Science in Bloomington.

## Computational Epidemics

Forecasting (and preventing the effects of) the next pandemic.

*Epidemic Modeling in Complex realities, V. Colizza, A. Barrat, M. Barthelemy, A.Vespignani, Comptes Rendus Biologie, 330, 364-374 (2007).*
*Reaction-diffusion processes and metapopulation models in heterogeneous networks, V.Colizza, R. Pastor-Satorras, A.Vespignani, Nature Physics 3, 276-282 (2007).*

*Modeling the Worldwide Spread of Pandemic Influenza: Baseline Case and Containment Interventions, V. Colizza, A. Barrat, M. Barthelemy, A.-J. Valleron, A.Vespignani, PloS-Medicine 4, e13, 95-110 (2007).*




## NWB Tool Download, Install, and Run

### NWB Tool 1.0.0

Can be freely downloaded for all major operating systems from http://nwb.cns.iu.edu

Select your operating system from the pull down menu and download.

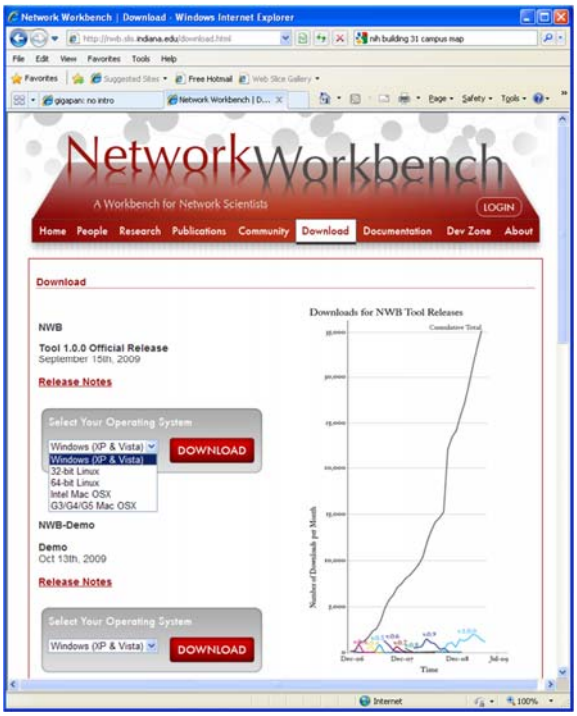
Unpack into a /nwb directory.

Run /nwb/nwb.exe

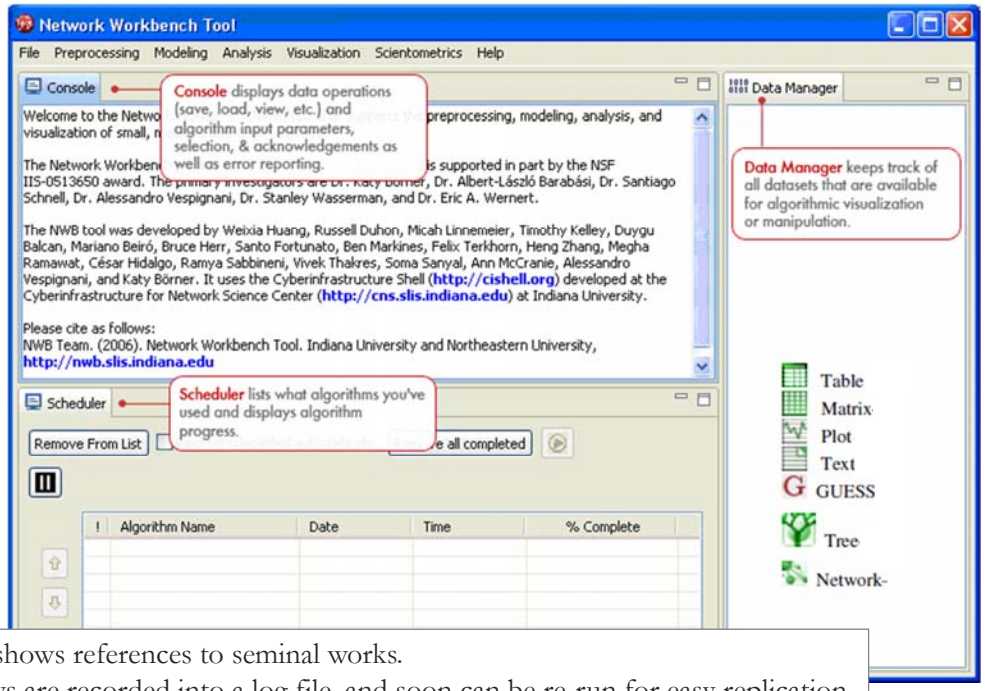
Session log files are stored in '**yournwbdirectory*/logs*' directory.

### Cite as

*NWB Team. (2006). Network Workbench Tool. Indiana University, Northeastern University, and University of Michigan, http://nwb.cns.iu.edu.*



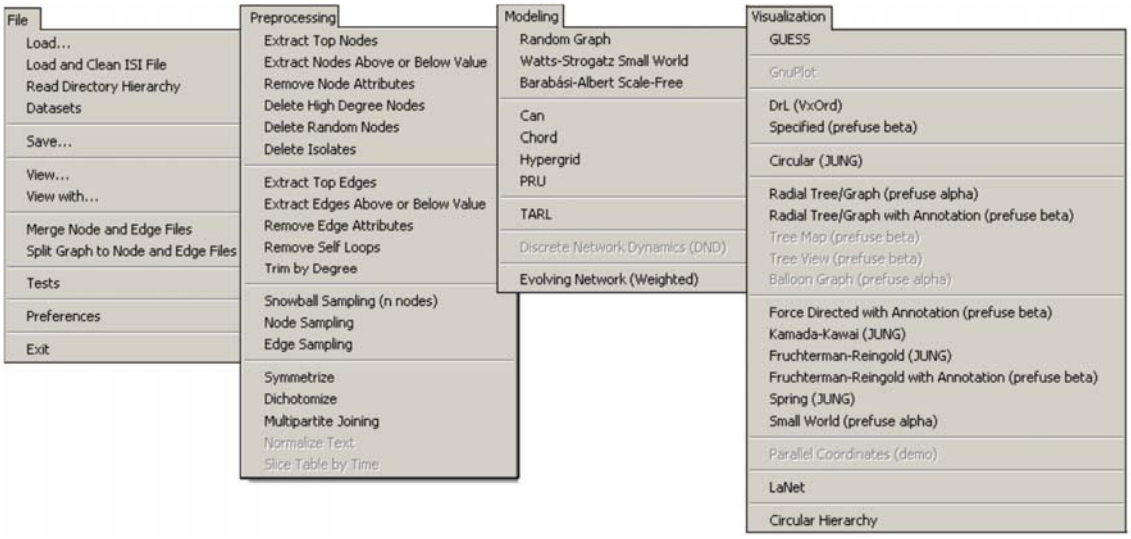
## NWB Tool Interface Components




Console shows references to seminal works.
Workflows are recorded into a log file, and soon can be re-run for easy replication.
All algorithms are documented online; workflows are given in tutorials.



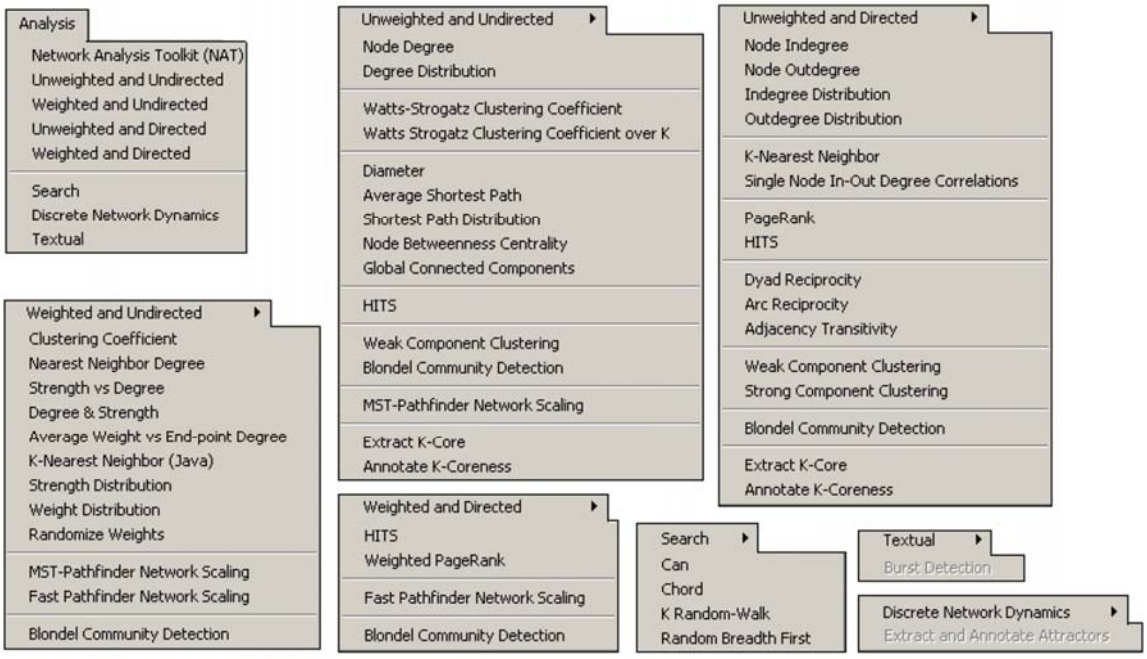
## File, Preprocessing, Modeling, and Visualization Menus




Börner, Katy, Sanyal, Soma and Vespignani, Alessandro (2007). **Network Science.** In Blaise Cronin (Ed.), *ARIST*, Information Today, Inc./American Society for Information Science and Technology, Medford, NJ, Volume 41, Chapter 12, pp. 537-607.

http://ivl.slis.indiana.edu/km/pub/2007-borner-arist.pdf

## Analysis Menu and Submenus

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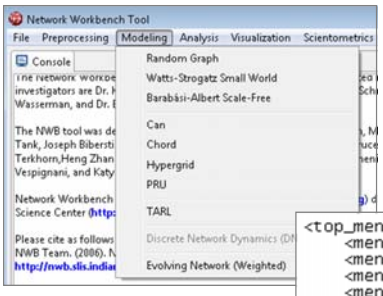
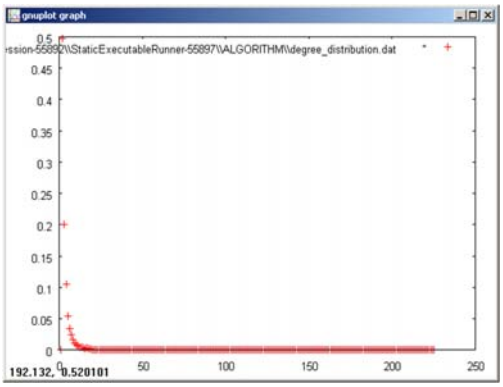
## CIShell – Customize Menu

- The file *'yourtooldirectory/configuration/default_menu.xml'* encodes the structure of the menu system.
- In NWB Tool, the Modeling menu (left) is encoded by the following piece of xml code:



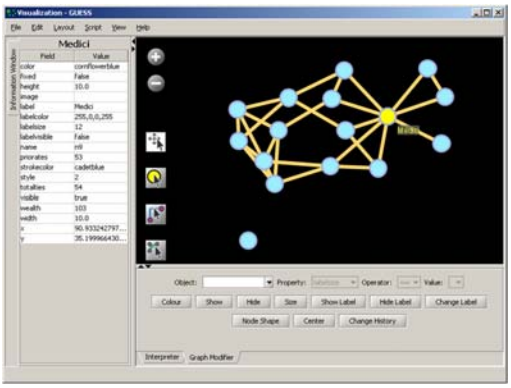

```
<top_menu name="Modeling">
    <menu pid="edu.iu.nwb.modeling.erdosrandomgraph"/>
    <menu pid="edu.iu.nwb.modeling.smallworld"/>
    <menu pid="edu.iu.nwb.modeling.barabasialbert"/>
    <menu type="break"/>
    <menu pid="edu.iu.iv.modeling.p2p.can.CanAlgorithm"/>
    <menu pid="edu.iu.iv.modeling.p2p.chord.ChordAlgorithm"/>
    <menu pid="edu.id.iv.modeling.p2p.hypergrid.Hypergrid"/>
    <menu pid="edu.iu.iv.modeling.p2p.pru.PruAlgorithm"/>
    <menu type="break"/>
    <menu pid="edu.iu.iv.modeling.tarl.TarlAlgorithm"/>
    <menu type="break"/>
    <menu pid="edu.iu.nwb.modeling.discretenetworkdynamics.DNDAlgorithm"/>
    <menu type="break"/>
    <menu pid="edu.iu.nwb.modeling.weighted.evolvingnetwork"/>
</top_menu>
```

## Integrated Tools




**Gnuplot**

portable command-line driven interactive data and function plotting utility http://www.gnuplot.info/.




**GUESS**

exploratory data analysis and visualization tool for graphs and networks.

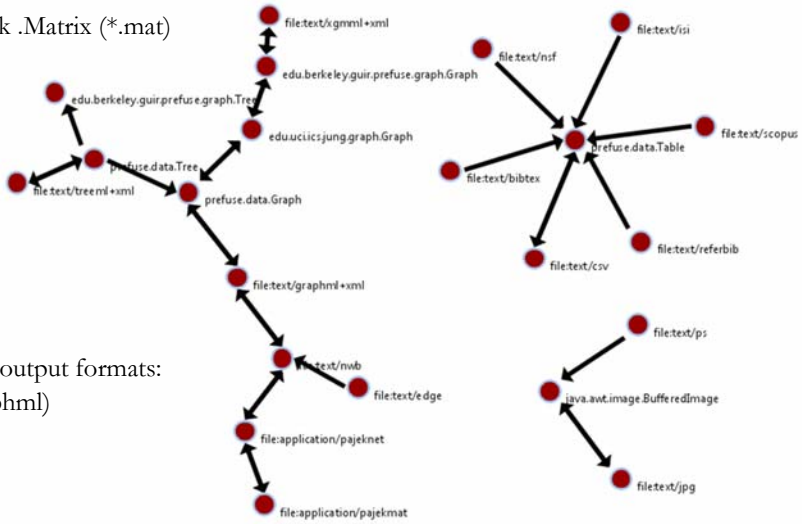
https://nwb.slis.indiana.edu/community/?n=VisualizeData.GUESS.



## Supported Data Formats

The NWB tool supports loading the following input file formats:

- GraphML (*.xml or *.graphml)
- XGMML (*.xml)
- Pajek .NET (*.net) & Pajek .Matrix (*.mat)
- NWB (*.nwb)
- TreeML (*.xml)
- Edge list (*.edge)
- CSV (*.csv)
- ISI (*.isi)
- Scopus (*.scopus)
- NSF (*.nsf)
- Bibtex (*.bib)
- Endnote (*.enw)




and the following network file output formats:

- GraphML (*.xml or *.graphml)
- Pajek .MAT (*.mat)
- Pajek .NET (*.net)
- NWB (*.nwb)
- XGMML (*.xml)
- CSV (*.csv)

Formats are documented at https://nwb.slis.indiana.edu/community/?n=DataFormats.HomePage.

## CIShell Powered Tools:
## Science of Science (Sci2) Tool

**Science of Science (Sci2) Tool**
http://sci2.cns.iu.edu

- Explicitly designed for SoS research and practice, well documented, easy to use.
- Empowers many to run common studies while making it easy for exports to perform novel research.
- Advanced algorithms, effective visualizations, and many (standard) workflows.
- Supports micro-level documentation and replication of studies.
- Is open source—anybody can review and extend the code, or use it for commercial purposes.

nature

Vol 464|25 March 2010

OPINION

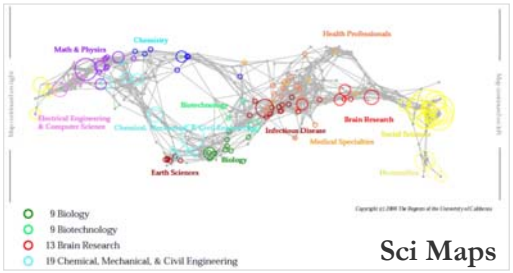
**SUMMARY**
- Existing metrics have known flaws
- A reliable, open, joined-up data infrastructure is needed
- Data should be collected on the full range of scientists' work
- Social scientists and economists should be involved

# Let's make science metrics more scientific

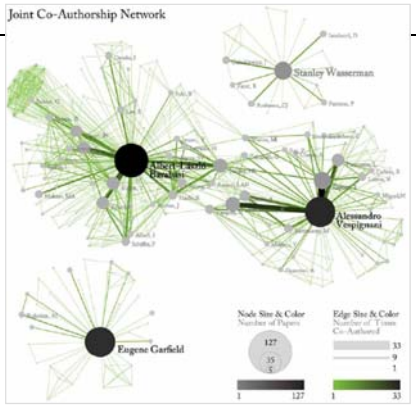
To capture the essence of good science, stakeholders must combine forces to create an open, sound and consistent system for measuring all the activities that make up academic productivity, says **Julia Lane**.

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

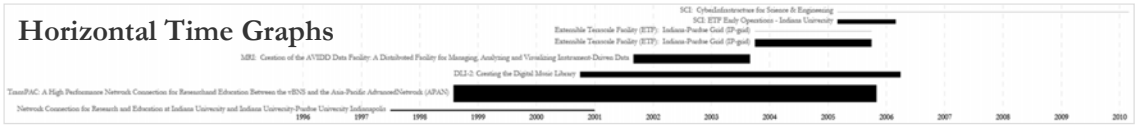
OSGi/CIShell powered tool with NWB plugins and many new scientometrics and visualizations plugins.




Sci Maps



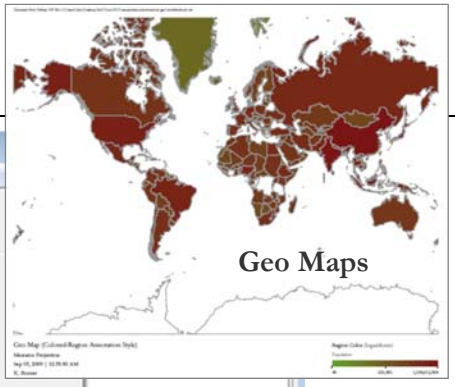

GUESS Network Vis

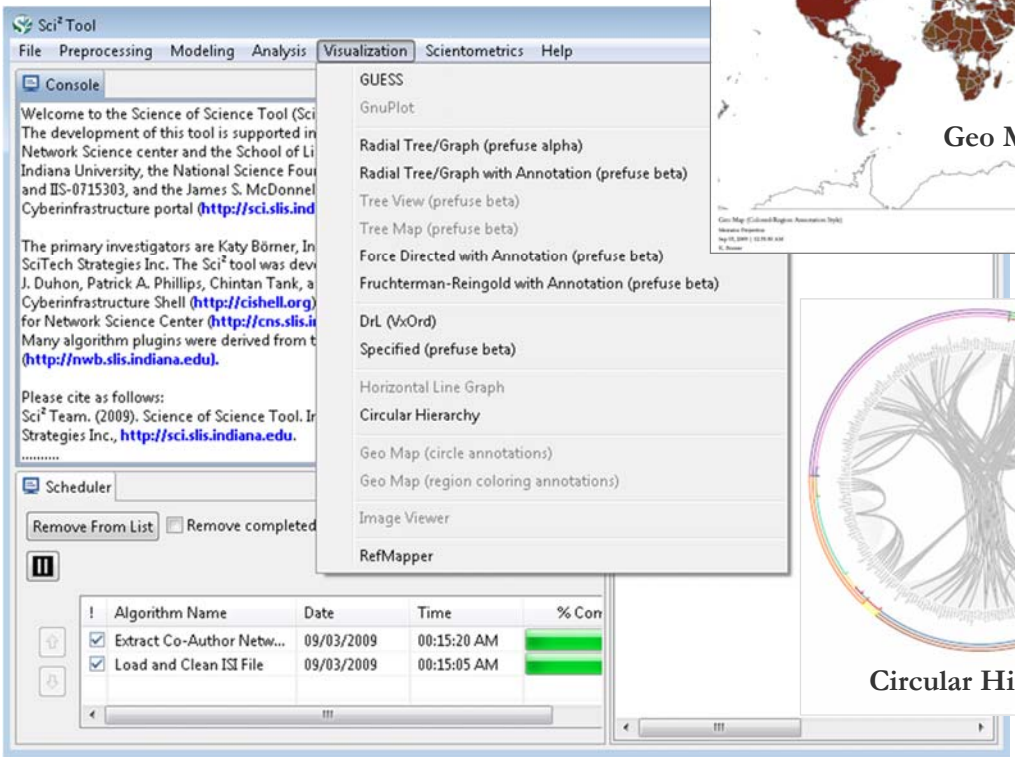


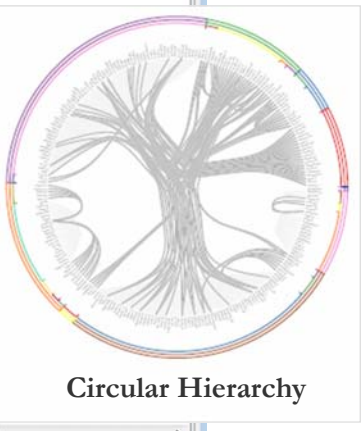

*Börner, Katy, Huang, Weixia (Bonnie), Linnemeier, Micah, Duhon, Russell Jackson, Phillips, Patrick, Ma, Nianli, Zoss, Angela, Guo, Hanning & Price, Mark. (2009). Rete-Netzwerk-Red: Analyzing and Visualizing Scholarly Networks Using the Scholarly Database and the Network Workbench Tool. Proceedings of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



## Sci² Tool



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## Sci² Tool: Download, Install, and Run

**Sci2 Tool v0.5 Alpha (April 4, 2011)**

Can be freely downloaded for all major operating systems from

http://sci2.cns.iu.edu

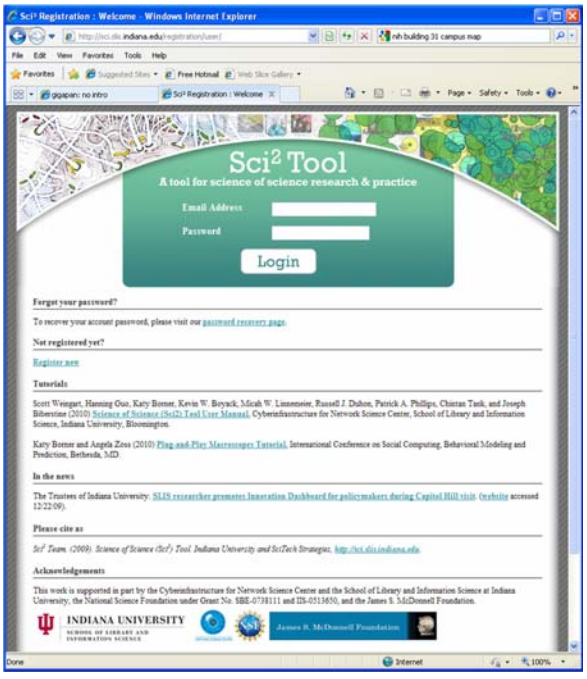
Select your operating system from the pull down menu and download.
Unpack into a /sci2 directory.
Run /sci2/sci2.exe

Sci2 Manual is at

http://sci2.wiki.cns.iu.edu

**Cite as**

*Sci² Team. (2009). Science of Science (Sci²) Tool. Indiana University and SciTech Strategies, http://sci2.cns.iu.edu*



## Sci² Tool: Download, Install, and Run

**Sci2 Tool v0.5 Alpha (April 4, 2011)**

- Supports ASCII UTF-8 characters
- Web-based Yahoo! and desktop Geocoders
- U.S. and World geomapper
- Customizable stop word lists
- Merging of networks
- New home page, wiki-based tutorial
- Bug fixes, streamlined workflows

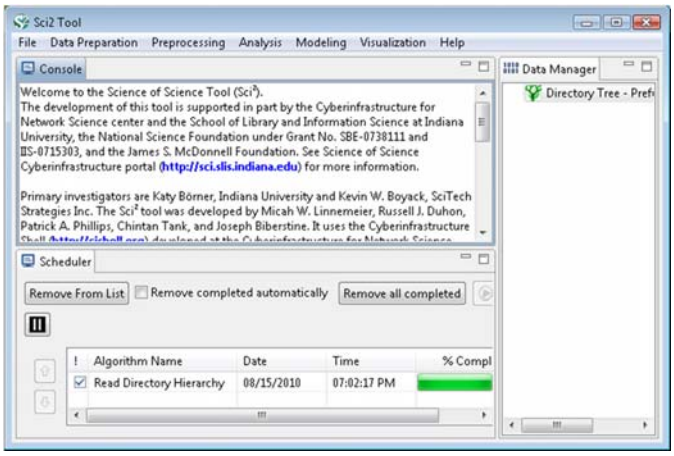
Sci2 Tool runs on Windows, Mac, and Linux.
Unzip.
Run /sci2/sci2.exe

## Sci2 Tool Interface Components

*See also http://sci2.wiki.cns.iu.edu/2.2+User+Interface*

Use

- **Menu** to read data, run algorithms.
- **Console** to see work log, references to seminal works.
- **Data Manager** to select, view, save loaded, simulated, or derived datasets.
- **Scheduler** to see status of algorithm execution.

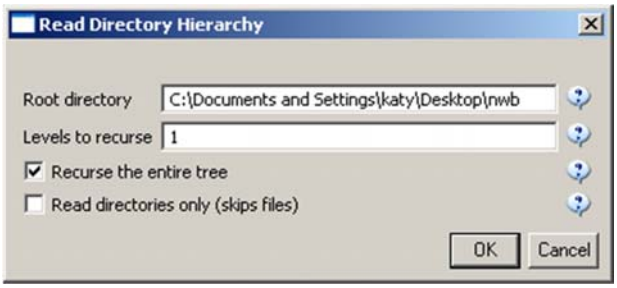



All workflows are recorded into a log file (see /sci2/logs/…), and soon can be re-run for easy replication. If errors occur, they are saved in a error log to ease bug reporting.

All algorithms are documented online; workflows are given in tutorials, see Sci2 Manual at http://sci2.wiki.cns.iu.edu

## Sci2 Tool – Read+Visualize Sci2 Tool Directory Tree

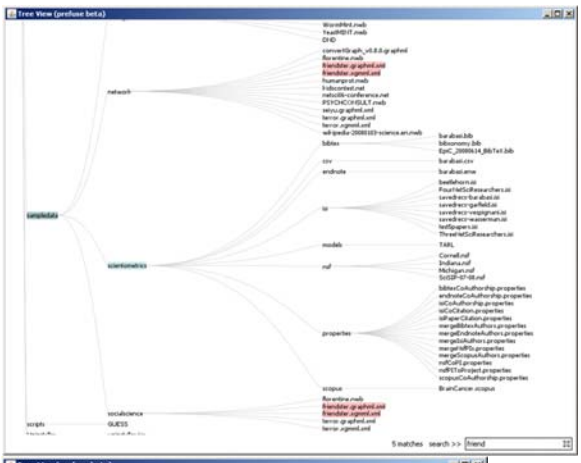
Use *'File > Read Directory Hierarchy'* with parameters




Visualize resulting *'Directory Tree - Prefuse (Beta) Graph'* using

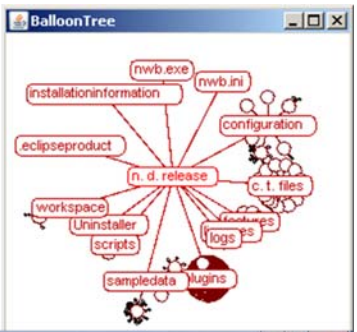
- *'Visualization > Tree View (prefuse beta)'*
- *'Visualization > Tree Map (prefuse beta)'*
- *'Visualization > Balloon Graph (prefuse alpha)'*
- *'Visualization > Radial Tree/Graph (prefuse alpha)'*

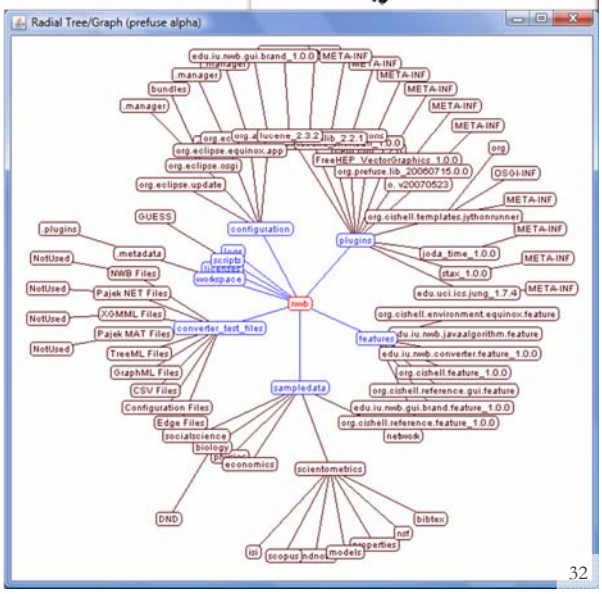




Different views of the /nwb directory hierarchy.

Note the size of the /plugin directory.

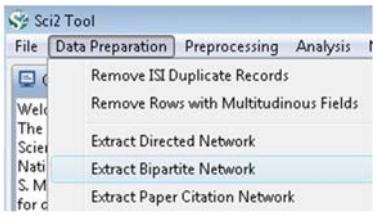


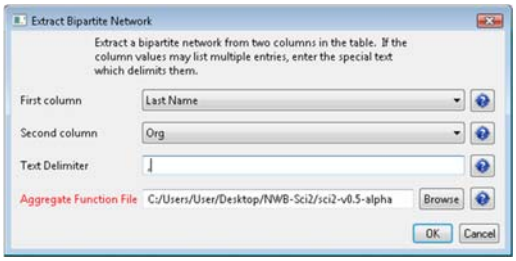
## Sci2 Tool – Visualize Workshop Attendees

Use *'File > Read'* to load *SciTS Conf SNA Registrants report 4.10.11-clean.csv*

| | A | B | C |
|---|---|---|---|
| 1 | **Last Name** | **Org** | **Organization-Cleaned** |
| 2 | Agoulnik | edu | Brigham and Women's Hospital, Harvard Medical School |
| 3 | Amaral | edu | Northwestern University |
| 4 | Bates | edu | University of Illinois at Chicago |
| 5 | Bennett | gov | NIH |
| 6 | Bietz | edu | University of California, Irvine |
| 7 | Bishop | edu | University of Tennessee |
| 8 | ... | | |
| 9 | Lotrecchiano | org,edu | George Washington University |
| 10 | Lusina | ca,edu | Centre for Hip Health & Mobility |




Run *'Data Preparation > Extract Bipartite Network'*
With parameter values:

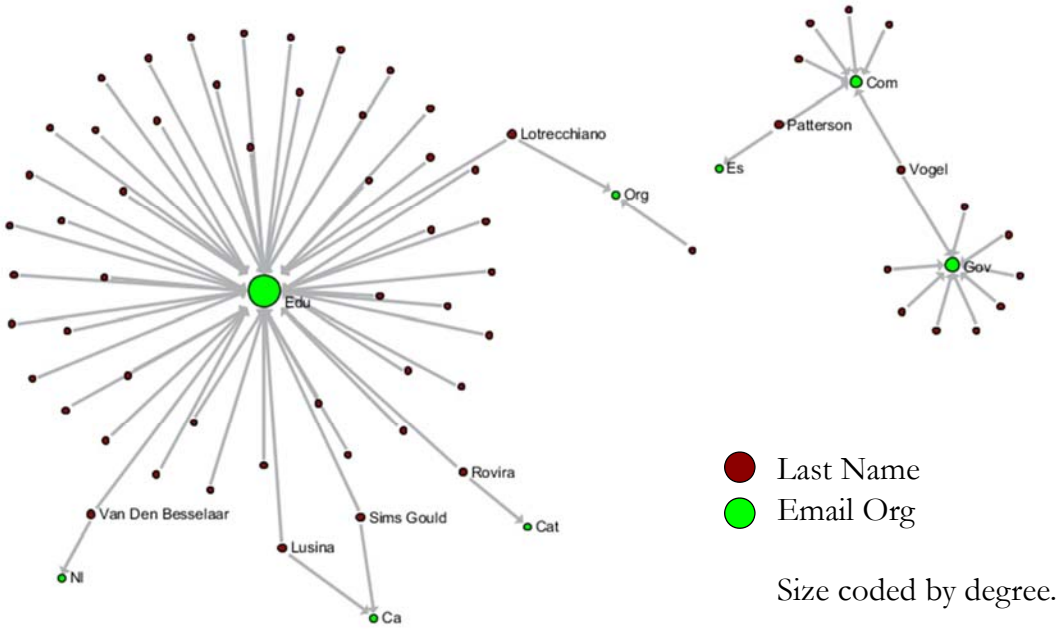



Optional: Calculate Node Degree

Visualize resulting *'Bipartite network from Last Name and Org'* using '*Visualization > Network > GUESS*' and *'Layout > GEM', 'Layout > Bin Pack'*



## Sci2 Tool – Visualize Workshop Attendees



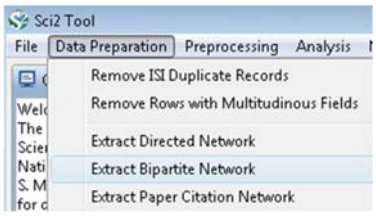

Last Name
Email Org

Size coded by degree.

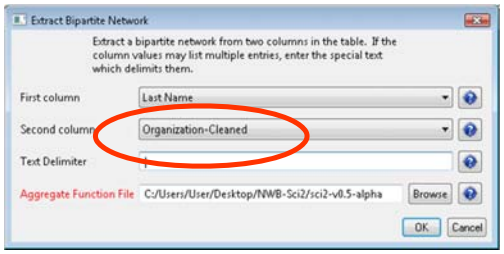
## Sci2 Tool – Visualize Workshop Attendees

Use *'File > Read'* to load *SciTS Conf SNA Registrants report 4.10.11-clean.csv*

| | A | B | C |
|---|---|---|---|
| 1 | **Last Name** | **Org** | **Organization-Cleaned** |
| 2 | Agoulnik | edu | Brigham and Women's Hospital, Harvard Medical School |
| 3 | Amaral | edu | Northwestern University |
| 4 | Bates | edu | University of Illinois at Chicago |
| 5 | Bennett | gov | NIH |
| 6 | Bietz | edu | University of California, Irvine |
| 7 | Bishop | edu | University of Tennessee |
| 8 | ... | | |
| 9 | Lotrecchiano | org,edu | George Washington University |
| 10 | Lusina | ca,edu | Centre for Hip Health & Mobility |




Run *'Data Preparation > Extract Bipartite Network'*
With parameter values:

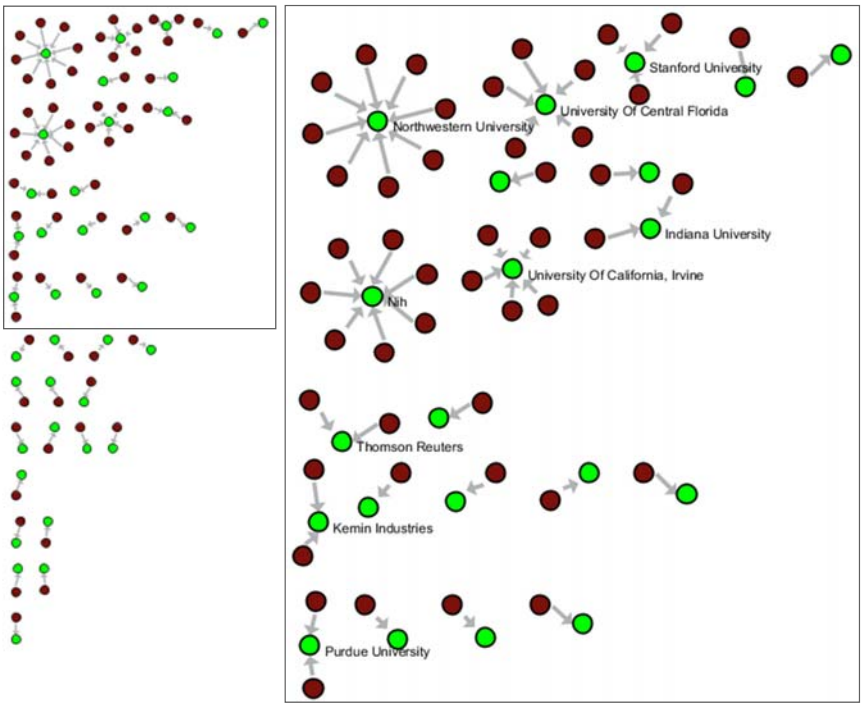



Optional: Calculate Node Degree

Visualize resulting *'Bipartite network from Last Name and Org'* using '*Visualization > Network > GUESS*' and *'Layout > GEM', 'Layout > Bin Pack'*



## Sci2 Tool – Visualize Workshop Attendees




Last Name
Affiliation

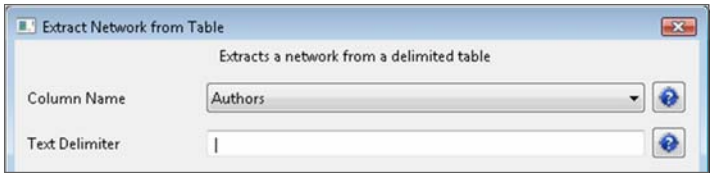
## Sci2 Tool – Visualize SciTS Co-Author Network Based on Holly's EndNote File

Open Holly's *'SciTS-Library-03-04-2011.enl'* in EndNote and save as *'SciTS-Library-03-04-2011.env'* following instructions on http://cishell.wiki.cns.iu.edu/Endnote+Export+Format

Use *'File > Read'* to load *'SciTS-Library-03-04-2011.env'*

Run *'Data Preparation > Extract Co-Occurrence Network'*

With parameter values:




Optional: Calculate Node Degree

Visualize resulting *'Bipartite network from Last Name and Org'* using '*Visualization > Network > GUESS*' and *'Layout > GEM', 'Layout > Bin Pack'*



## Sci2 Tool – Visualize SciTS Co-Author Network Based on Holly's EndNote File

.....
Network Analysis Toolkit (NAT) was selected.
Implementer(s): Timothy Kelley
Integrator(s): Timothy Kelley
Reference: Robert Sedgewick. Algorithms in Java, Third Edition, Part 5 - Graph Algorithms. Addison-Wesley, 2002. ISBN 0-201-31663-3. Section 19.8, pp.205
Documentation:
http://wiki.cns.iu.edu/display/CISHELL/Network+Analysis+Toolkit+%28NAT%29
This graph claims to be undirected.

Nodes: 706
Isolated nodes: 100
Node attributes present: label

Edges: 1687
No self loops were discovered.
No parallel edges were discovered.

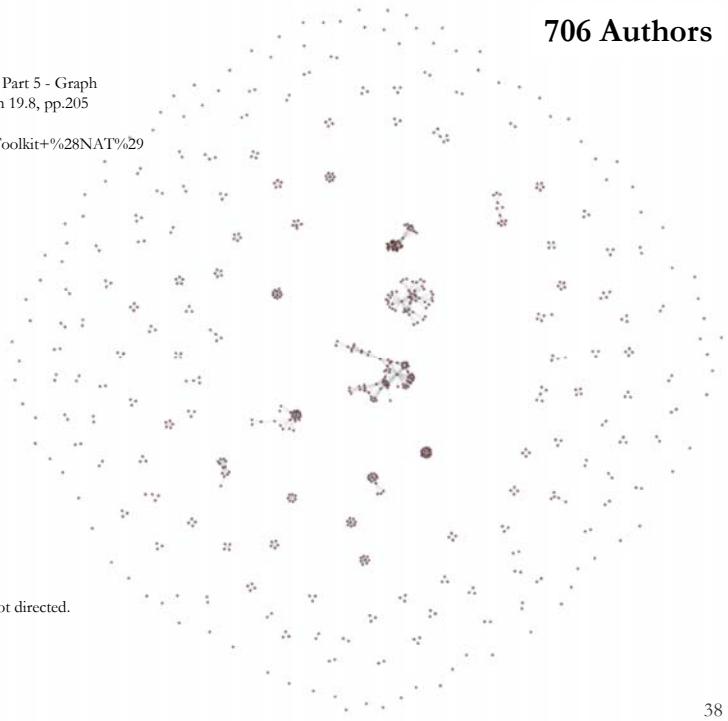
Edge attributes:
Did not detect any nonnumeric attributes.
Numeric attributes:
minmaxmean
weight 151.15412

This network seems to be valued.

Average degree: 4.779
This graph is not weakly connected.
There are 223 weakly connected components. (100 isolates)
The largest connected component consists of 73 nodes.
Did not calculate strong connectedness because this graph was not directed.

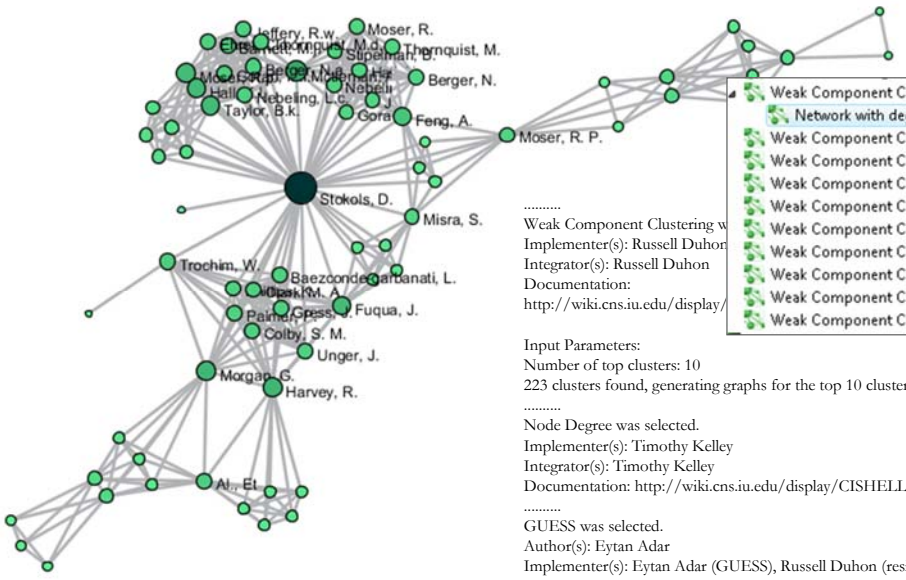
Density (disregarding weights): 0.0068
Additional Densities by Numeric Attribute

**706 Authors**



## Sci2 Tool – Visualize SciTS Co-Author Network Based on Holly's EndNote File

### Largest "Giant" Component



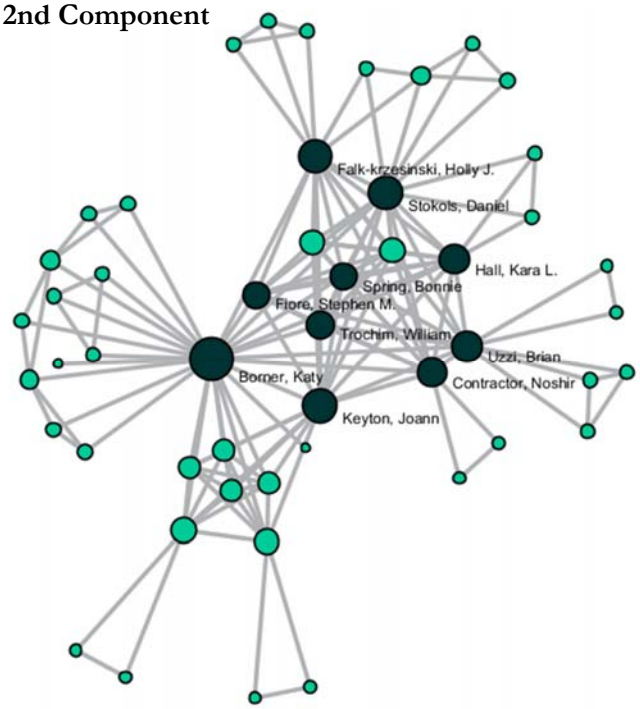

.....
Weak Component Clustering w
Implementer(s): Russell Duhon
Integrator(s): Russell Duhon
Documentation:
http://wiki.cns.iu.edu/display/

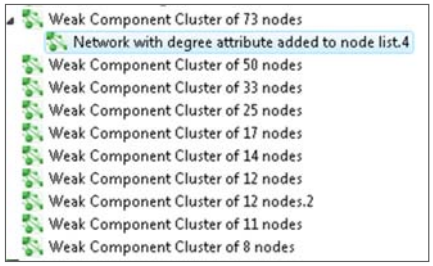
Input Parameters:
Number of top clusters: 10
223 clusters found, generating graphs for the top 10 clusters.
.....
Node Degree was selected.
Implementer(s): Timothy Kelley
Integrator(s): Timothy Kelley
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Node+Degree
.....
GUESS was selected.
Author(s): Eytan Adar
Implementer(s): Eytan Adar (GUESS), Russell Duhon (resizeLinear, colorize fix)
Integrator(s): Russell Duhon
Reference: Adar, Eytan, "GUESS: A Language and Interface for Graph Exploration," CHI 2006 (http://graphexploration.cond.org/)
Documentation: http://wiki.cns.iu.edu/display/CISHELL/GUESS



## Sci2 Tool – Visualize SciTS Co-Author Network Based on Holly's EndNote File

### 2nd Component




| | | | |
|---|---|---|---|
| 602 | Stipelman, B. | 589 | * |
| 603 | Stokols, D. | 200 | * |
| 604 | Stokols, Daniel | 75 | * |
| 605 | Stone, Anthony R. | 606 | * |
| 606 | Stringer, M.j. | 608 | * |
| 607 | Subramanian, S. | 559 | * |
| 608 | Sundstrom, Eric | 219 | * |
| 609 | Sung, N. | 611 | * |
| 610 | Sung, N. S. | 628 | * |
| 611 | Syme, | | |

| | | | |
|---|---|---|---|
| 638 | Tress, G. | 661 | * |
| 639 | Trochim, W. | 596 | * |
| 640 | Trochim, W. M. | 408 | * |
| 641 | Trochim, W. M. K. | 48 | * |
| 642 | Trochim, W.m. | 444 | * |
| 643 | Trochim, William | 76 | * |
| 644 | Trochim, William M. K. | 666 | * |
| 645 | Unger, J. | 598 | * |
| 646 | Uzzi, B. | 346 | * |
| 647 | Uzzi, Brian | 68 | * |

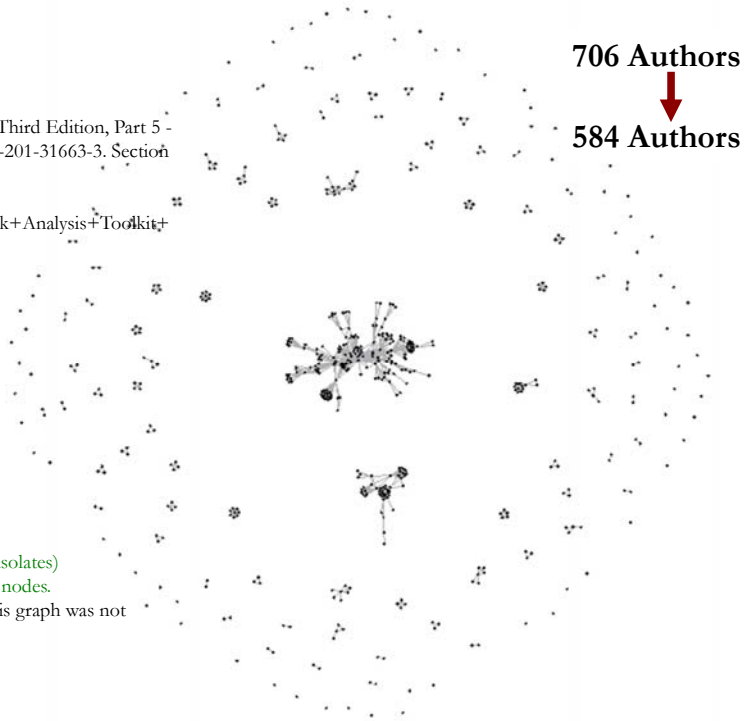
## Sci2 Tool – Visualize SciTS Co-Author Network Based on Holly's EndNote File – Last Names

.....
Network Analysis Toolkit (NAT) was selected.
Implementer(s): Timothy Kelley
Integrator(s): Timothy Kelley
Reference: Robert Sedgewick. Algorithms in Java, Third Edition, Part 5 - Graph Algorithms. Addison-Wesley, 2002. ISBN 0-201-31663-3. Section 19.8, pp.205
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Network+Analysis+Toolkit+%28NAT%29
This graph claims to be undirected.

Nodes: 584
Isolated nodes: 79
Node attributes present: label, totalDegree

Edges: 1472
No self loops were discovered.
No parallel edges were discovered.

Average degree: 5.0411
This graph is not weakly connected.
There are 162 weakly connected components. (79 isolates)
The largest connected component consists of 183 nodes.
Did not calculate strong connectedness because this graph was not directed.
Density (disregarding weights): 0.0086
Additional Densities by Numeric Attribute



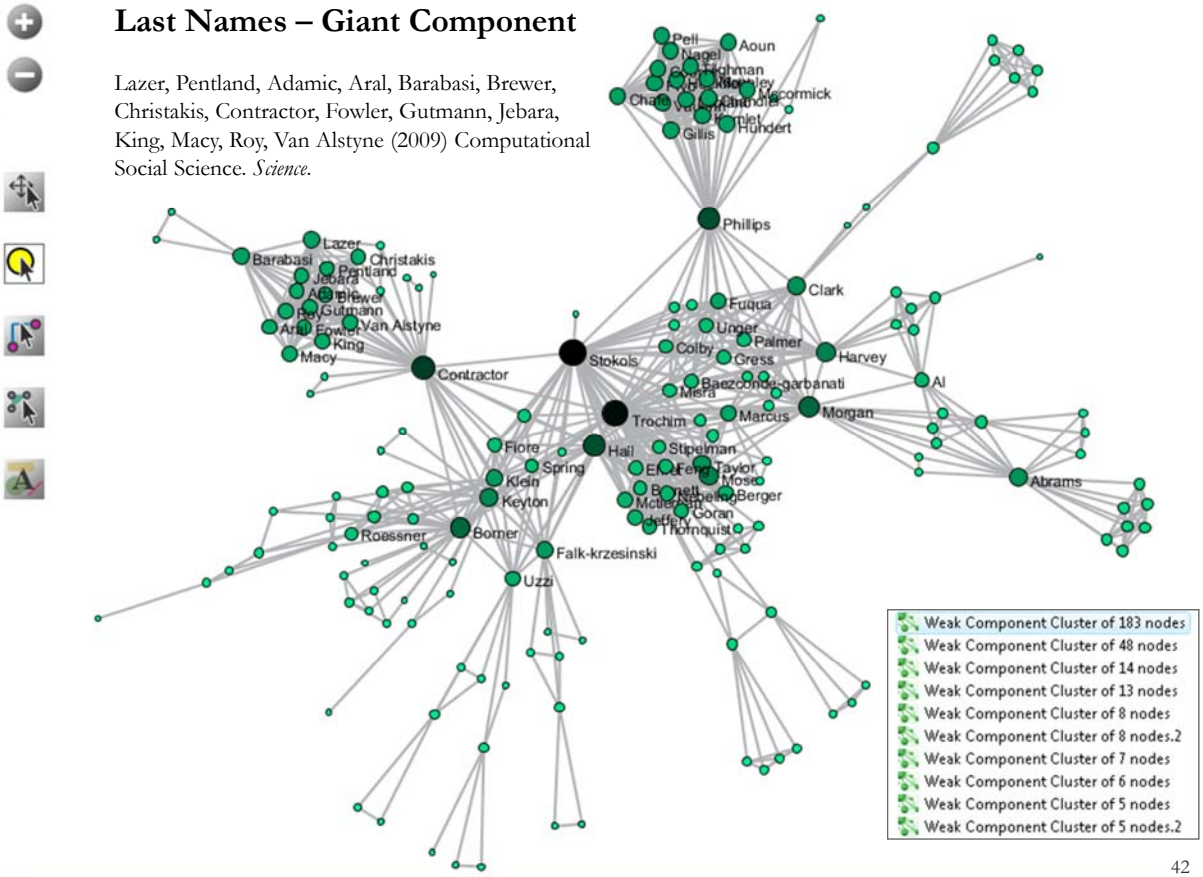
**706 Authors**

**584 Authors**



## Last Names – Giant Component

Lazer, Pentland, Adamic, Aral, Barabasi, Brewer, Christakis, Contractor, Fowler, Gutmann, Jebara, King, Macy, Roy, Van Alstyne (2009) Computational Social Science. *Science*.



## Workshop Overview

1:30 Macroscope Design and Usage & CIShell Powered Tools: NWB & Sci2

1:45 Sci2 Tool Basics

- Download and run the tool.

**2:00 Sci2 Sample Workflow: Padgett's Florentine Families - Prepare, load, analyze, and visualize family and business networks from 15th century Florence.**

2:30 Sci2 Sample Workflow: Studying Four Major NetSci Researchers.

- Load and clean a dataset as text file; process raw data into networks.
- Find basic statistics and run various algorithms over the network.
- Visualize as either a circular hierarchy or network

*3:30 Break*

4:00 Sci2 Demo I: Geospatial maps with congressional districts

4:30 Sci2 Demo II: Evolving collaboration networks

4:45 Outlook and Discussion

*5:00 Adjourn*

## Padgett's Florentine Families - Compute Basic Network Properties & View in GUESS

- Florentine families related through business ties (specifically, recorded financial ties such as loans, credits and joint partnerships) and marriage alliances.
- Node attributes

  Wealth: Each family's net wealth in 1427 (in thousands of lira)

  Priorates: The number of priorates (seats on the civic council) held between 1282- 1344

  Totalties: The total number of business or marriage ties in the total dataset of 116 families.
- "Substantively, the data include families who were locked in a struggle for political control of the city of Florence around 1430. Two factions were dominant in this struggle: one revolved around the infamous Medicis, the other around the powerful Strozzis."

- http://svitsrv25.epfl.ch/R-doc/library/ergm/html/florentine.html

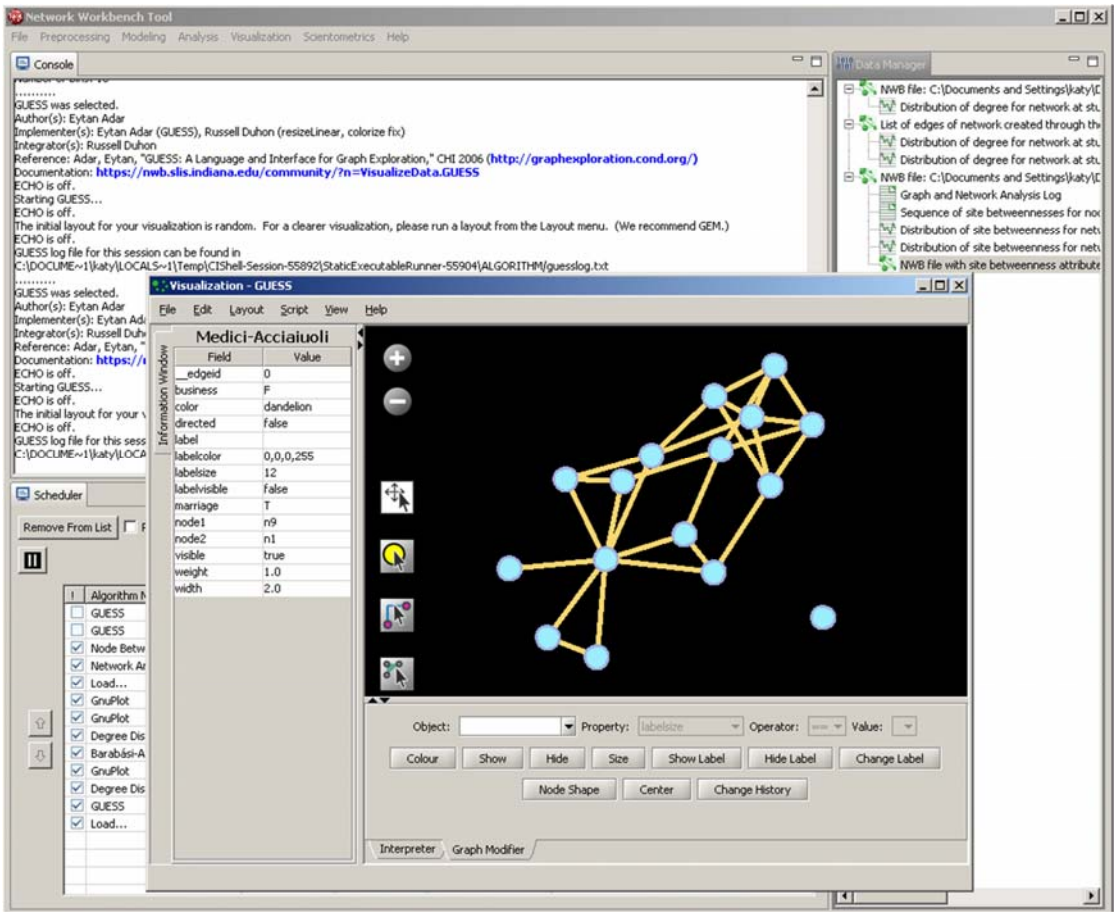
## Padgett's Florentine Families - Compute Basic Network Properties & View in GUESS

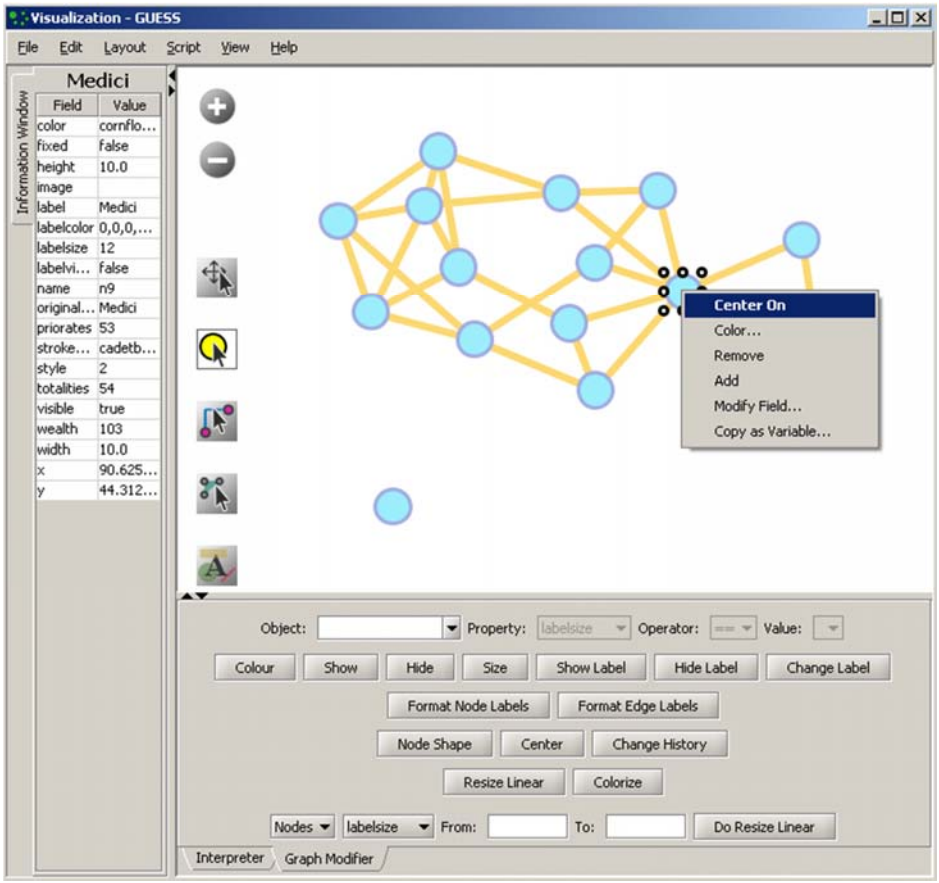
- Load **yoursci2directory*/sampledata/socialscience/florentine.nwb*
- Run *'Analysis > Network Analysis Toolkit (NAT)'* to get basic properties.

This graph claims to be undirected.
Nodes: 16
Isolated nodes: 1
Node attributes present: label, wealth, totalities, priorates
Edges: 27
No self loops were discovered.
No parallel edges were discovered.
Edge attributes:
Nonnumeric attributes:
Example value
marriag...T
busines...F
Average degree: 3.375
There are 2 weakly connected components. (1 isolates)
The largest connected component consists of 15 nodes.
Did not calculate strong connectedness because this graph was not directed.
Density (disregarding weights): 0.225

- Select network and run *'Visualization > GUESS'* to open GUESS with file loaded.
- Apply 'Layout > GEM'.








Pan:

"grab" the background by holding left-click and moving your mouse.

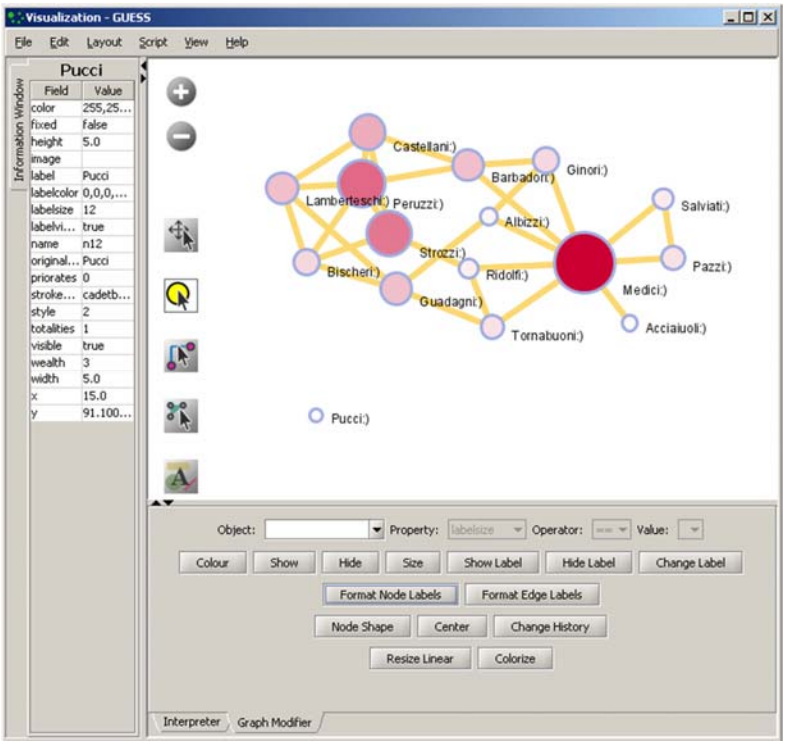
Zoom:

Using scroll wheel, press the "+" and "-" buttons in the upper-left hand corner, or right-click and move the mouse left or right. Center graph by selecting 'View -> Center'.

Select to select/move single nodes. Hold down 'Shift' to select multiple.

Right click to modify Color, etc.





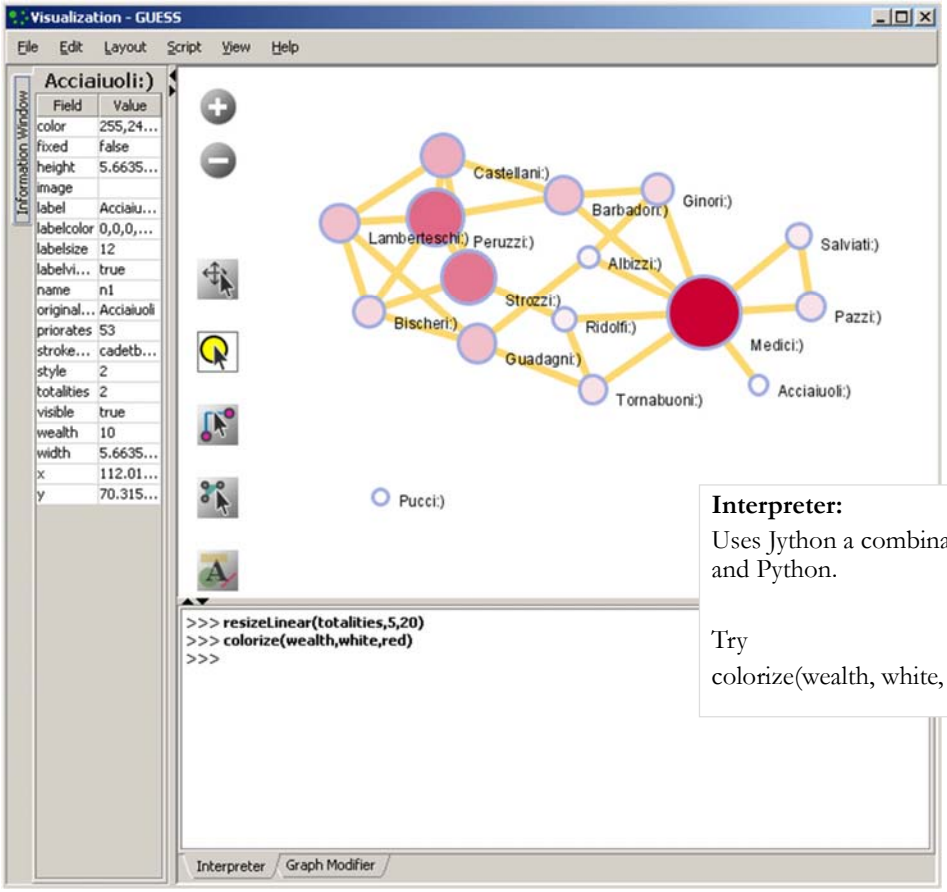

**Graph Modifier:**

Select "all nodes" in the Object drop-down menu and click 'Show Label' button.

Select 'Resize Linear > Nodes > totalities' drop-down menu, then type "5" and "20" into the From" and To" Value box separately. Then select 'Do Resize Linear'.

Select 'Colorize> Nodes>totalities', then select white and enter (204,0,51) in the pop-up color boxes on in the "From" and "To" buttons.

Select "Format Node Labels", replace default text {originallabel} with your own label in the pop-up box 'Enter a formatting string for node labels.'




**Interpreter:**
Uses Jython a combination of Java and Python.

Try
colorize(wealth, white, red)

## Workshop Overview

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- **Load and clean a dataset; process raw data into networks.**
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- **Visualize as either a circular hierarchy or network.**

*3:30 Break*

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4:30 Sci2 Demo II: Evolving collaboration networks

4:45 Outlook and Discussion

*5:00 Adjourn*

## Studying Four Major NetSci Researchers (ISI Data) using Database *(section 5.1.4)*

| FourNetSciResearchers.isi | |
|---|---|
| **Time frame:** | 1955-2007 |
| **Region(s):** | Miscellaneous |
| **Topical Area(s):** | Network Science |
| **Analysis Type(s):** | Paper Citation Network, Co-Author Network, Bibliographic Coupling Network, Document Co-Citation Network, Word Co-Occurrence Network |

Thomson Reuter's Web of Knowledge (WoS) is a leading citation database. Access it via the "Web of Science" tab at http://www.isiknowledge.com (**note:** access to this database requires a paid subscription). Along with Scopus, WoS provides some of the most comprehensive datasets for scientometric analysis.

To find all publications by an author, search for the last name and the first initial followed by an asterisk in the author field.

*http://sci2.wiki.cns.iu.edu/5.1.4+Studying+Four+Major+NetSci+Researchers+(ISI+Data)*



## Data Acquisition from Web of Science

In Dec 2007, we downloaded all papers by

- Eugene Garfield
- Stanley Wasserman
- Alessandro Vespignani
- Albert-László Barabási

from

- Science Citation Index Expanded (SCI-EXPANDED) --1955-present
- Social Sciences Citation Index (SSCI)--1956-present
- Arts & Humanities Citation Index (A&HCI)--1975-present

## Comparison of Counts

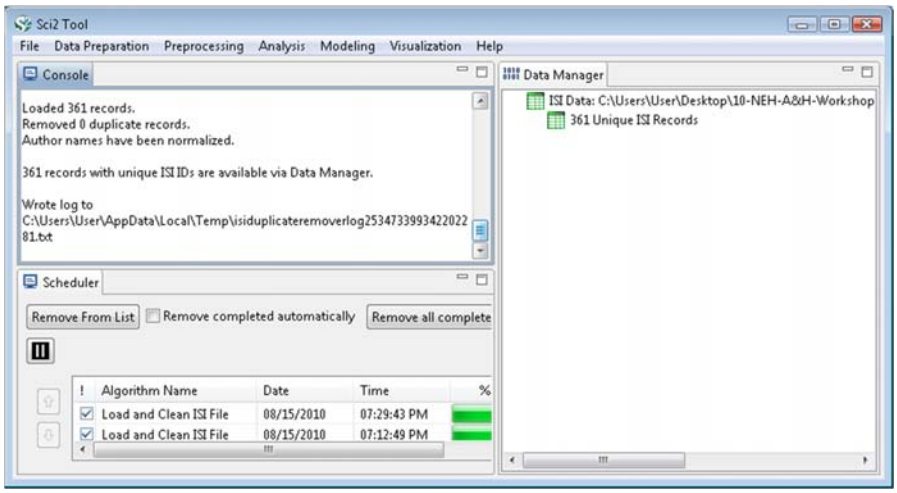
No books and other non-WoS publications are covered.

| | Age | Total # Cites | Total # Papers | H-Index | |
|---|---|---|---|---|---|
| Eugene Garfield | 82 | 1,525 | 672 | 31 | |
| Stanley Wasserman | | 122 | 35 | 17 | |
| Alessandro Vespignani | 42 | 451 | 101 | 33 | |
| Albert-László Barabási | 40 | 2,218 | 126 | 47 | *(Dec 2007)* |
| | 41 | 16,920 | 159 | 52 | *(Dec 2008)* |
| | 44 | 30,102 | 201 | 68 | *(April 11)* |



## Extract Co-Author Network

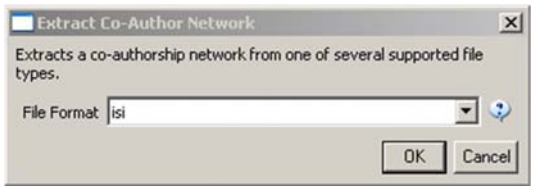
Load *'*yoursci2directory*/sampledata/scientometrics/isi/FourNetSciResearchers.isi'*
using *'File > Load …'*
And file with 361 records appears in the Data Manager.
Duplicates were removed, author names normalized. Log file exists.



## Extract Co-Author Network

*(see section 5.1.4.2 on correcting duplicate/misspelled author names)*

To extract the co-author network, select the *'361 Unique ISI Records'* table and run *'Data Preparation > Extract Co-Author Network'* using isi file format:




The result is an undirected but weighted network of co-authors in the Data Manager.

Run *'Analysis > Network > Network Analysis Toolkit (NAT)'* to calculate basic properties: the network has 247 nodes and 891 edges.

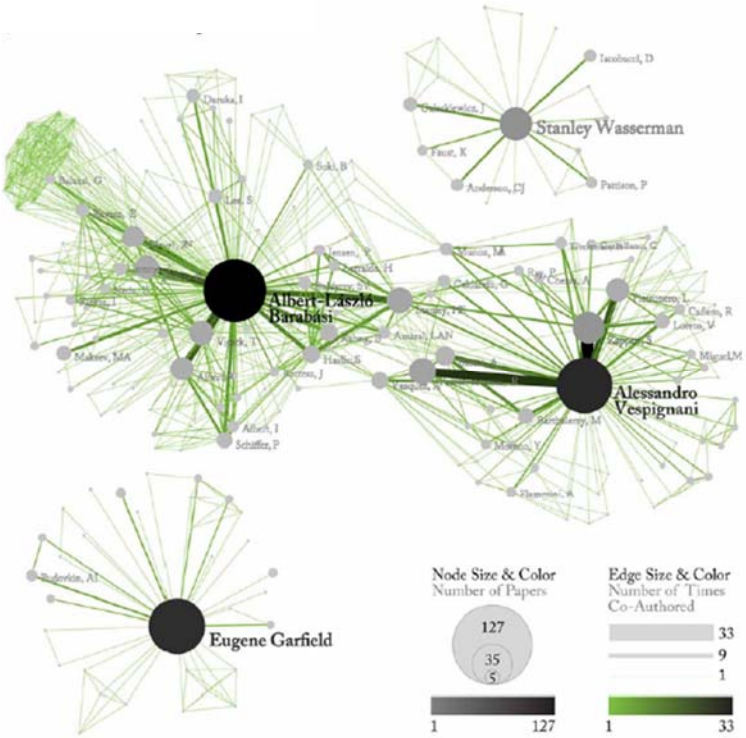
Use *'Analysis > Network > Unweighted and Undirected > Node Degree' to calculate the number of neighbors for each node independent of co-authorship weight.*

To view the complete network, select the *'Extracted Co-Authorship Network'* and run *'Visualization > Networks > GUESS'.*

Network is loaded with random layout. In GUESS, run *'Layout > GEM'* and 'Layout > Bin Pack' to improve layout. Run *'Script > Run Script* …' and select ' *yoursci2directory/scripts/GUESS/co-author-nw.py'.*



## Co-Author Network of all Four NetsSci Researchers

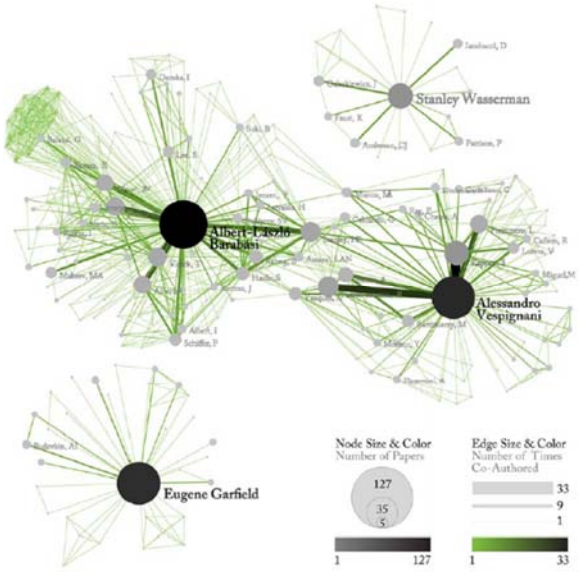


## Co-Author Network of all Four NetsSci Researchers

Use the GUESS Graph Modifier to change color and size coding.

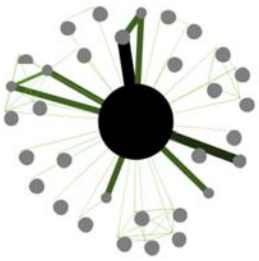
Calculate node degrees in Sci2 Tool.

Use a graphic program to add legend.

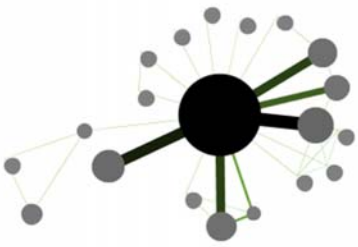





## Individual Co-Author Networks (Read/map 4 files separately)

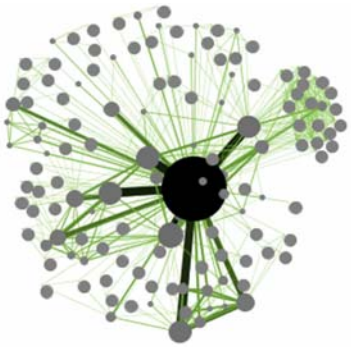


Eugene Garfield



Stanley Wasserman

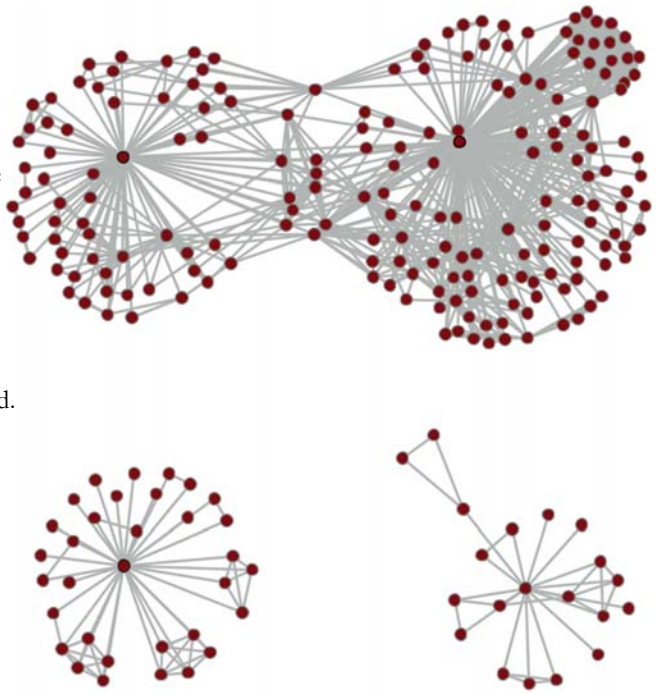
Alessandro Vespignani



Albert-László Barabási

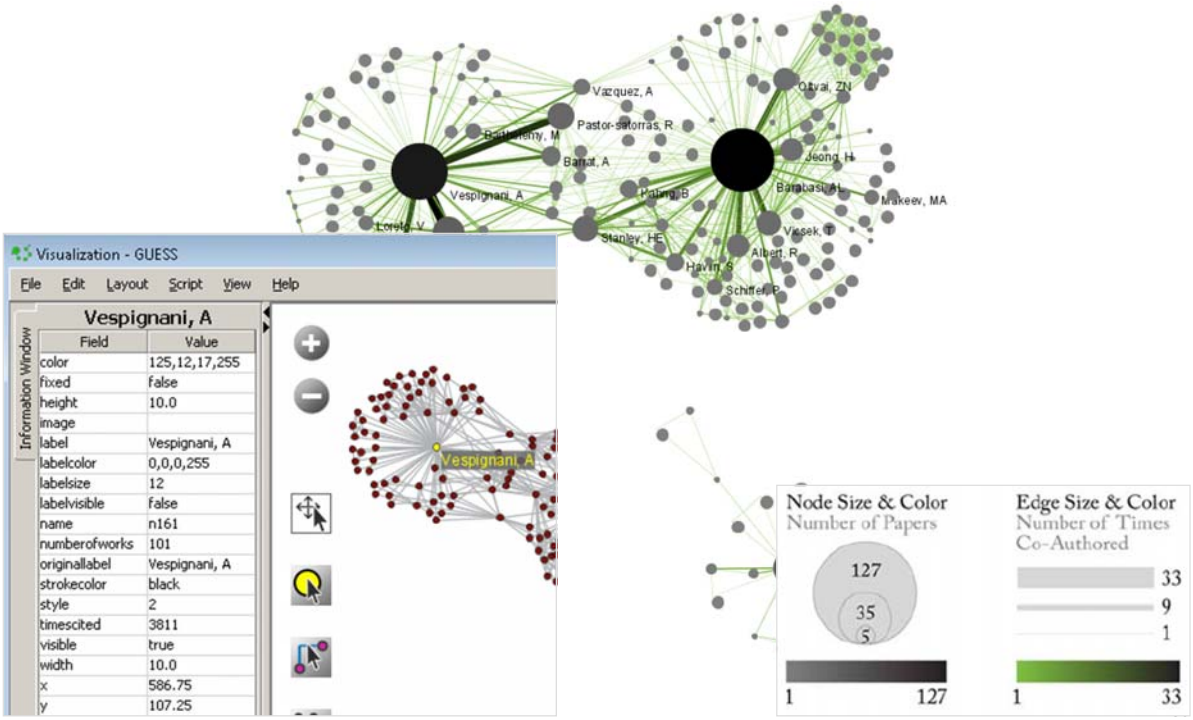
## Network Visualization: Node Layout

Load and Clean ISI File was selected.
Loaded 361 records.
Removed 0 duplicate records.
Author names have been normalized.
361 records with unique ISI IDs are available via Data Manager.
.....
Extract Co-Author Network was selected.
Input Parameters:
File Format: isi
.....
Network Analysis Toolkit (NAT) was selected.
Nodes: 247
Edges: 891
.....
GUESS was selected.

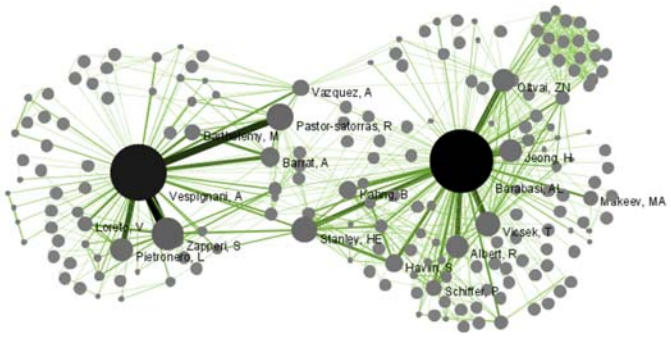




## Network Visualization: Color/Size Coding by Data Attribute Values



## Network Visualization: Giant Component

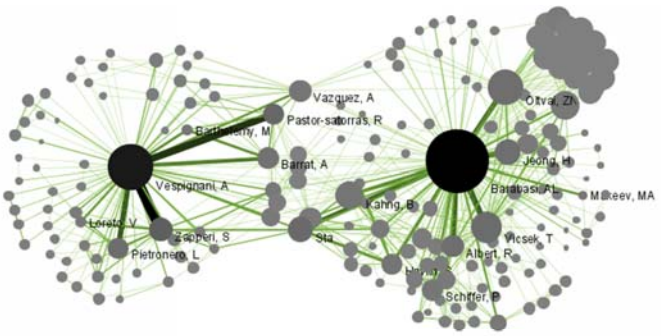



.....
Weak Component Clustering was selected.
Implementer(s): Russell Duhon
Integrator(s): Russell Duhon

Input Parameters:
Number of top clusters: 10
3 clusters found, generating graphs for the top 3 clusters.
.....

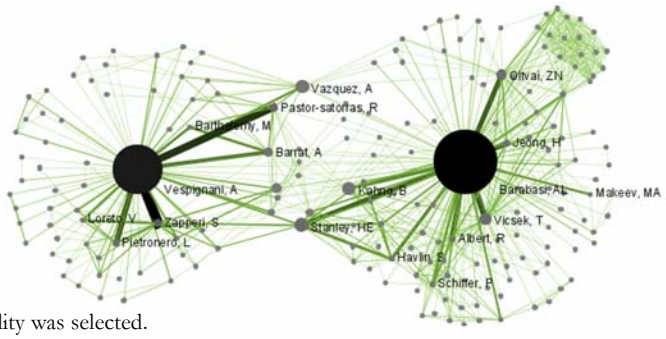


## Network Visualization: Color/Size Coding by Degree




.....
Node Degree was selected.
Documentation:
https://nwb.slis.indiana.edu/community/?n=AnalyzeData.NodeDegree
.....

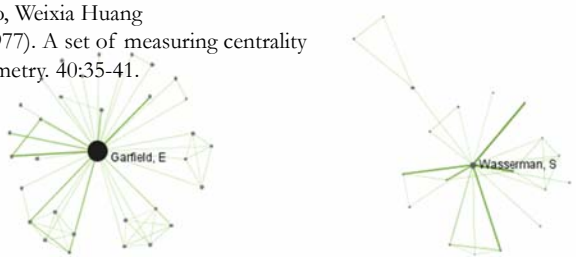
## Network Visualization:
## Color/Size Coding by Betweeness Centrality




.....
Node Betweenness Centrality was selected.
Author(s): L. C. Freeman
Implementer(s): Santo Fortunato
Integrator(s): Santo Fortunato, Weixia Huang
Reference: Freeman, L. C. (1977). A set of measuring centrality based on betweenness. Sociometry. 40:35-41.

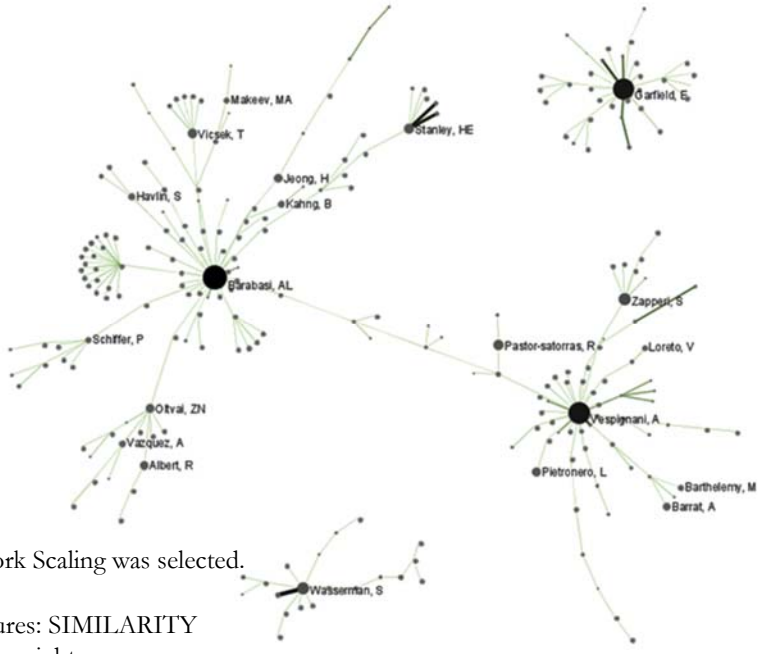
Input Parameters:
Number of bins: 10

umber of bins: 10
.....





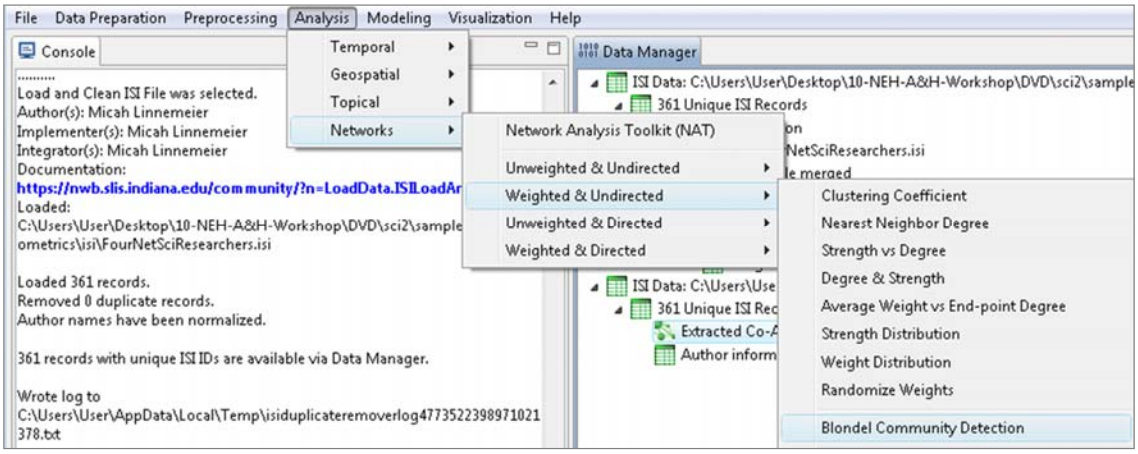

## Network Visualization:
## Reduced Network After Pathfinder Network Scaling



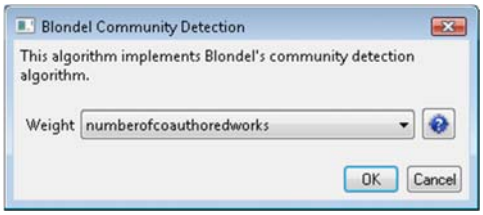

.....
MST-Pathfinder Network Scaling was selected.
Input Parameters:
Weight Attribute measures: SIMILARITY
Edge Weight Attribute: weight
.....

## Network Visualization: Circular Hierarchy Visualization

Select Co-Author Network and run Blondel Community detection:

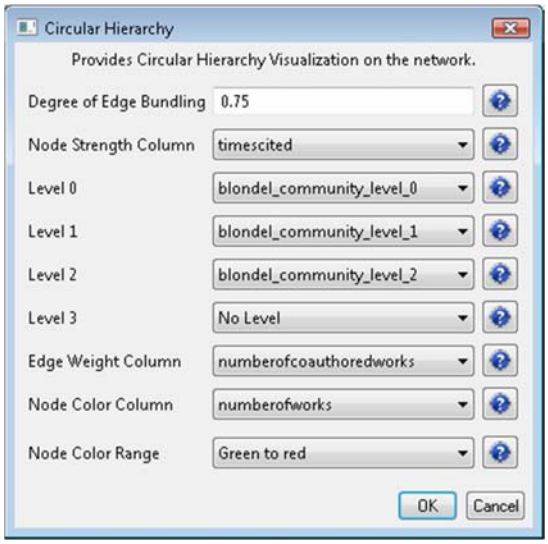



With parameter values



## Network Visualization: Circular Hierarchy Visualization

Visualize resulting file using *'Visualization > Networks > Circular Hierarchy'* with parameter values



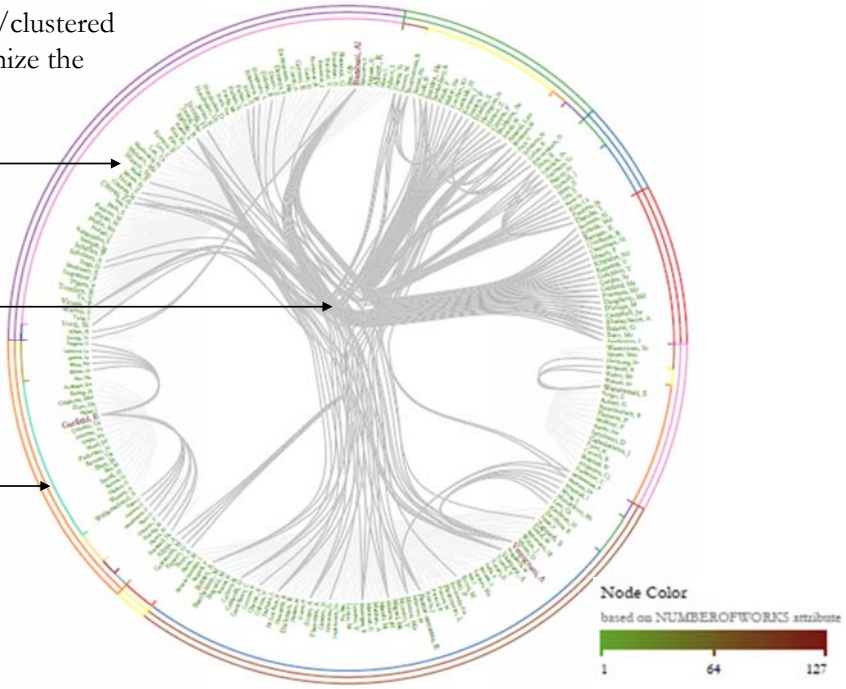
## Network Visualization: Circular Hierarchy Visualization

Nodes that are interlinked/clustered are spatially close to minimize the number of edge crossings.

Node labels, e.g., author names.

Network structure using edge bundling.

Color coded cluster hierarchy according to Blondel community detection algorithm.




Note:
Header/footer info, legend, and more meaningful color coding are under development.



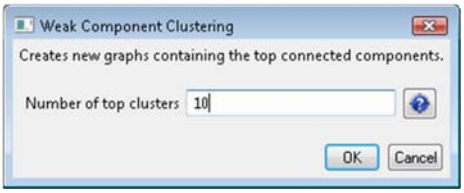
## Paper-Citation Network Layout

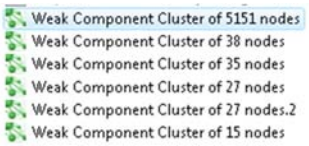
To extract the paper-citation network, select the *'361 Unique ISI Records'* table and run *'Data Preparation > Extract Paper Citation Network.'*

The result is a unweighted, directed network of papers linked by citations, named *Extracted paper-citation network* in the Data Manager.

Run *NAT* to calculate that the network has 5,342 nodes and 9,612 edges. There are 15 weakly connected components. (0 isolates)

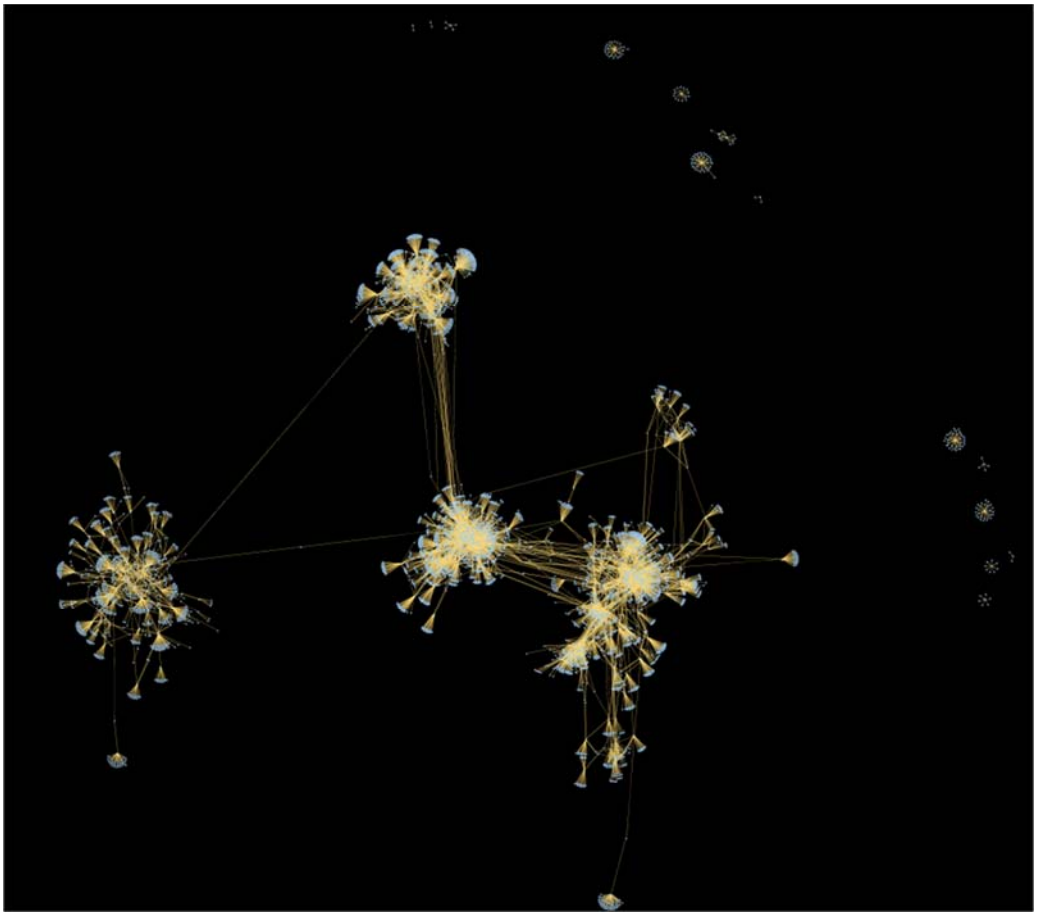
Run *'Analysis > Networks > Unweighted and Directed > Weak Component Clustering'* with parameters



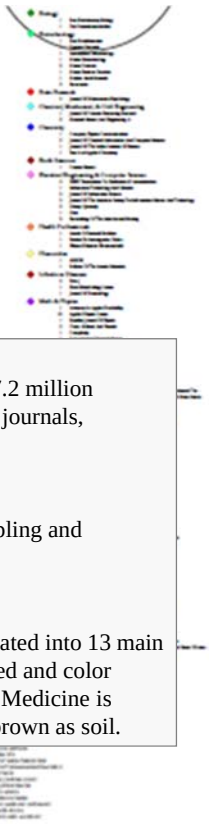




to identify top-10 largest components. The largest (giant) component has 5,151 nodes.

To view the complete network, select the network and run *'Visualization > GUESS'*.



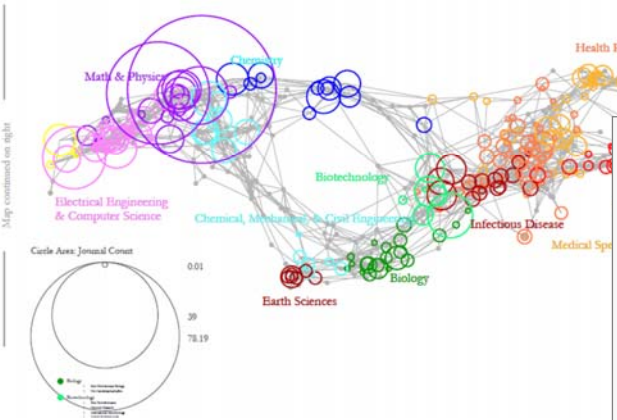
## Topic Mapping: UCSD Science Map

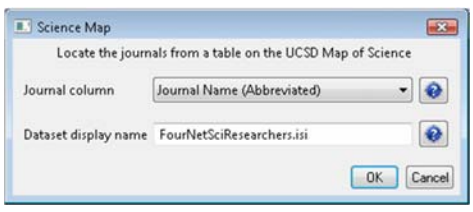


Science Map via Journals for FourNetSciResearchers.isi

314 journal references matched out of 361 found.

These 314 references are associated with 13 of 13 disciplines of science and 255 of 554 research specialties in the UCSD Map of Science.



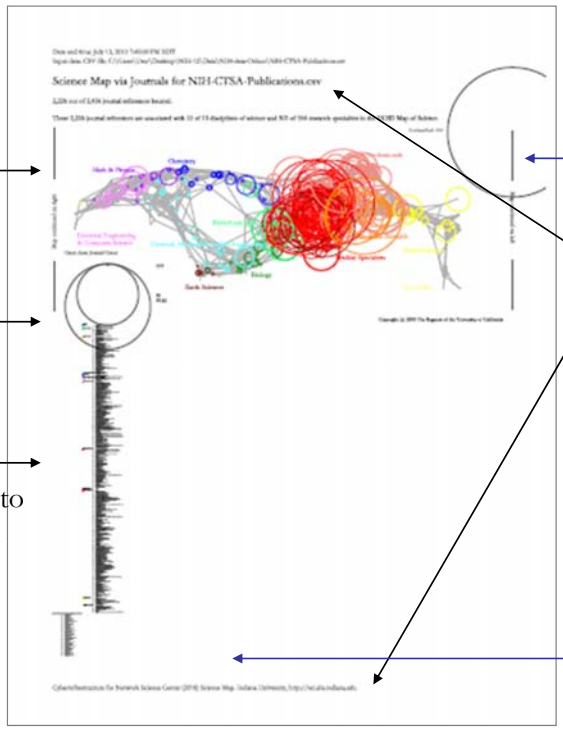




**Data:**
WoS and Scopus for 2001–2005, 7.2 million papers, more than 16,000 separate journals, proceedings, and series

**Similarity Metric:**
Combination of bibliographic coupling and keyword vectors

**Number of Disciplines:**
554 journal clusters further aggregated into 13 main scientific disciplines that are labeled and color coded in a metaphorical way, e.g., Medicine is blood red and Earth Sciences are brown as soil.

## How to Read the UCSD Map




UCSD Science Map with data overlay.

Map legend of circle area size coding

Listing of all data records organized into UCSD science areas.

Circle of non-located, e.g., 'Unclassified' records.

Header and footer with information when this map was created, by whom and using what data set.

Listing and circle of non-located, e.g., 'Unclassified' records.



# Break

## Workshop Overview

1:30 Macroscope Design and Usage & CIShell Powered Tools: NWB & Sci2

1:45 Sci2 Tool Basics

- Download and run the tool.

2:00 Sci2 Sample Workflow: Padgett's Florentine Families - Prepare, load, analyze, and visualize family and business networks from 15th century Florence.

2:30 Sci2 Sample Workflow: Studying Four Major NetSci Researchers.

- Load and clean a dataset as text file; process raw data into networks.
- Find basic statistics and run various algorithms over the network.
- Visualize as either a circular hierarchy or network

*3:30 Break*

**4:00 Sci2 Demo I: Geospatial maps with congressional districts**

4:30 Sci2 Demo II: Evolving collaboration networks

4:45 Outlook and Discussion

*5:00 Adjourn*



## Sci2 Demo I: Geospatial maps with congressional districts

| | A |
|---|---|
| 1 | Zip code |
| 2 | 90095 |
| 3 | 4672 |
| 4 | 232980568 |
| 5 | 10032 |
| 6 | 10039242 |
| 7 | 46091500 |
| 8 | 191112434 |
| 9 | 27705 |
| 10 | 981959472 |
| 11 | 10065 |
| 12 | 10065 |

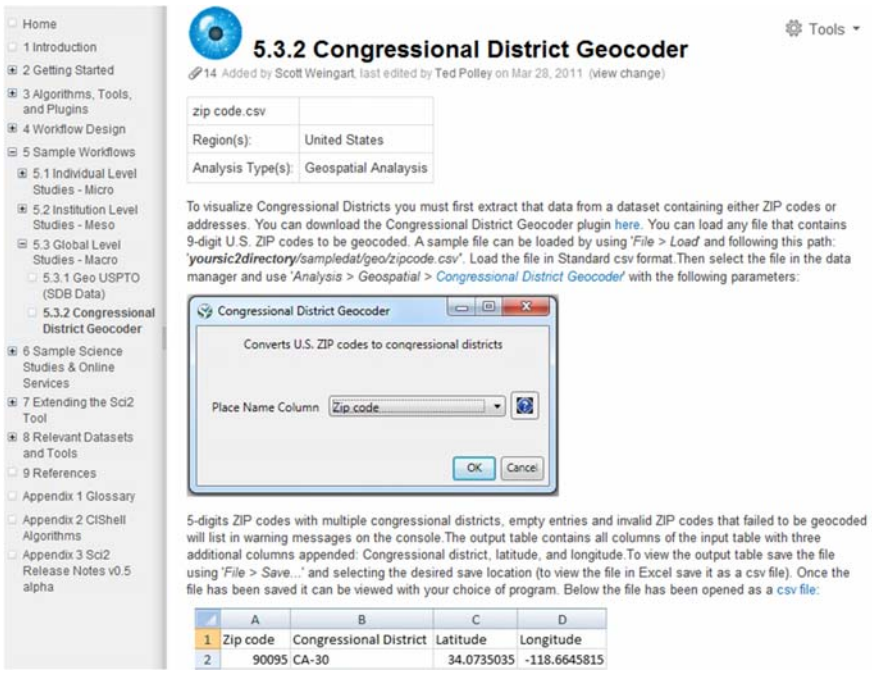
Identify Congressional District, Latitude, Longitude

| | A | B | C | D |
|---|---|---|---|---|
| 1 | Zip code | Congressional District | Latitude | Longitude |
| 2 | 90095 | CA-30 | 34.0735035 | -118.6645815 |
| 3 | 4672 | ME-02 | 45.818717 | -69.0290345 |
| 4 | 232980568 | VA-03 | 37.270472 | -77.0699835 |

Aggregate/Count identical Congressional Districts

| | A | B | C | D |
|---|---|---|---|---|
| 1 | Congressional District | Latitude | Longitude | Count |
| 2 | CA-30 | 34.0735035 | -118.6645815 | 4 |
| 3 | ME-02 | 45.818717 | -69.0290345 | 2 |
| 4 | VA-03 | 37.270472 | -77.0699835 | 1 |
| 5 | NY-15 | 40.8341475 | -73.9342095 | 4 |

## Relevant Sci2 Manual entry



- Home
- 1 Introduction
- 2 Getting Started
- 3 Algorithms, Tools, and Plugins
- 4 Workflow Design
- 5 Sample Workflows
  - 5.1 Individual Level Studies - Micro
  - 5.2 Institution Level Studies - Meso
  - 5.3 Global Level Studies - Macro
    - 5.3.1 Geo USPTO (SDB Data)
    - 5.3.2 Congressional District Geocoder
- 6 Sample Science Studies & Online Services
- 7 Extending the Sci2 Tool
- 8 Relevant Datasets and Tools
- 9 References
- Appendix 1 Glossary
- Appendix 2 CIShell Algorithms
- Appendix 3 Sci2 Release Notes v0.5 alpha

Tools

### 5.3.2 Congressional District Geocoder

14 Added by Scott Weingart, last edited by Ted Polley on Mar 28, 2011 (view change)

| zip code.csv | |
|---|---|
| Region(s): | United States |
| Analysis Type(s): | Geospatial Analaysis |

To visualize Congressional Districts you must first extract that data from a dataset containing either ZIP codes or addresses. You can download the Congressional District Geocoder plugin here. You can load any file that contains 9-digit U.S. ZIP codes to be geocoded. A sample file can be loaded by using '*File > Load*' and following this path: '***yoursic2directory***/*sampledat/geo/zipcode.csv*'. Load the file in Standard csv format.Then select the file in the data manager and use '*Analysis > Geospatial > Congressional District Geocoder*' with the following parameters:



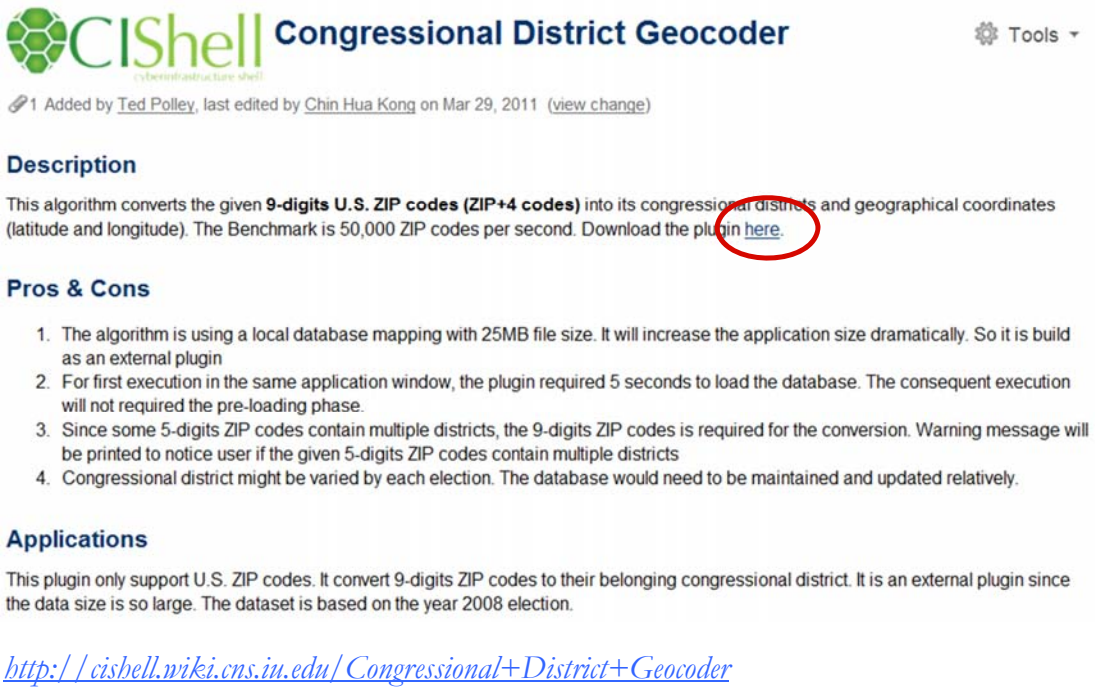

5-digits ZIP codes with multiple congressional districts, empty entries and invalid ZIP codes that failed to be geocoded will list in warning messages on the console.The output table contains all columns of the input table with three additional columns appended: Congressional district, latitude, and longitude.To view the output table save the file using '*File > Save...*' and selecting the desired save location (to view the file in Excel save it as a csv file). Once the file has been saved it can be viewed with your choice of program. Below the file has been opened as a csv file:

| | A | B | C | D |
|---|---|---|---|---|
| 1 | Zip code | Congressional District | Latitude | Longitude |
| 2 | 90095 | CA-30 | 34.0735035 | -118.6645815 |

http://sci2.wiki.cns.iu.edu/5.3.2+Congressional+District+Geocoder



## Relevant CIShell plugin



CIShell cyberinfrastructure shell

### Congressional District Geocoder

Tools

1 Added by Ted Polley, last edited by Chin Hua Kong on Mar 29, 2011 (view change)

#### Description

This algorithm converts the given **9-digits U.S. ZIP codes (ZIP+4 codes)** into its congressional districts and geographical coordinates (latitude and longitude). The Benchmark is 50,000 ZIP codes per second. Download the plugin here.

#### Pros & Cons

1. The algorithm is using a local database mapping with 25MB file size. It will increase the application size dramatically. So it is build as an external plugin
2. For first execution in the same application window, the plugin required 5 seconds to load the database. The consequent execution will not required the pre-loading phase.
3. Since some 5-digits ZIP codes contain multiple districts, the 9-digits ZIP codes is required for the conversion. Warning message will be printed to notice user if the given 5-digits ZIP codes contain multiple districts
4. Congressional district might be varied by each election. The database would need to be maintained and updated relatively.

#### Applications

This plugin only support U.S. ZIP codes. It convert 9-digits ZIP codes to their belonging congressional district. It is an external plugin since the data size is so large. The dataset is based on the year 2008 election.

http://cishell.wiki.cns.iu.edu/Congressional+District+Geocoder

## Console Messages

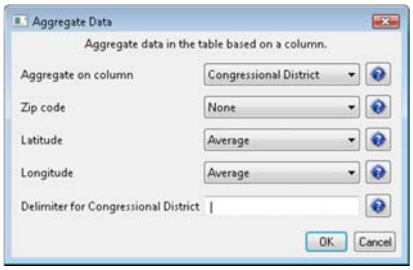
Load... was selected.
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Data+Formats
Loaded: C:\Users\katy\Desktop\NWB-SCI2\sci2-2011.04.04-v0.5a\sampledata\geo\zip code.csv
.....
Congressional District Geocoder was selected.
Implementer(s): Chin Hua Kong
Integrator(s): Chin Hua Kong
Documentation: https://nwb.cns.iu.edu/community/?n=SampleData.CongressionalDistrictGeocoder

Input Parameters:
Place Name Column: Zip code
District values added to Congressional District, Latitude and Longitude respectively.
There are 2 rows with "33612" ZIP code, which could not been given a congressional district.
There are 1 rows with "2472" ZIP code, which could not been given a congressional district.
There are 3 rows with "10016" ZIP code, which could not been given a congressional district.
There are 1 rows with "11203" ZIP code, which could not been given a congressional district.
There are 1 rows with "60637" ZIP code, which could not been given a congressional district.
There are 1 rows with "70118" ZIP code, which could not been given a congressional district.
There are 1 rows with "60612" ZIP code, which could not been given a congressional district.
There are 3 rows with "21205" ZIP code, which could not been given a congressional district.
There are 1 rows with "2467" ZIP code, which could not been given a congressional district.
5-digit ZIP codes may often be insufficient, as many zip codes contain multiple congressional districts. 9-digit zip codes may be required. If a zip code was recently created, it may also not be contained in our database.
Successfully converted 86 out of 100 ZIP codes to congressional districts.
.....



## Sci2 Demo I:
## Geospatial maps with congressional districts

Run *'Preprocessing > General > Aggregate Data'*
using parameter values




Note: Need lat/long for geomap.

Input Parameters:
Aggregate on column: Congressional District
Longitude: AVERAGE
Latitude: AVERAGE
Delimiter for Congressional District: |
Zip code: NONE
Aggregated by '': All rows of Latitude column were skipped due to no non-null, non-empty values.
Aggregated by '': All rows of Longitude column were skipped due to no non-null, non-empty values.
Frequency of unique "Congressional District" values added to "Count" column.
"Zip code" column has been deleted from the output. Since No aggregation was mentioned for it.

## Create Geo Map (Circle Annotation)

.....
Geo Map (Circle Annotations) was selected.
Author(s): Joseph R. Biberstine
Implementer(s): Joseph R. Biberstine
Integrator(s): Joseph R. Biberstine
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Geo+Map

Input Parameters:
Longitude: Longitude
Size Circles By: CircleSize
Color Circle Exteriors By: None (no outer color)
Color Circle Interiors By: CircleSize
Exterior Color Scaling: Linear
Exterior Color Range: Yellow to Blue
Interior Color Range: Blue to Red
Size Scaling: Linear
Map: US States
Author Name:
Interior Color Scaling: Linear
Latitude: Latitude
14 rows in the table did not specify all values needed to make a circle; those rows were skipped.
Printing PostScript..
Done.
Saved: C:\Users\katy\Desktop\geoMaps2903082942930990749.ps

Save ps file, convert to pdf, view.

## How to Read the Geo Map

Header and footer with information when this map was created, by whom and using what data set.

U.S. Map with data overlay.

Listing of map type, author, and parameters used.

Map legend with color coding.

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- Load and clean a dataset as text file; process raw data into networks.
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- Visualize as either a circular hierarchy or network

*3:30 Break*

4:00 Sci2 Demo I: Geospatial maps with congressional districts

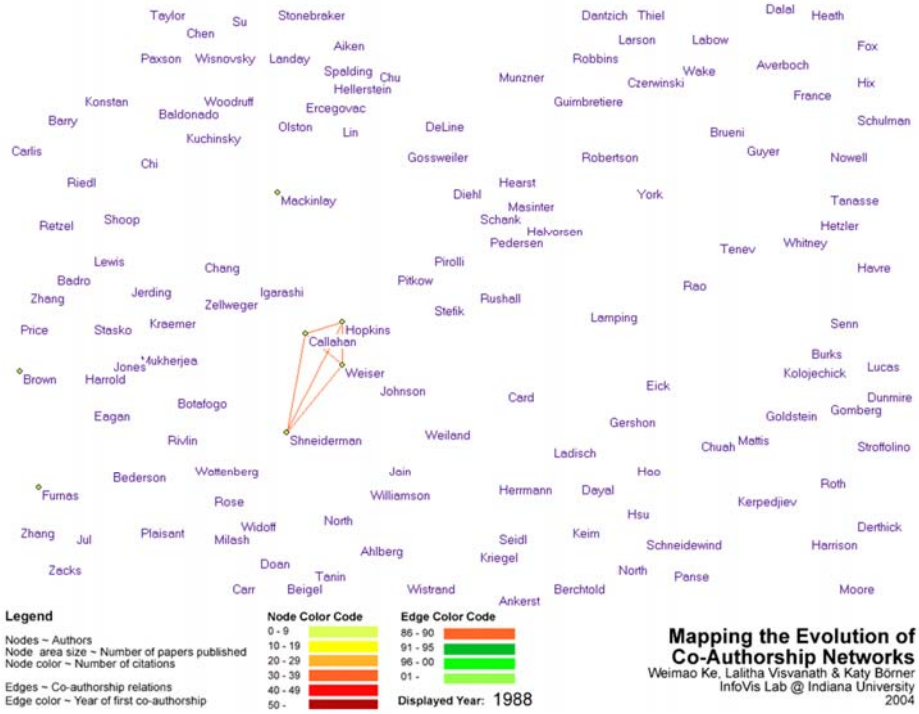
**4:30 Sci2 Demo II: Evolving collaboration networks**

4:45 Outlook and Discussion

*5:00 Adjourn*

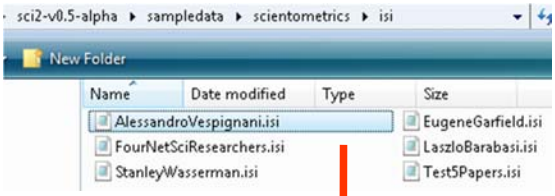


## Sci2 Demo II: Evolving collaboration networks



## Sci2 Demo II:
## Evolving collaboration networks

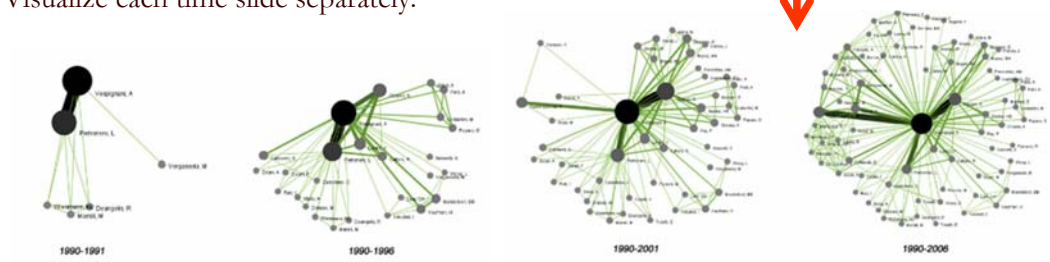
Load isi formatted file




As csv, file looks like:

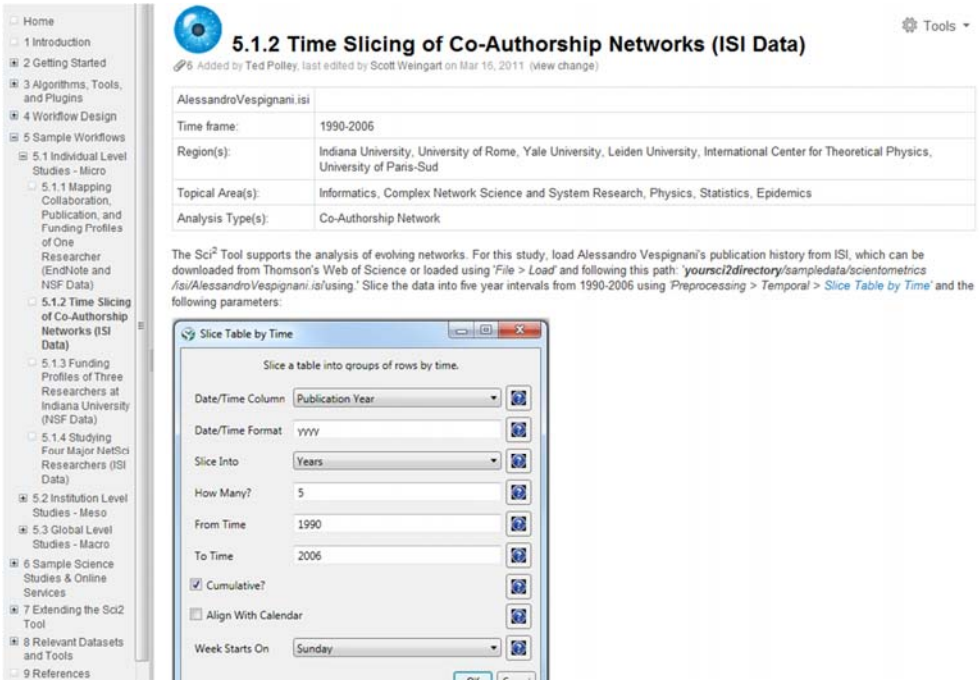
| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | Abstract | Authors | Authors (Full Names) | Beginning | Book Serie | Book Serie | Cited Pate |
| 2 | The systematic study of | Colizza, V\|Barrat, A\|Barthelemy, M\|Vespignani, A | | 2015 | | | |
| 3 | Uncovering the hidden r | Colizza, V\|Flammini, A\|Serrano, MA\|Vespignani, A | | 110 | | | |
| 4 | Computer viruses can s | Vespignani, A | | 135 | | | |
| 5 | Mapping the Internet ge | Dall'Asta, L\|Alvarez-Hamelin, I\|Barrat, A\|Vazquez, A\|Vespignani, A | | 140 | | LECTURE NOTES IN | |

Visualize each time slide separately:



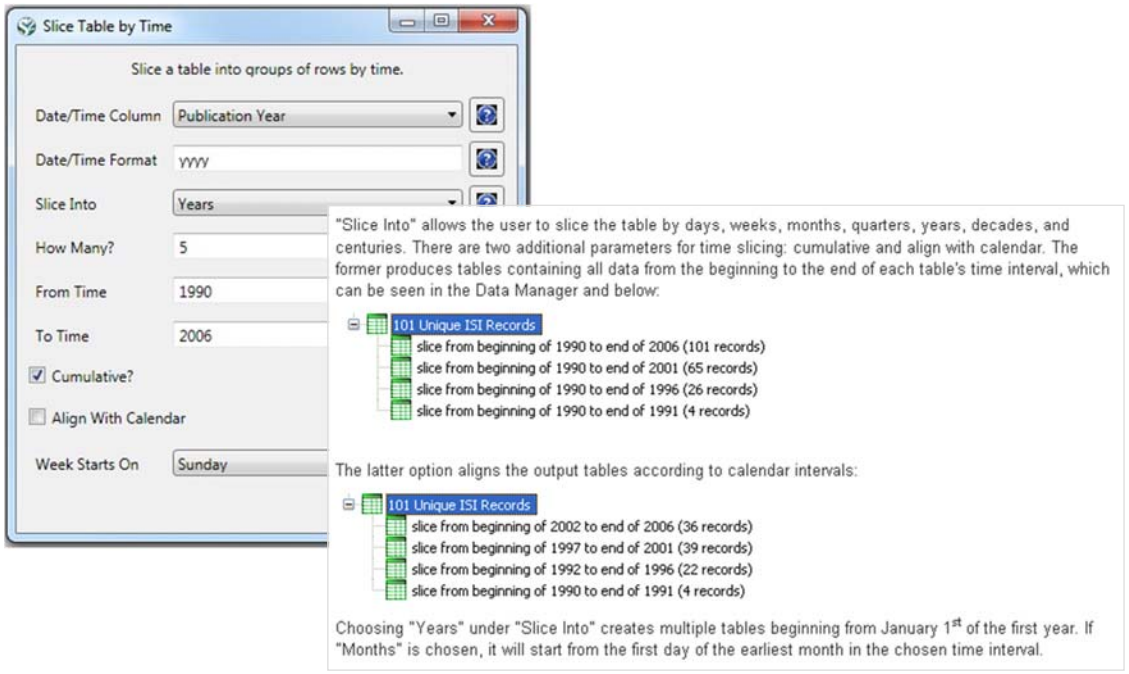



## Relevant Sci2 Manual entry




http://sci2.wiki.cns.iu.edu/5.1.2+Time+Slicing+of+Co-Authorship+Networks+(ISI+Data)

## Slice Table by Time




http://sci2.wiki.cns.iu.edu/5.1.2+Time+Slicing+of+Co-Authorship+Networks+(ISI+Data)

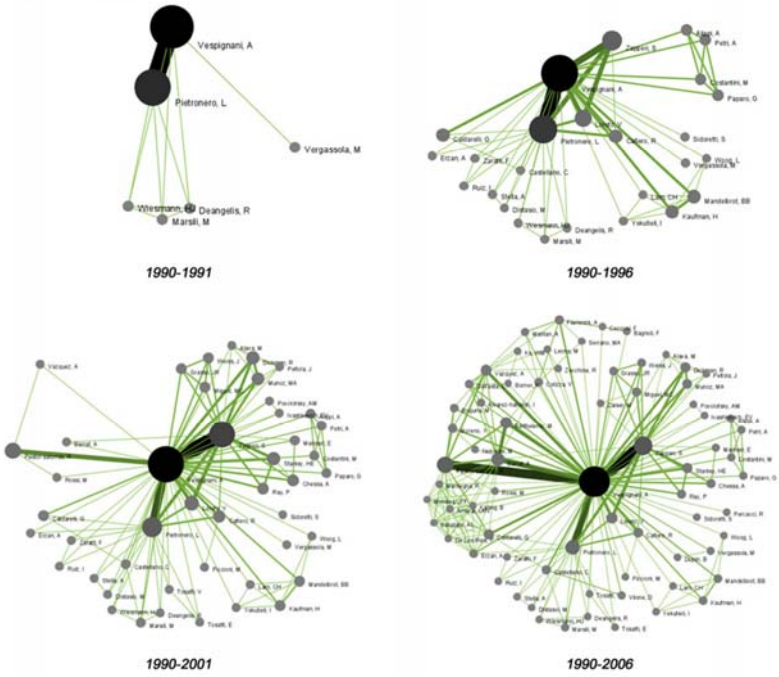


## Visualize Each Network, Keep Node Positions

1. To see the evolution of Vespignani's co-authorship network over time, check '*cumulative*'.
2. Extract co-authorship networks one at a time for each sliced time table using *'Data Preparation > Extract Co-Author Network'*, making sure to select "ISI" from the pop-up window during the extraction.
3. To view each of the Co-Authorship Networks over time using the same graph layout, begin by clicking on longest slice network (the *'Extracted Co-Authorship Network*' under *'slice from beginning of 1990 to end of 2006 (101 records)')* in the data manager. Visualize it in GUESS using *'Visualization > Networks > GUESS'*.
4. From here, run *'Layout > GEM*' followed by *'Layout > Bin Pack*'. Run *'Script > Run Script …*' and select '*yoursci2directory/scripts/GUESS/co-author-nw.py'*.
5. In order to save the x, y coordinates of each node and to apply them to the other time slices in GUESS, select *'File > Export Node Positions*' and save the result as '*yoursci2directory/NodePositions.csv*'. Load the remaining three networks in GUESS using the steps described above and for each network visualization, run *'File > Import Node Positions'* and open *'yoursci2directory/NodePositions.csv'*.
6. To match the resulting networks stylistically with the original visualization, run *'Script > Run Script …'* and select *'yoursci2directory/scripts/GUESS/co-author-nw.py', followed by 'Layout > Bin Pack',* for each.

http://sci2.wiki.cns.iu.edu/5.1.2+Time+Slicing+of+Co-Authorship+Networks+(ISI+Data)

## Visualize Each Network, Keep Node Positions




http://sci2.wiki.cns.iu.edu/5.1.2+Time+Slicing+of+Co-Authorship+Networks+(ISI+Data)



## Relevant CIShell plugin

CIShell **Slice Table by Time**

Tools

Added by Aretha Alencar, last edited by Ted Polley on Jan 12, 2011 (view change)

**Description**

Slice Table By Time is an algorithm to chop a table up into new tables, based on a date/time column. It takes the column with the date/time data, a string describing the format of that column, the intervals that the data should be sliced into, whether or not the slices are cumulative, whether or not the slices should be aligned with the calendar, and what day the week is considered to start on (which only matters if the slices are aligned with the calendar) as parameters.

The column to use for date/time values should have a single value for each row of data. It is used by the algorithm to choose which slice(s) the row should end up in. In order to determine what date/time is represented by that row, you must provide the algorithm with a descriptive format, in the second parameter. For instance, a four digit year would be represented by yyyy (the default value). See http://joda-time.sourceforge.net/api-release/org/joda/time/format/DateTimeFormat.html for details of all the various formatting options.

The next dropdown has the available intervals to slice the table into. These include milliseconds, seconds, minutes, hours, days, weeks, fortnights, months, quarters, years, decades, and centuries. A future version of the algorithm may include the ability to select how many of these intervals should be grouped together at once.

The checkbox that follows determines if the slices will be cumulative. If the slices are not cumulative, every row in the original table is in one and only one resulting slice. However, if the slices are cumulative, every row in the original table is in the slice it is for and every slice for a period after that.

The checkbox that follows determines if the slices will be aligned with the calendar. For instance, if the first row is for June 7th, 2006 and yearly slices are chosen, then the default behavior will be to have the first slice be from June 7th, 2006 to June 6th, 2007. However, if the slices are aligned with the calendar, the first slice will be from January 1st, 2006 to December 31st, 2006. Alignment does not affect the output for intervals of fortnights, quarters, decades, or milliseconds.

If the slices are aligned with the calendar and are weekly, then the day the week starts is used to determine how they are aligned.

**Pros & Cons**

The output of the slice algorithm is in separate tables, so a longitudinal analysis will require working with each slice separately, which can be awkward. There will likely be future versions of the time slice algorithm that annotate the original table with the slice the rows belong to.

**Applications**

When doing longitudinal analysis of data, it can be useful to consider it in chunks, such as to calculate how statistics have changed over time. Alternatively, only a particular time period might be of interest, and this algorithm can extract it from data for a larger time range.

**Implementation Details**

This algorithm uses the Joda Time library extensively, which provides significantly improved capabilities compared to the default Java algorithms for dates and times.

http://cishell.wiki.cns.iu.edu/Slice+Table+by+Time

## Workshop Overview

1:30 Marcoscope Design and Usage & CIShell Powered Tools: NWB & Sci2

1:45 Sci2 Tool Basics

- Download and run the tool.

2:00 Sci2 Sample Workflow: Padgett's Florentine Families - Prepare, load, analyze, and visualize family and business networks from 15th century Florence.

2:30 Sci2 Sample Workflow: Studying Four Major NetSci Researchers.

- Load and clean a dataset as text file; process raw data into networks.
- Find basic statistics and run various algorithms over the network.
- Visualize as either a circular hierarchy or network

*3:30 Break*

4:00 Sci2 Demo I: Geospatial maps with congressional districts

4:30 Sci2 Demo II: Evolving collaboration networks

**4:45 Marcoscopes: Outlook and Discussion**

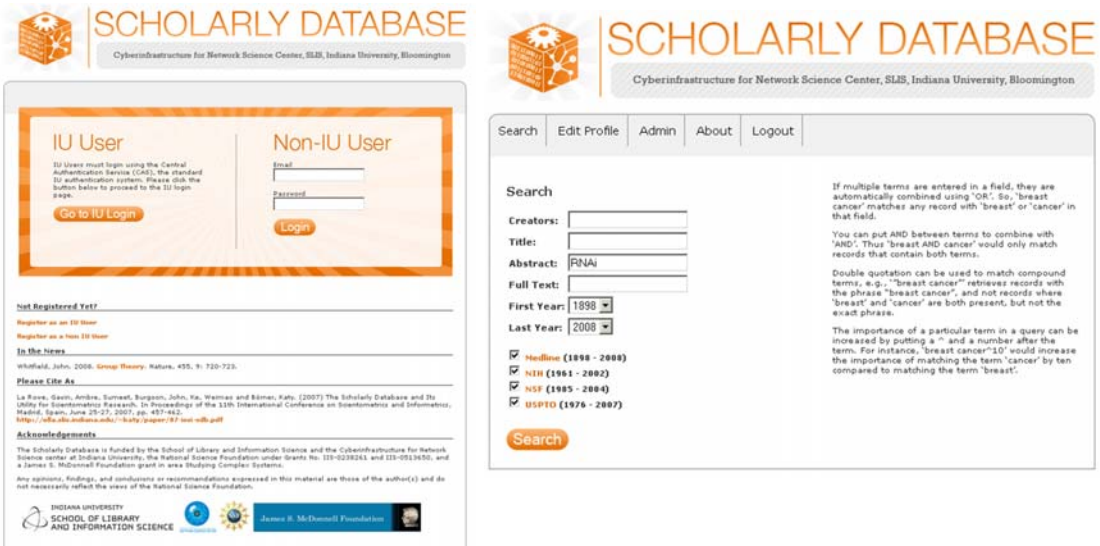
*5:00 Adjourn*



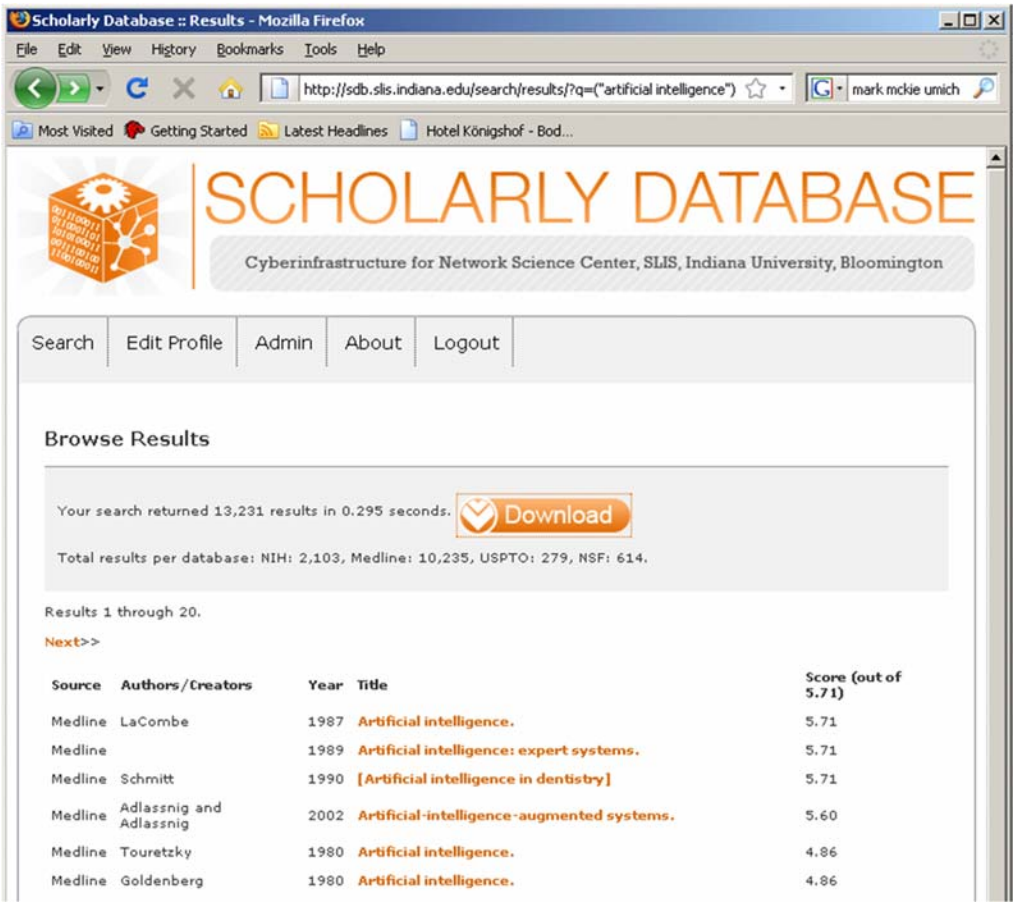
## Scholarly Database at Indiana University

*http://sdb.wiki.cns.iu.edu*

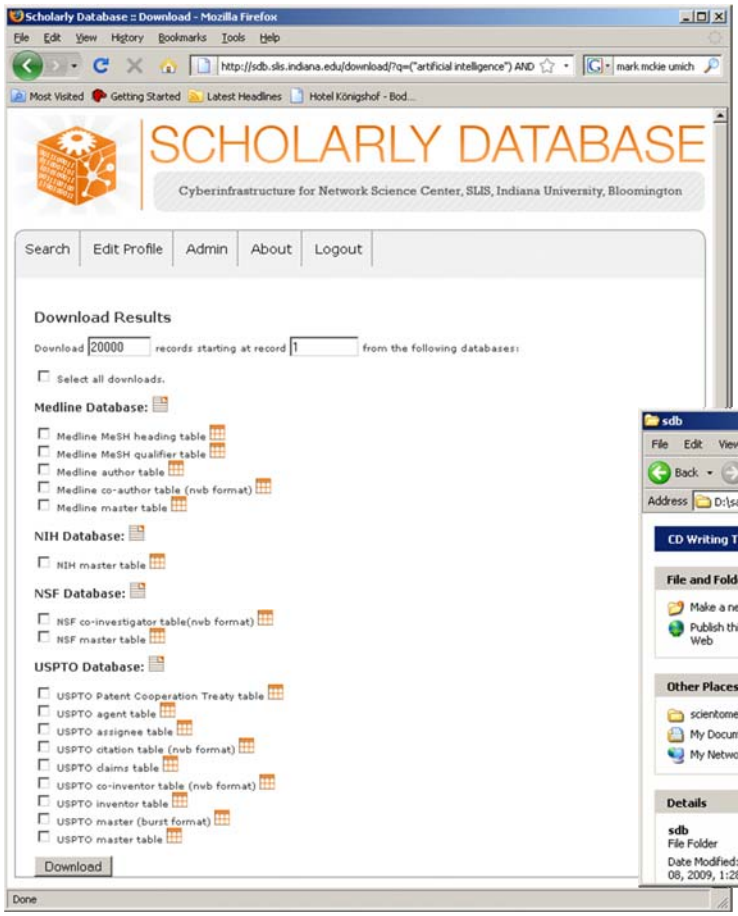
Supports federated search of 25 million publication, patent, grant records.
Results can be downloaded as data dump and (evolving) co-author, paper-citation networks.




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

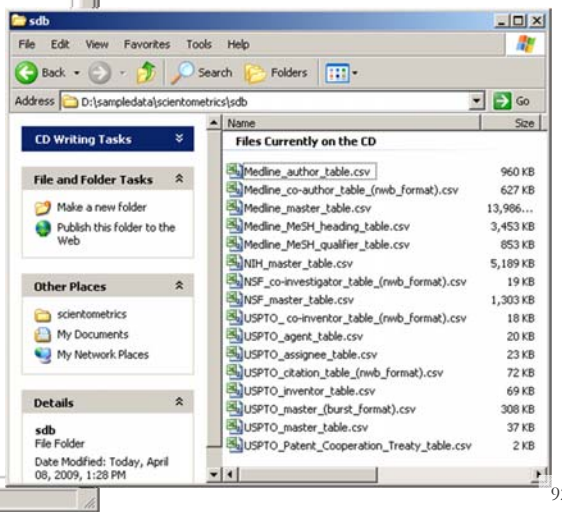


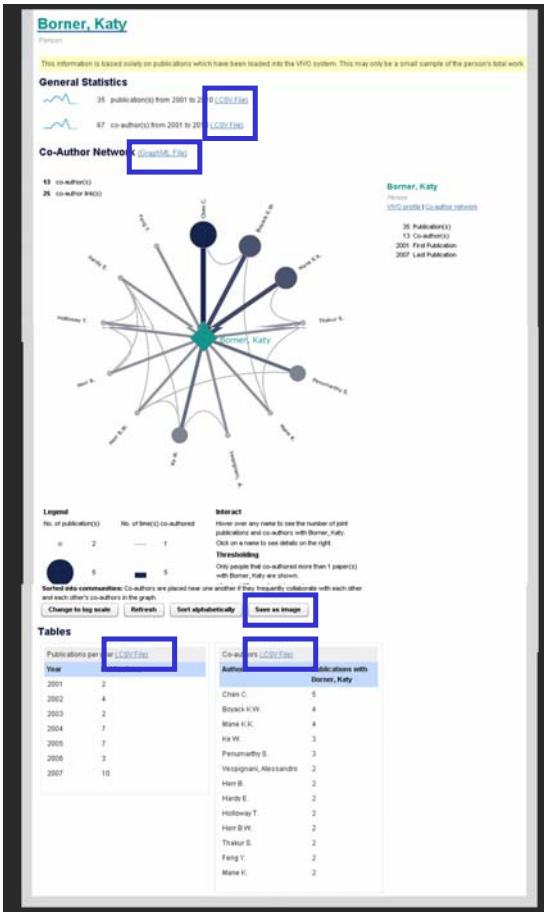



**Since March 2009:**
Users can download networks:
- Co-author
- Co-investigator
- Co-inventor
- Patent citation

and tables for
burst analysis in NWB.






## Download Data

VIVO Enabling a National Network of Scientists

### General Statistics

- 36 publication(s) from 2001 to 2010 (.CSV File)
- 80 co-author(s) from 2001 to 2010 (.CSV File)

### Co-Author Network

(GraphML File)

Save as Image (.PNG file)

### Tables

- Publications per year (.CSV File)
- Co-authors (.CSV File)

*http://vivo-netsci.cns.iu.edu/vivo/visualization?uri=http%3A%2F%2Fvivo-trunk.indiana.edu%2Findividual%2FPerson74&vis=person_level&render_mode=standalone*



VIVO Enabling a National Network of Scientists

36 publication(s) from 2001 to 2010 (.CSV File)

| Year | Publications |
|---|---|
| 2001 | 2 |
| 2002 | 4 |
| 2003 | 2 |
| 2004 | 7 |
| 2005 | 7 |
| 2006 | 3 |
| 2007 | 10 |
| 2010 | 1 |

80 co-author(s) from 2001 to 2010 (.CSV File)

| Year | Count | Co-Author(s) |
|---|---|---|
| 2001 | 1 | Chen C. |
| 2002 | 3 | Chen C.; McMahon T.; Feng Y. |
| 2003 | 2 | Chen C.; Boyack K.W. |
| 2004 | 17 | Sengupta A.; Penumarthy S.; Thakur S.; Sooriamurthi R.; Maru J.T.; Shiffrin R.M.; Mane K.; Moor K.A.; |

Co-author network (GraphML File)

```
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<key id="number_of_authored_works" for="node" attr.name="number_of_authored_works" attr.type="int" />
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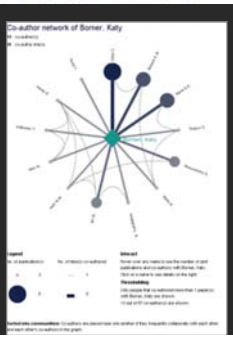
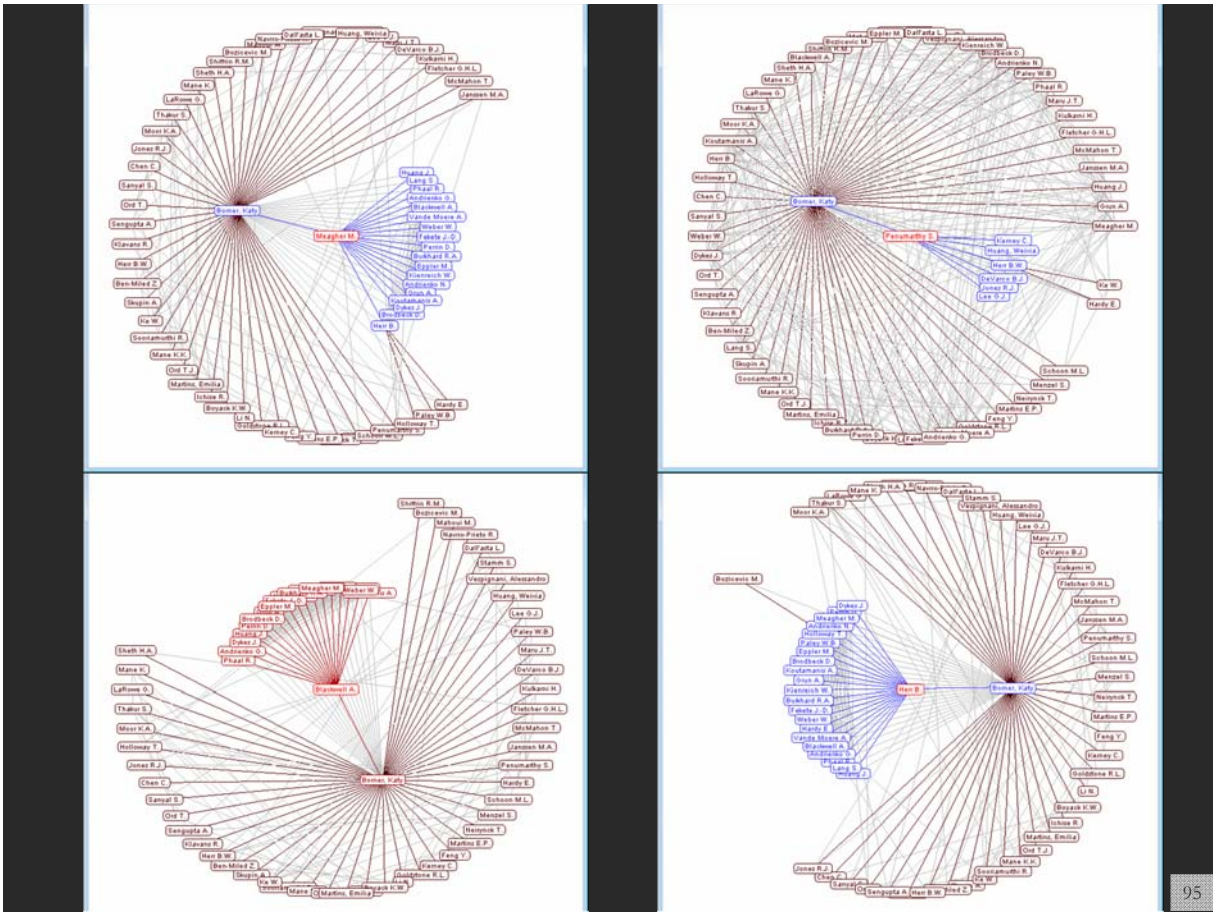
Save as Image (.PNG file)



Publications per year (.CSV File), see top file.

Co-authors (.CSV File)

| Co-Author | Count |
|---|---|
| Andrienko G. | 1 |
| Andrienko N. | 1 |
| Ben-Miled Z. | 1 |
| Blackwell A. | 1 |
| Boyack K.W. | 4 |
| Bozicevic M. | 1 |
| Brodbeck D. | 1 |
| Burkhard R.A. | 1 |
| Chen C. | 5 |





## CIShell – Integrate New Algorithms

### 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 Developer Guide is at*** *http://cishell.wiki.cns.iu.edu*

***Additional Sci2 Plugins are at*** *http://sci2.wiki.cns.iu.edu/3.2+Additional+Plugins*

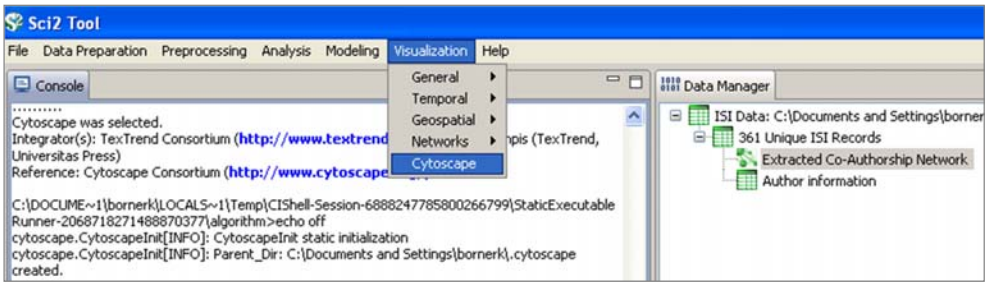
## CIShell – Add new Plugins, e.g., Cytoscape

Adding more alyout algorithms and network visualization interactivity via Cytoscape http://www.cytoscape.org.

Simply add *org.textrend.visualization.cytoscape_0.0.3.jar* into your /plugin directory.

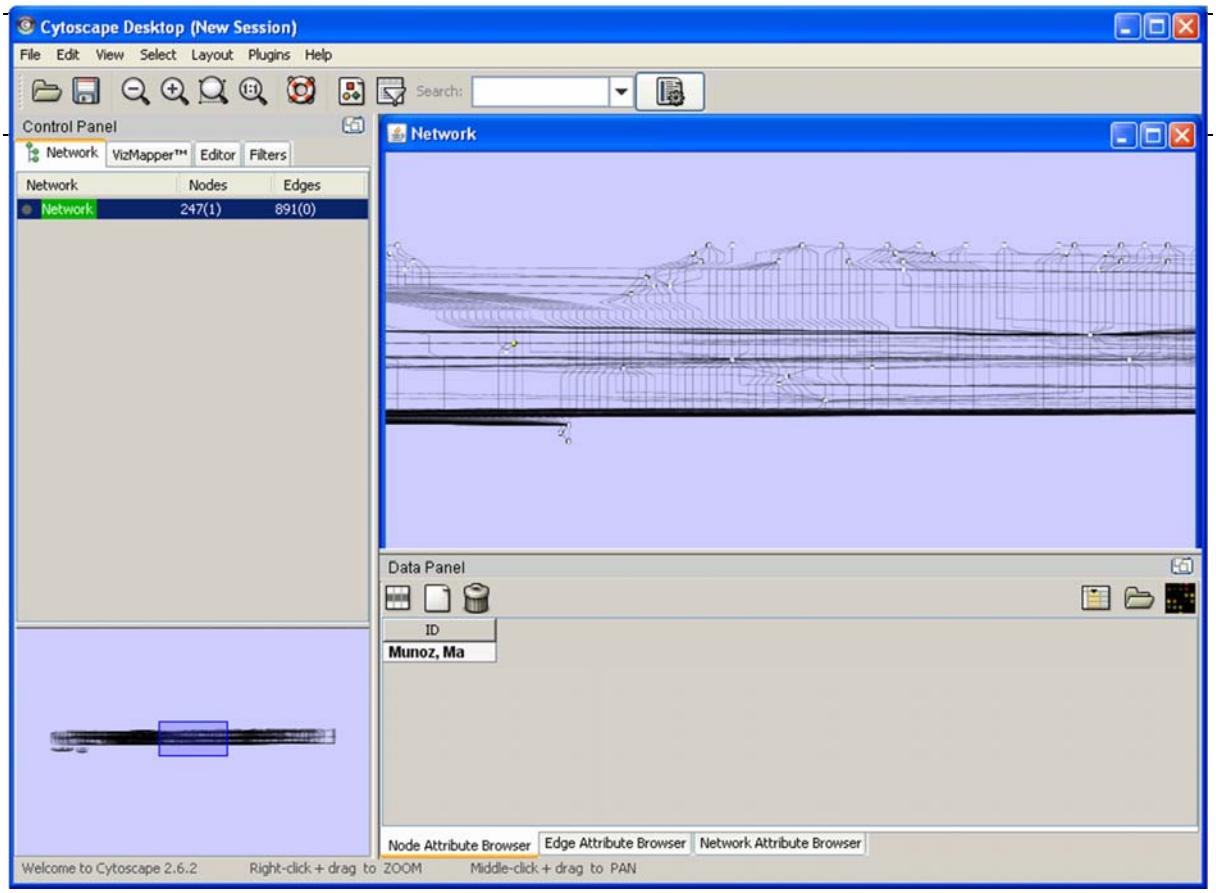
Restart Sci2 Tool.

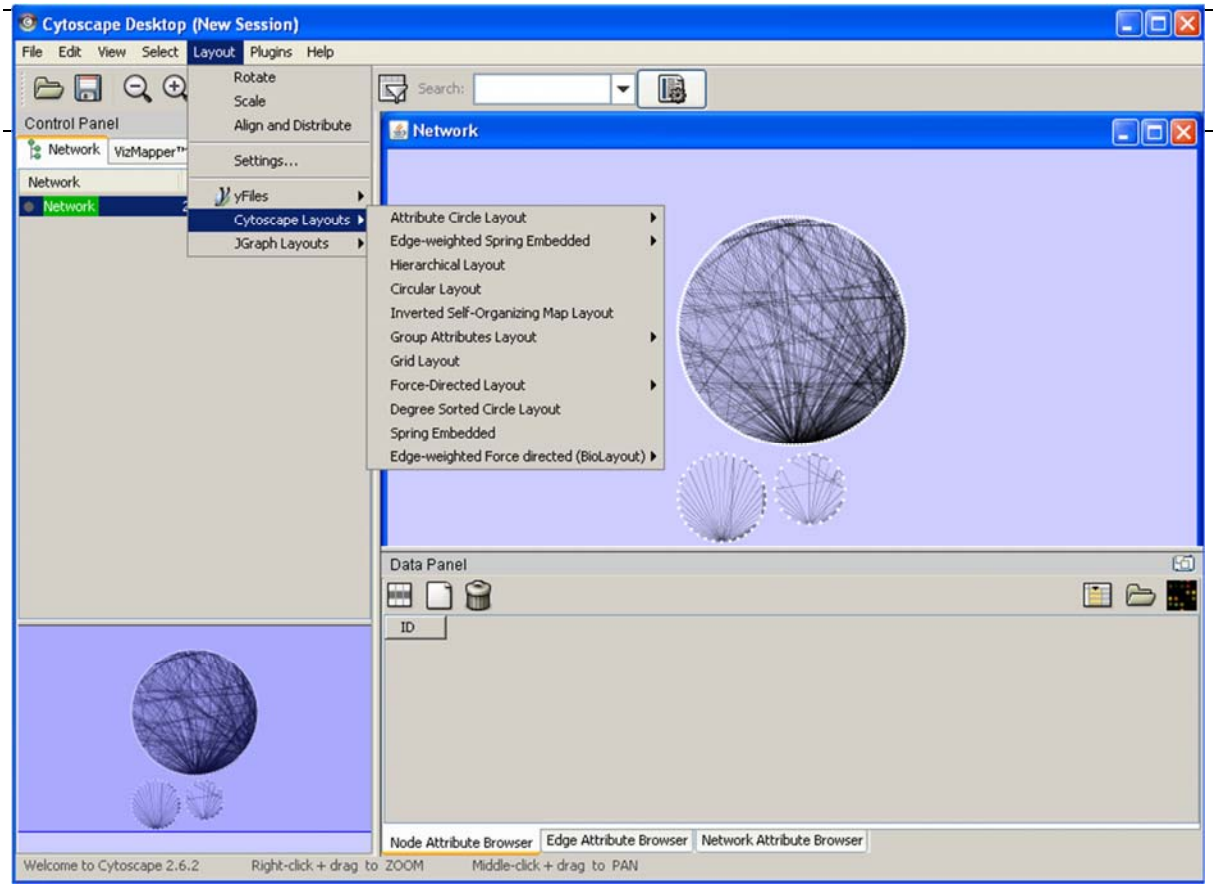
Cytoscape now shows in the Visualization Menu.




Select a network in Data Manager, run Cytoscape and the tool will start with this network loaded.







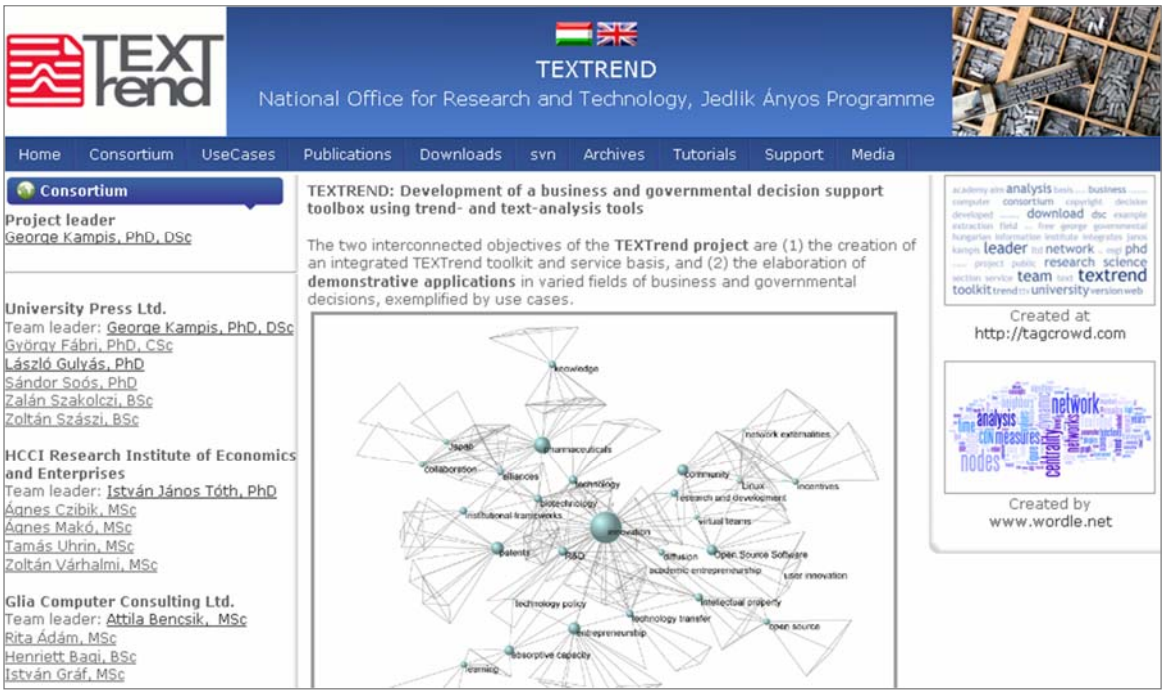

## OSGi/CIShell Adoption

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

*Cytoscape (http://cytoscape.org)* Led by Trey Ideker at the University of California, San Diegois 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).

- *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.
- *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.
- *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.

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.

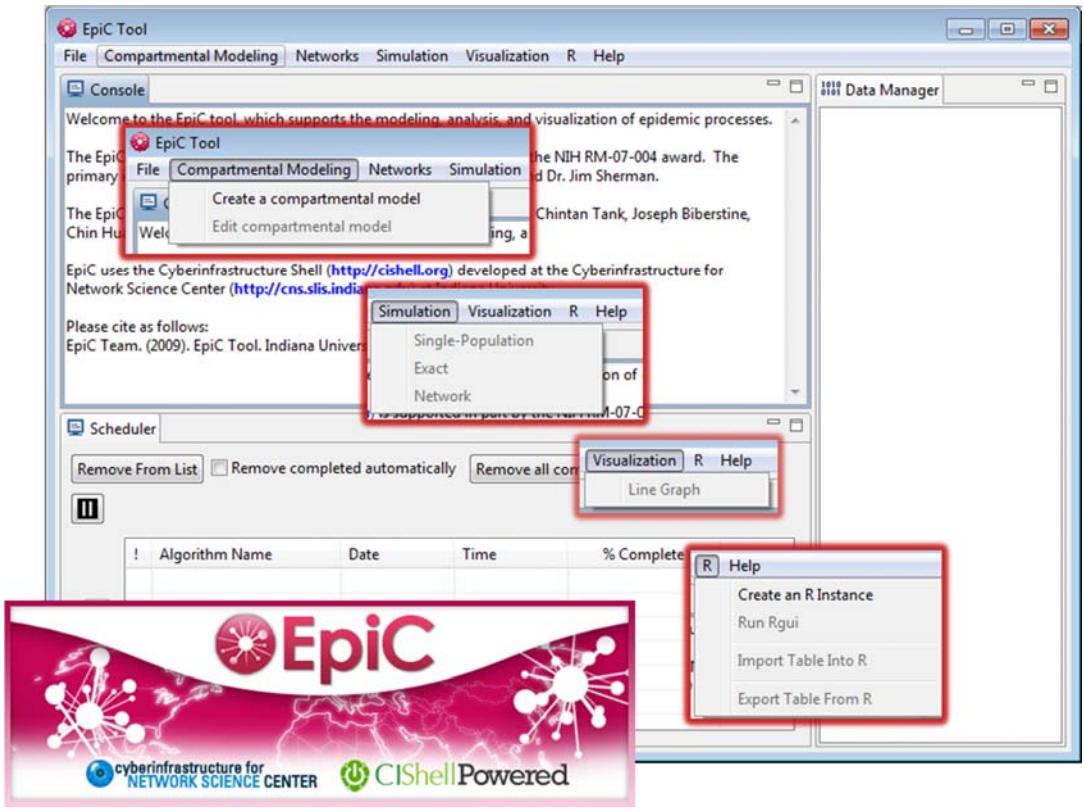


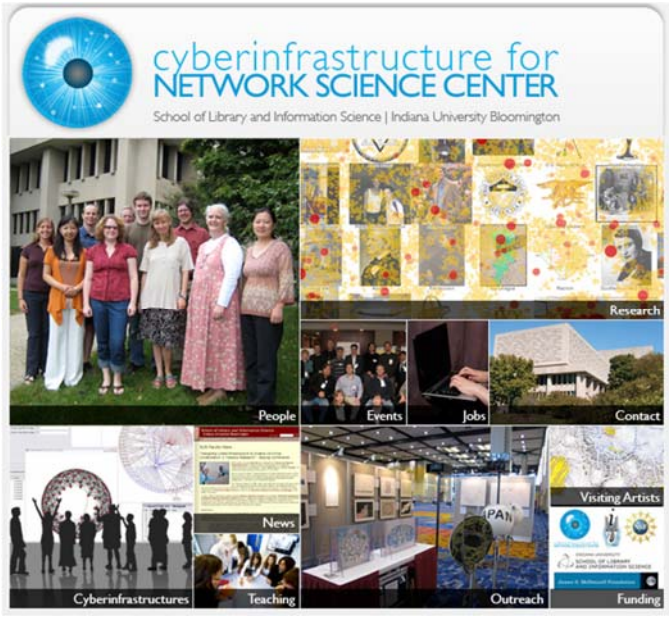

TEXTrend adds R bridge, WEKA, Wordij, CFinder, and more.

See the latest versions of TEXTrend Toolkit modules at

*http://textrend.org/index.php?option=com_content&view=article&id=47&Itemid=53*








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

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