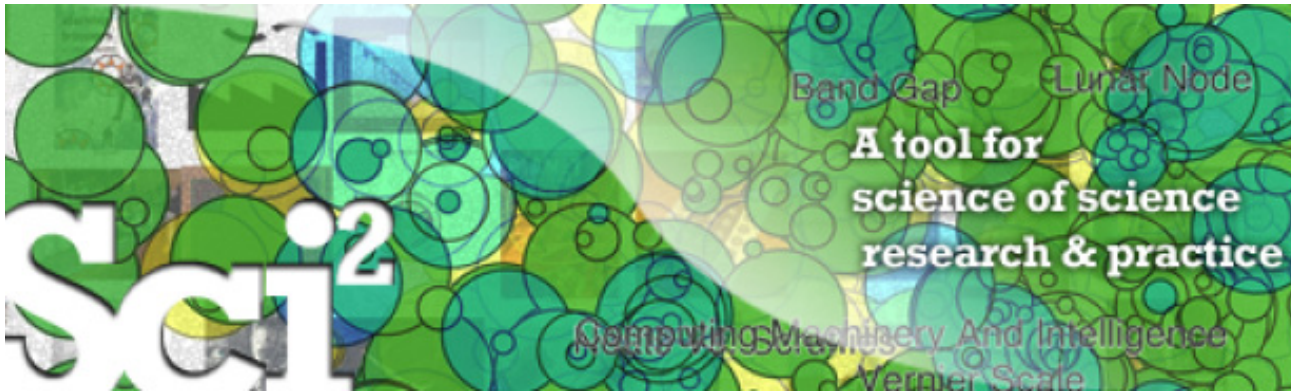


Visualizing Networks with the Science of Science (Sci2) Tool



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School of Library and Information Science
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<http://cns.iu.edu>

Presentation Overview

Introduction to Sci2

- Introduction
- Macroscopes
- OSGi & Cyberinfrastructure Shell
- Types and levels of analysis
- File formats supported by Sci2
- User Interface
- Supported tools
- Visualizations
- Sci2 Adoption
- Break

Hands-on with Sci2

- Installing Sci2
- Needs Driven Workflow Design
- Introduction to Networks
- Visualizing the Florentine Dataset
- Evolving Co-Authorship Networks
- Word Co-Occurrence Network
- Congressional Money Trail
- Discussion/Questions

Introduction to Sci2

The Science of Science (Sci2) Tool is an open-source modular toolset originally designed for the study of science. However it has many uses that support temporal, geospatial, topical, and network analysis and visualization of scholarly datasets.

Macrosopes

Decision making in science, industry, and politics, as well as in daily life, requires that we make sense of the massive amounts of data that result from complex systems.

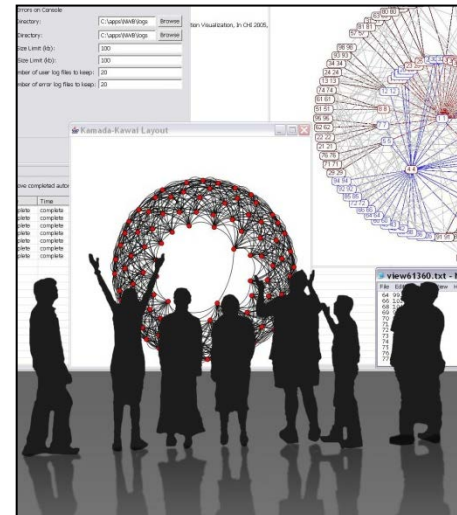
Rather than making things larger or smaller, **macrosopes let us observe what is too great, slow, or complex for us to comprehend or sometimes even notice.**



Microscopes



Telescopes



Macrosopes

Plug-and-Play Macrosopes

While microscopes and telescopes are physical instruments, macrosopes are **continuously changing bundles of software plugins**

Macrosopes make it easy to

- Simply drop plugins into the tool and they appear in the menu, ready to use
- Sharing algorithm components, tools, or novel interfaces becomes as easy as sharing images on Flickr or videos on YouTube



OSGi & Cyberinfrastructure Shell (CShell)

- CShell (<http://cishell.org>) is an open source software specification for the integration and utilization of datasets, algorithms, and tools
- It extends the Open Services Gateway Initiative (OSGi) (<http://osgi.org>), a standardized, modularized service platform
- CShell provides “sockets” into which algorithms, tools, and datasets can be plugged using a wizard-driven process



OSGi & Cyberinfrastructure Shell (CShell)

Developers



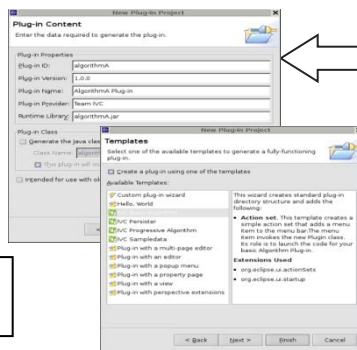
Users



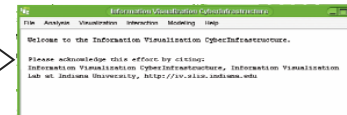
CShell



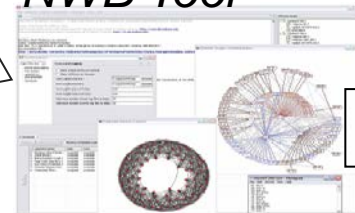
CShell Wizards



Sci2 Tool



NWB Tool



Workflow

Workflow

Workflow

Workflow

Alg

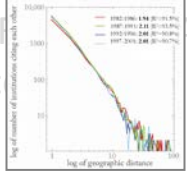
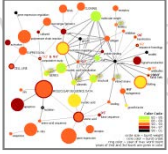
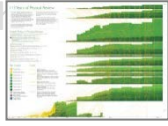



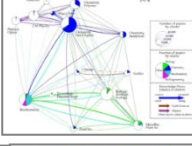
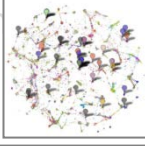

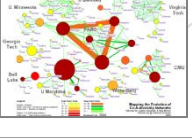
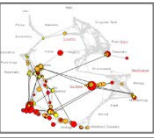
Alg

Alg

Tool

Tool

Type of Analysis vs. Level of Analysis

	<i>Micro/Individual (1-100 records)</i>	<i>Meso/Local (101–10,000 records)</i>	<i>Macro/Global (10,000 < records)</i>
Statistical Analysis/Profiling	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NSF, all of science 
Temporal Analysis (When)	Funding portfolio of one individual	Topic bursts 	113 Years of PNAS Research 
Geospatial Analysis (Where)	Career trajectory of one individual	Mapping a state intellectual landscape 	PNAS 
Topical Analysis (What)		flows in research 	VxOrd/Topic m NIH funding 
Network Analysis (With Whom?)	NSF C...ork of one in 	netw 	NIH's core c...cy 

Sci2 Tool – Supported Data Formats

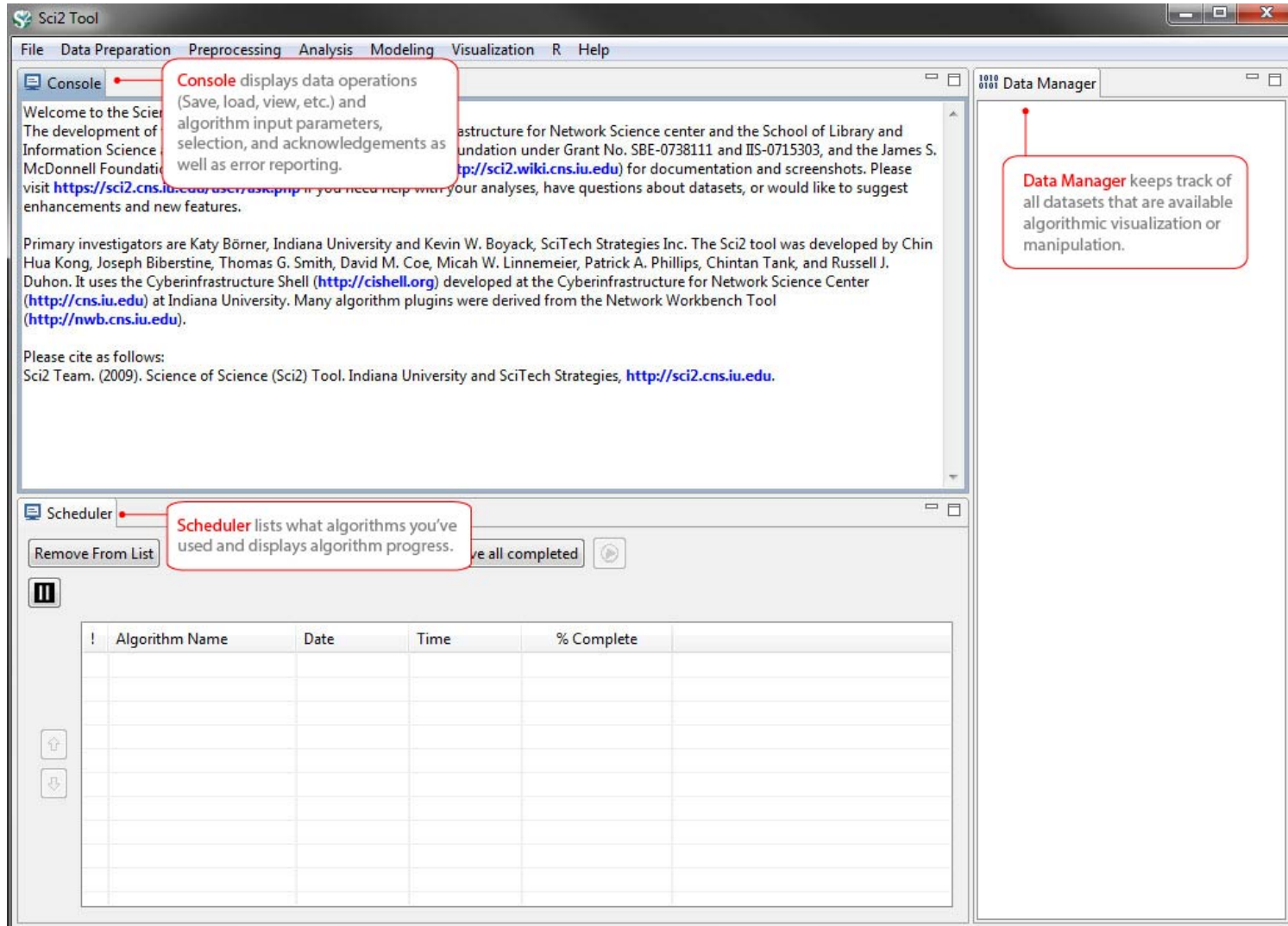
Input:

- Network Formats
- GraphML (*.xml or *.graphml)
- XGMML (*.xml)
- Pajek .NET (*.net)
- NWB (*.nwb)
- Scientometric Formats
- ISI (*.isi)
- Bibtex (*.bib)
- Endnote Export Format (*.enw)
- Scopus csv (*.scopus)
- NSF csv (*.nsf)
- Other Formats
- Pajek Matrix (*.mat)
- TreeML (*.xml)
- Edgelist (*.edge)
- CSV (*.csv)

Output:

- Network File Formats
- GraphML (*.xml or *.graphml)
- Pajek .MAT (*.mat)
- Pajek .NET (*.net)
- NWB (*.nwb)
- XGMML (*.xml)
- CSV (*.csv)
- JPEG (*.jpg)
- PDF (*.pdf)
- PostScript (*.ps)

User Interface

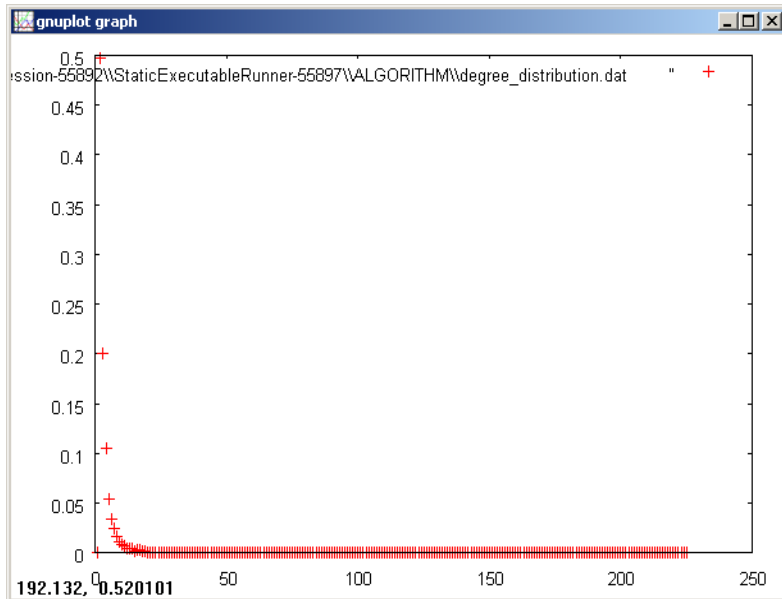


The screenshot shows the Sci2 Tool application window with the following components and callouts:

- Console:** A text area displaying a welcome message and instructions. A callout box states: "Console displays data operations (Save, load, view, etc.) and algorithm input parameters, selection, and acknowledgements as well as error reporting."
- Scheduler:** A panel for managing algorithm execution. It includes a "Remove From List" button, a "Have all completed" button, and a table with the following columns: "Algorithm Name", "Date", "Time", and "% Complete". A callout box states: "Scheduler lists what algorithms you've used and displays algorithm progress."
- Data Manager:** A panel on the right side of the interface. A callout box states: "Data Manager keeps track of all datasets that are available algorithmic visualization or manipulation."

The main window title is "Sci2 Tool" and the menu bar includes "File", "Data Preparation", "Preprocessing", "Analysis", "Modeling", "Visualization", "R", and "Help".

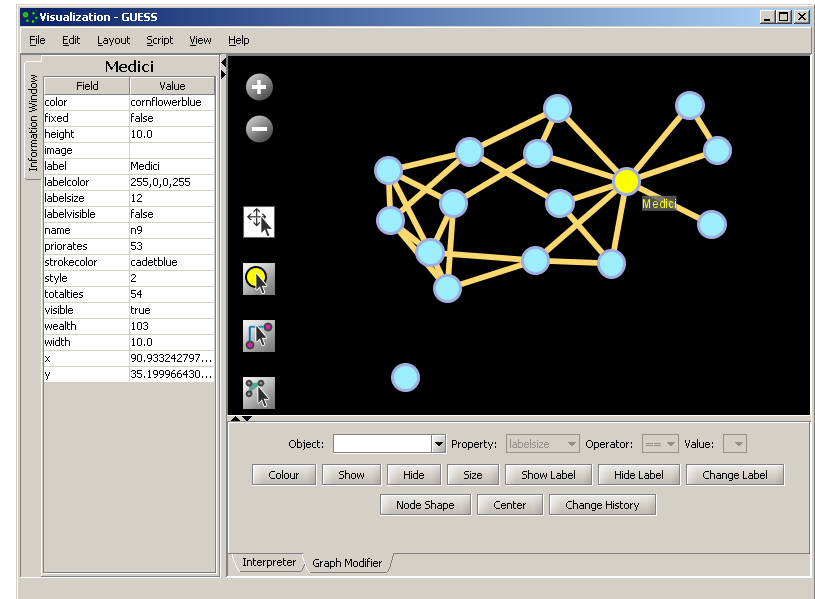
Supported Tools



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>.

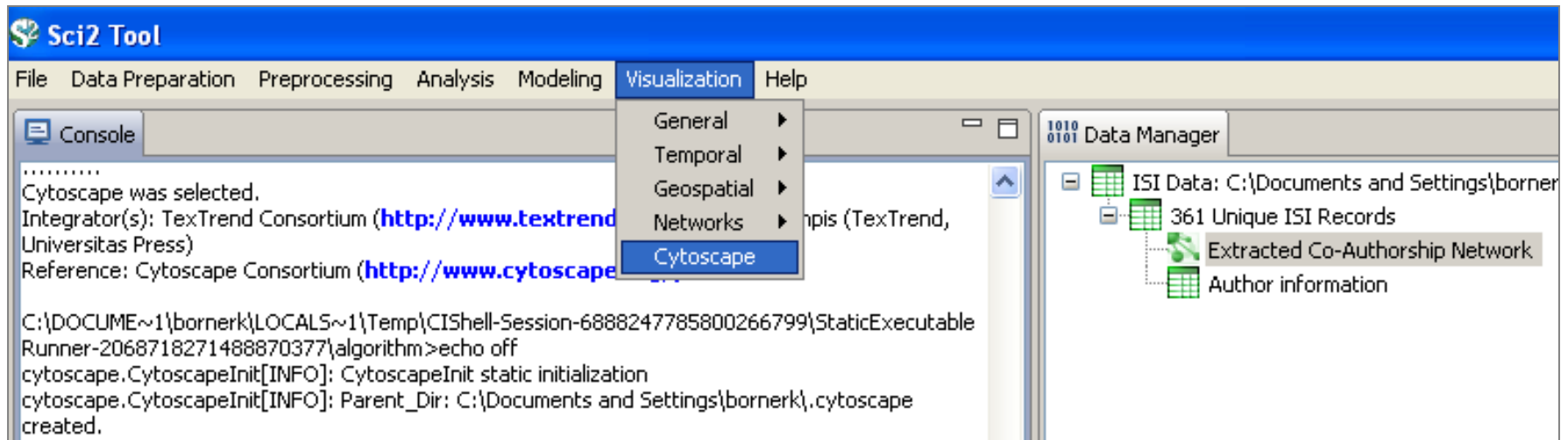
Supported Tools

Adding more layout 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

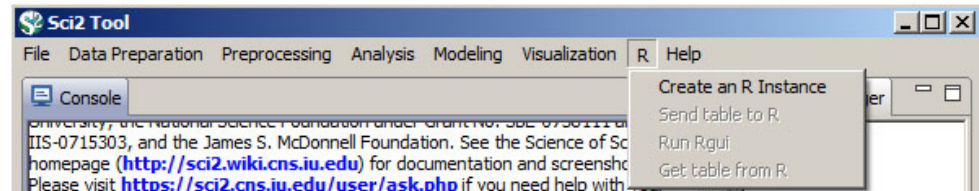
Cytoscape now shows in the Visualization Menu



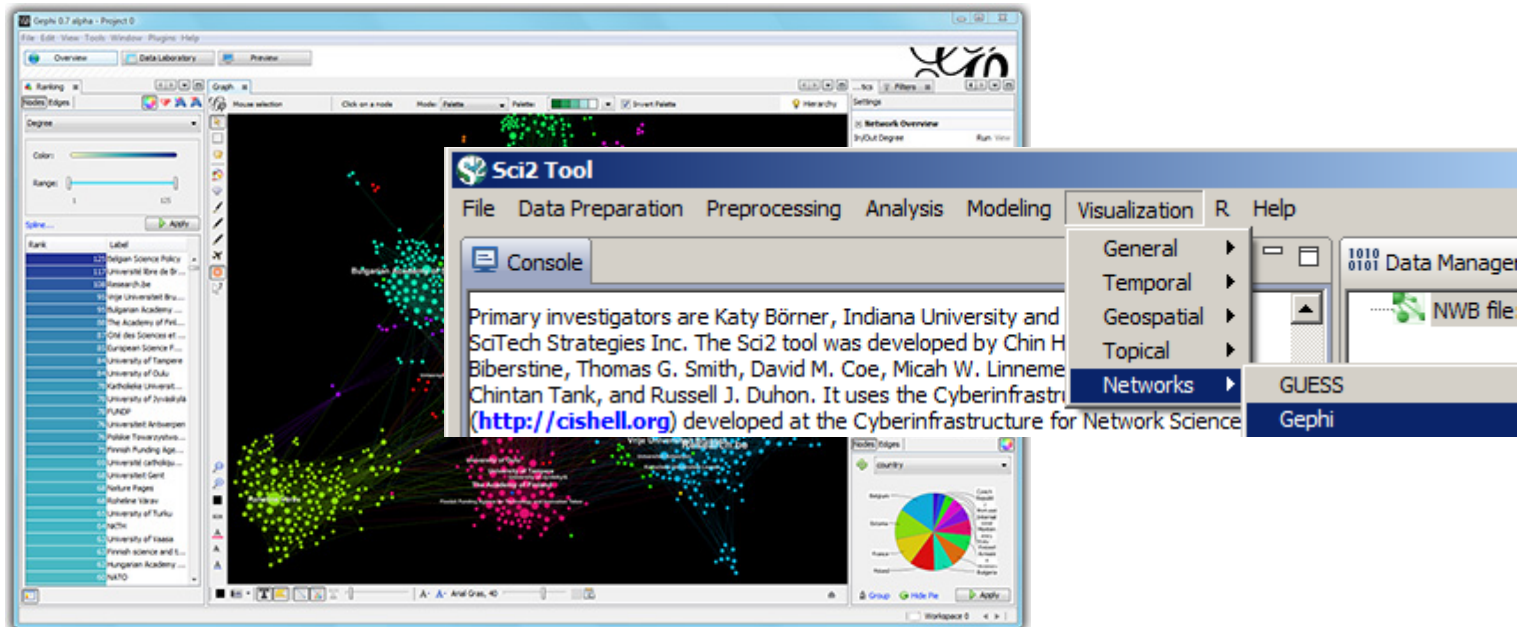
Select a network in Data Manager, run Cytoscape and the tool will start with this network loaded.

Bridged Tools

R statistical tool

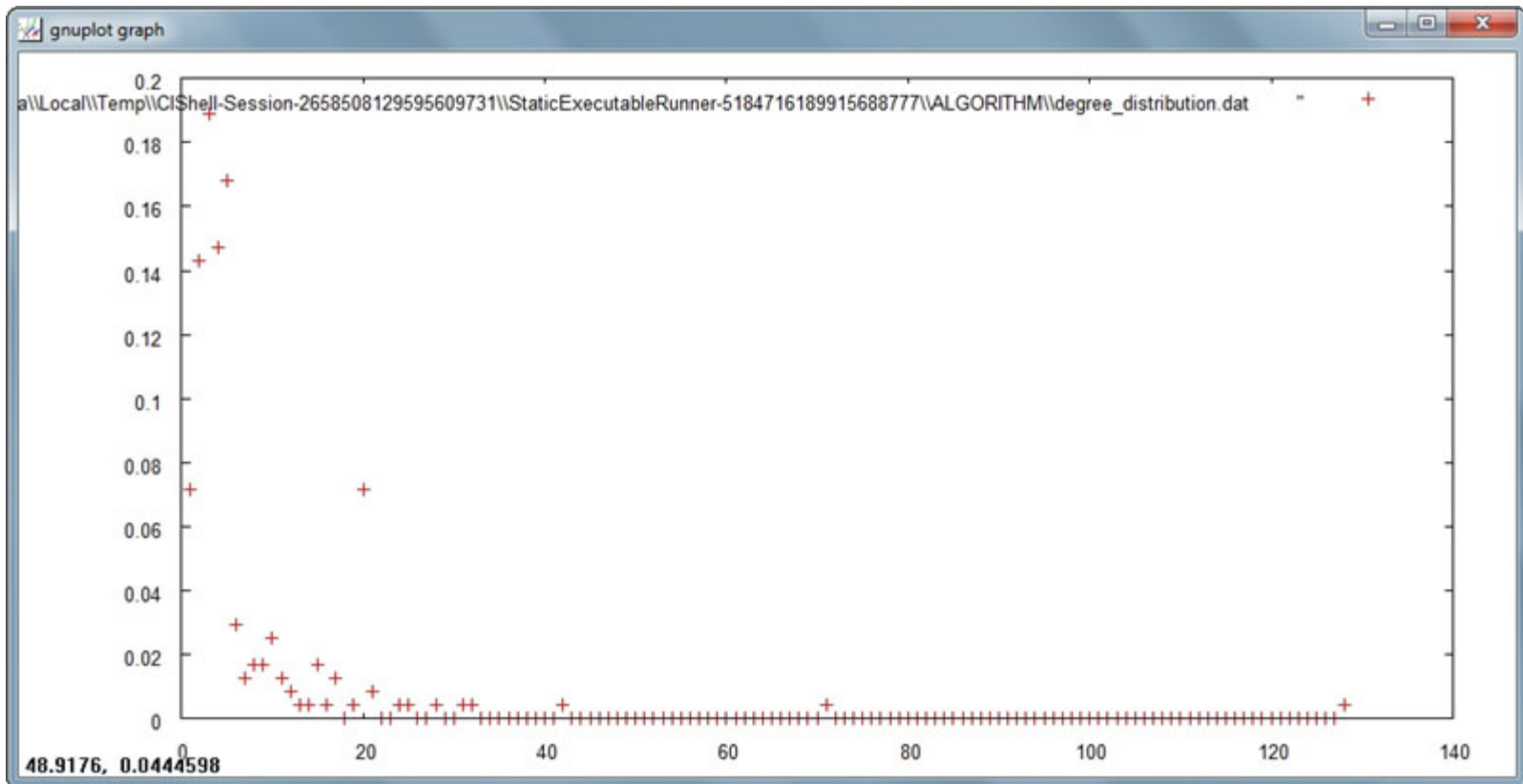


Gephi visualization tool



Sci2 Visualizations: *General*

Use GnuPlot to visualize the degree distribution of a co-authorship network extracted from ISI data...

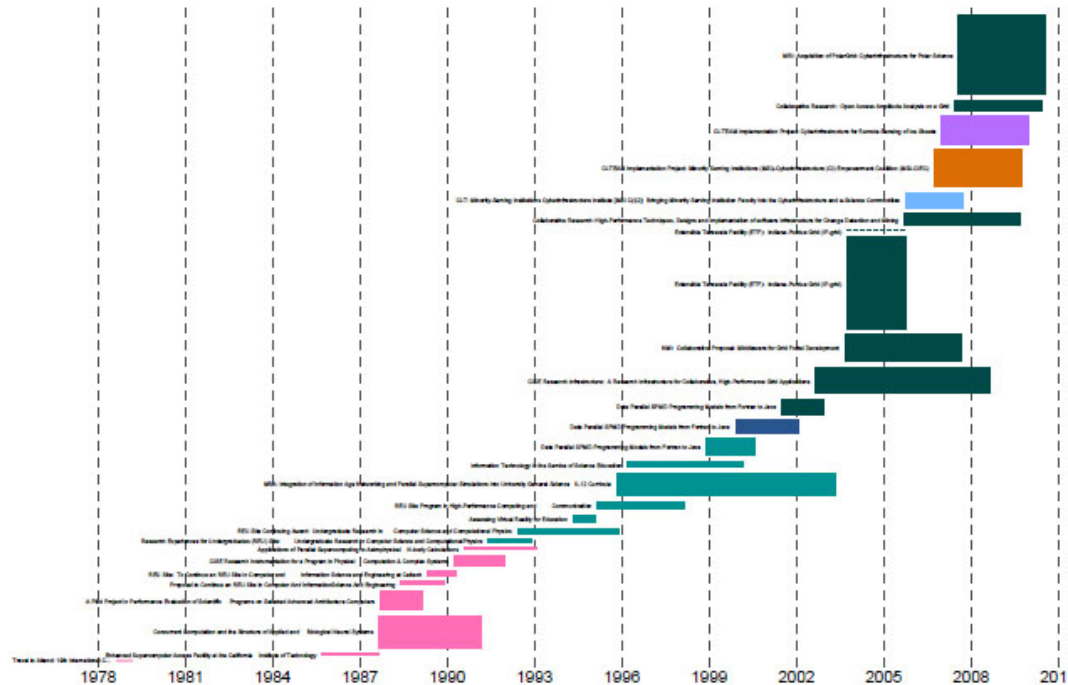


Sci2 Tool Visualizations: *Temporal*

Use Temporal Bar Graph to visualize NSF funding profiles over time...

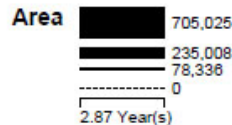
Temporal Visualization

Generated from NSF csv file: C:\Users\dapolley\Desktop\sci2-N-1.0.0.201206150117NGT-win32.win32.x86\sci2sampledatascientometrics\sfGeoffreyFox.nsf
June 15, 2012 | 10:16 AM EDT



Legend

Area size: Awarded Amount to Date
Minimum = 0
Maximum = 1,964,049
Text label: Title
Color: Organization
See end of PDF for color legend.



How To Read This Map

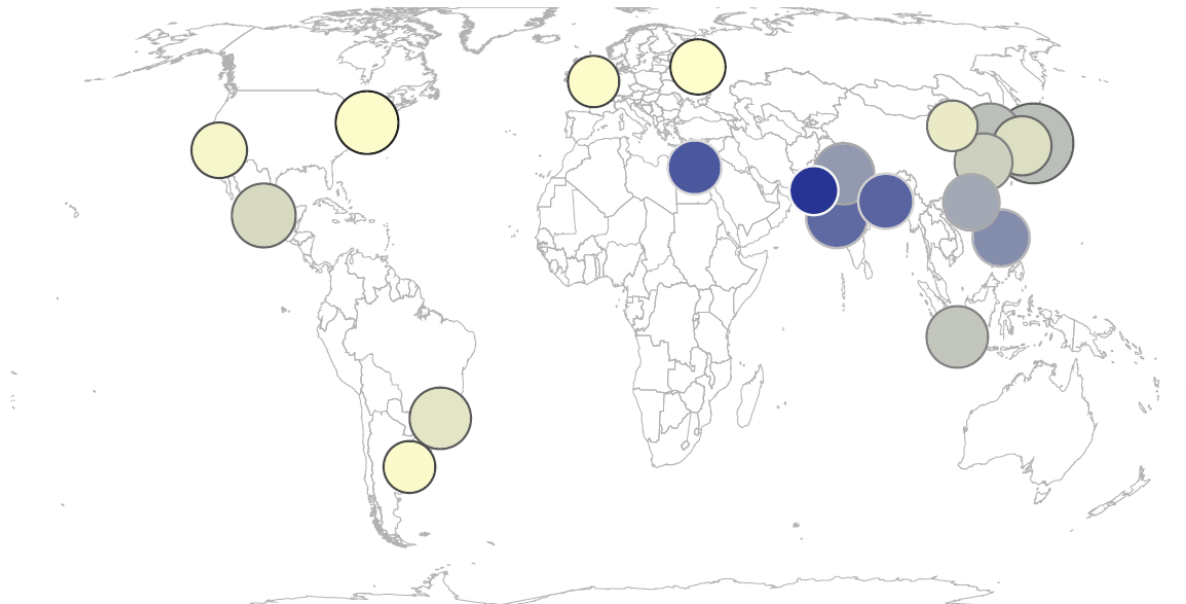
This *temporal bar graph* visualization represents each record as a horizontal bar with a specific start and end date and a text label on its left side. The area of each bar encodes a numerical attribute value, e.g., total amount of funding. Bars may be colored to present categorical attribute values of records.

Sci2 Tool Visualizations: *Geospatial*

Use the Proportional Symbol Map to size and color symbols proportionally to numeric data, in this case the 20 most populated cities around the world...

Geospatial Visualization (Proportional Symbol Map)

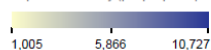
Generated from 20 most populous cities
May 02, 2012 | 06:13:38 PM EDT



Legend

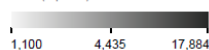
Interior Color (Linear)

Population density (people per sq. km.)



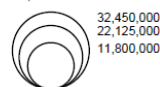
Exterior Color (Logarithmic)

Area (sq. km.)



Area (Linear)

Population



How to Read this Map

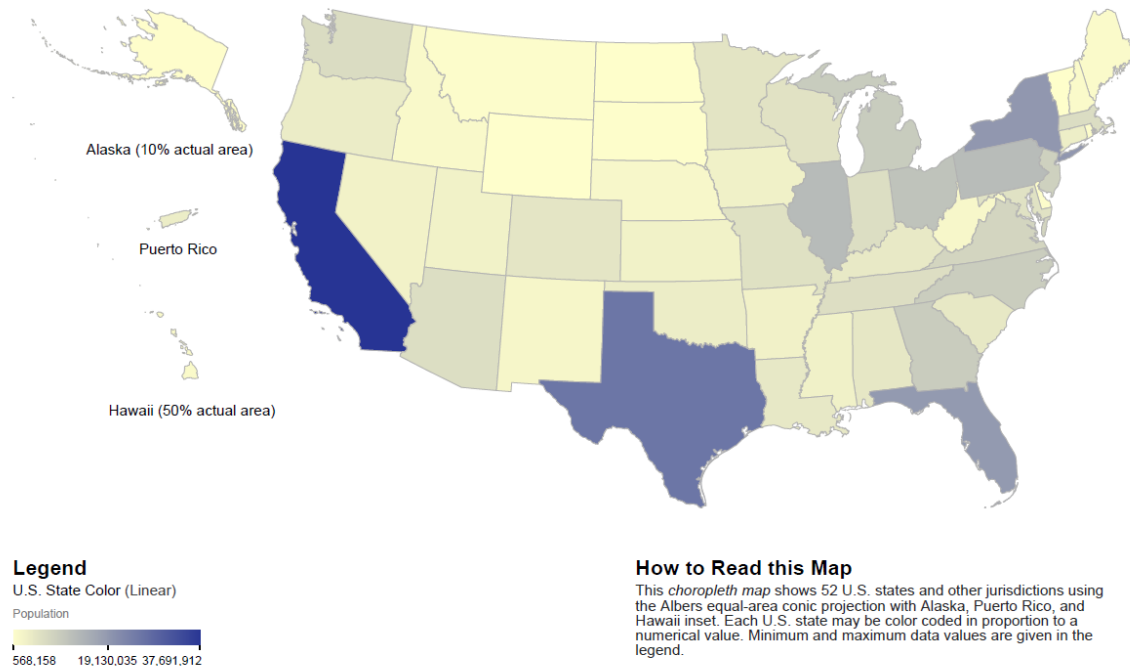
This *proportional symbol map* shows 209 countries of the world using the equal-area Eckert IV projection. Each dataset record is represented by a circle centered at its geolocation. The area, interior color, and exterior color of each circle may represent numeric attribute values. Minimum and maximum data values are given in the legend.

Sci2 Tool Visualizations: *Geospatial*

Use the Choropleth Map to color regions proportionally to numeric data, in this case the US by state population...

Geospatial Visualization (Choropleth Map)

Generated from U.S. state populations
May 02, 2012 | 06:13:42 PM EDT



Sci2 Tool Visualizations: *Geospatial*

Overlay a geospatial network on a base map, in this case Albert-László Barabási and his collaborators...



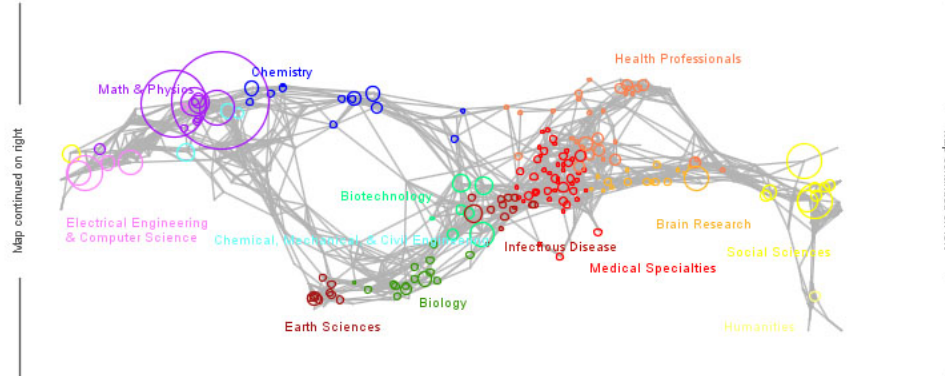
Geo Map ()
Eckert IV Projection
Apr 19, 2012 | 11:14:48 AM

Sci2 Tool Visualizations: *Topical*

Use the Map of Science via Journals visualization a network drawn the result of mapping a dataset's journals to the underlying sub-discipline(s) those journals contain...

Topical Visualization

Generated from 361 Unique ISI Records
 90 out of 112 records were mapped to 182 subdisciplines and 13 disciplines.
 September 20, 2012 | 11:29 AM EDT



© 2008 The Regents of the University of California and SciTech Strategies.
 Map updated by SciTech Strategies, OST, and CNS in 2011.

Legend

Circle area: Fractional record count
 Unclassified = 22
 Minimum = 0
 Maximum = 98
 Scaling factor = 0.5076673
 Color: Discipline
 See end of PDF for color legend.

Area



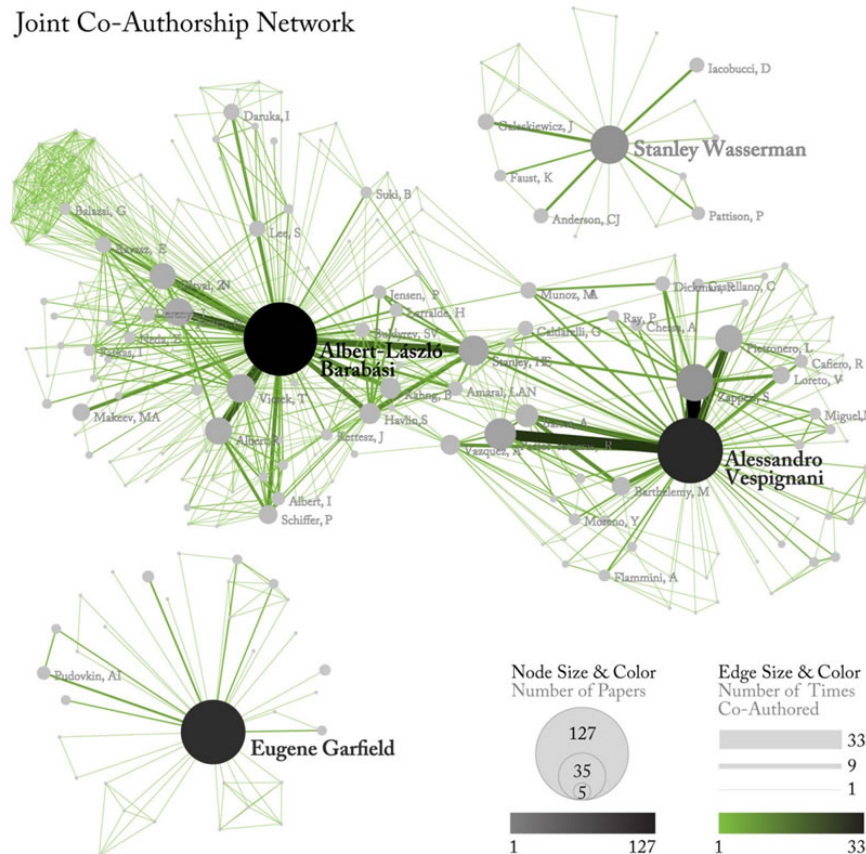
How To Read This Map

The UCSD map of science depicts a network of 554 subdiscipline nodes that are aggregated to 13 main disciplines of science. Each discipline has a distinct color and is labeled. Overlaid are circles, each representing all records per unique subdiscipline. Circle area is proportional to the number of fractionally assigned records. Minimum and maximum data values are given in the legend.

Sci2 Tool Visualizations: *Networks*

Use GUESS to visualize networks, such as this co-authorship network extracted from ISI data...

Joint Co-Authorship Network



Sci2 Tool Visualizations: *Networks*

Use Circular Hierarchy to visualize networks with community attributes appended...

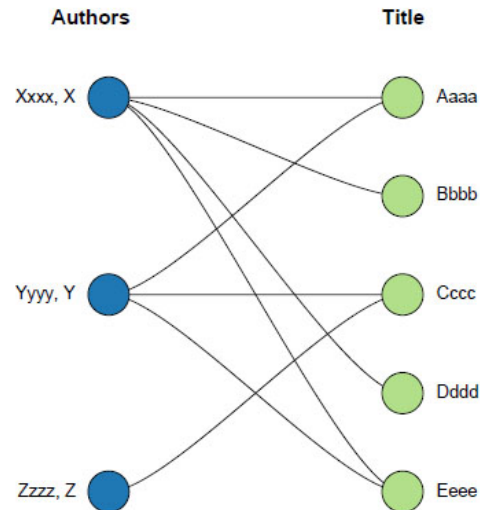


Sci2 Tool Visualizations: *Networks*

Use the Bipartite Network visualization to create a network of authors and publication titles...

Network Visualization

Generated from Bipartite network from Authors and Title.2
September 20, 2012 | 11:04 AM EDT



Legend

Sorted by
Left side:
Alphabetical
Right side:
Alphabetical

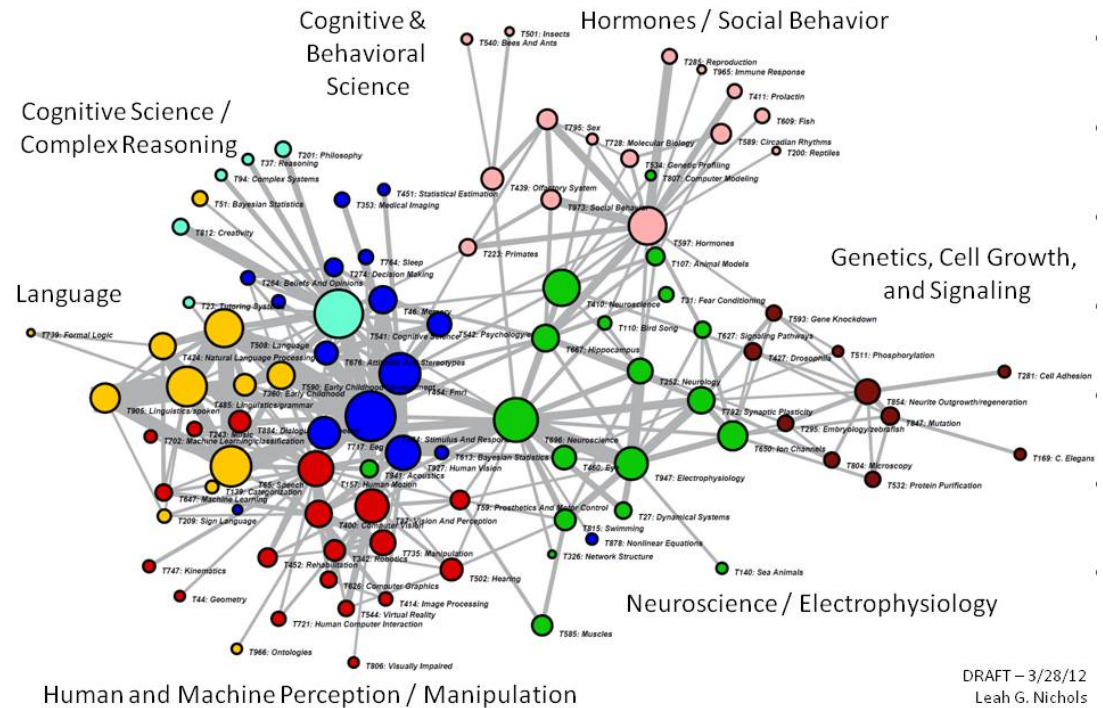
How To Read This Map

This *bipartite network* shows two record types and their interconnections. Each record is represented by a labeled circle that is size coded by a numerical attribute value. Records of each type are vertically aligned and sorted, e.g., by node size or alphabetically. Links between records of different type may be weighted as represented by line thickness.

Topic co-occurrence network of the 2885 cognitive and neuroscience NSF projects funded between 2007 and 2011.

The nodes are labeled based on how the awards were tagged. The nodes are scaled by number of awards (max = 355) with a particular tag and the edges are scaled by number of co-occurrences (max = 91) of those tags. The node colors differentiate the different communities of awards, which allows you to identify topic areas.

Cognitive and Neuroscience at the NSF: 2007-2011



This is ... an **entirely new way of characterizing and understanding the NSF portfolio**. This is in part because this enables **analysis of the content of the awards/proposals independent of the institutional structure**. One can quickly identify ALL of the Cog/Neuro awards throughout the entire NSF portfolio – so it captures research in all of the unexpected institutional places. This method also allows one to **easily identify areas of parallel or potentially collaborative research being funded by different institutional structures** and ... to identify potential areas for advancing science by facilitating collaborations.

Leah G. Nichols, NSF

Questions?

Please copy the version of Sci2 and Gephi that you need from the flash drive:

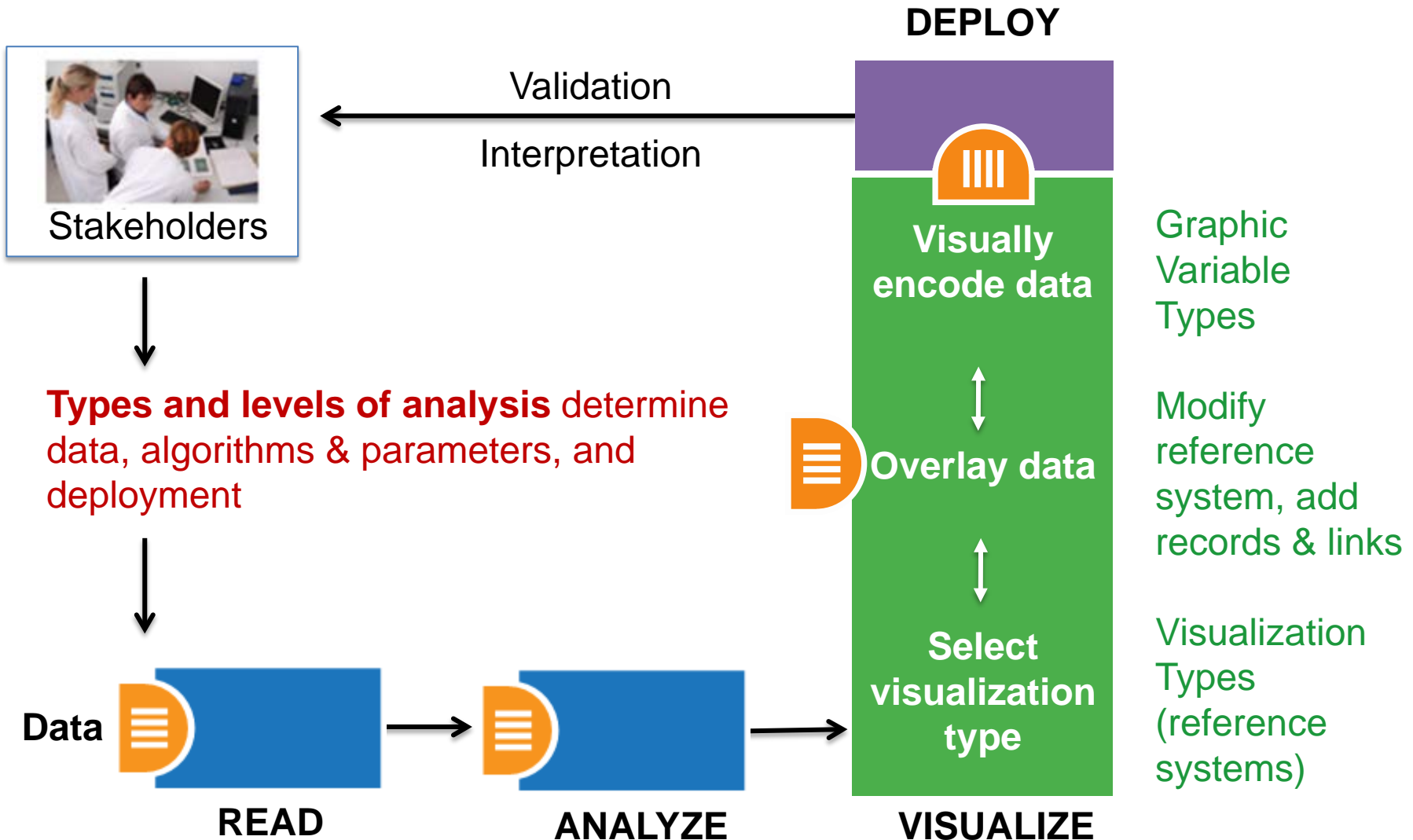
Sample Data	6/26/2013 6:27 PM	File folder		
gephi-0.8.2-beta.dmg	6/19/2013 9:16 AM	DMG File	41,001 KB	← Linux Users
gephi-0.8.2-beta.setup.exe	6/19/2013 9:15 AM	Application	36,273 KB	← Windows Users
gephi-0.8.2-beta.tar.gz	6/19/2013 9:16 AM	GZ File	40,063 KB	
sci2-N-1.0.0.201206130117NGT-linux.gtk....	6/19/2013 1:12 PM	Compressed (zipp...	128,231 KB	← Mac Users
sci2-N-1.0.0.201206130117NGT-macosx.c...	6/19/2013 1:12 PM	Compressed (zipp...	131,160 KB	
sci2-N-1.0.0.201206130117NGT-win32.wi...	6/19/2013 1:12 PM	Compressed (zipp...	131,373 KB	

Please unzip the Sci2 folder to your desktop. You do not need to install anything in your program files directory. Sci2 will run fine from the desktop.

Please go through the Gephi installation process.

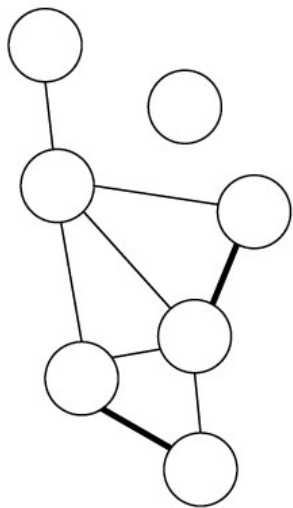
Make sure to copy over the sample data folder and save it to your desktop.

Needs-Driven Workflow Design



Introduction to Networks

Undirected Networks



Nodes:



Edges:



Node Degree:

Number of edges
connected to nodes

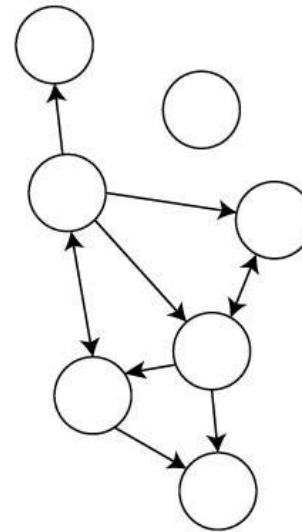
Isolates:

Nodes that are not connected
to the rest of the network

Edge Weight:

Demonstrates relative importance
of relationships

Directed Networks



Edge Direction:

Directional relationship is
represented by arrows

In-Degree:

Number of incoming edges

Out-Degree:

Number of outgoing
edges

Visualizing the Florentine Dataset

This example will demonstrate how to visualize data using Sci2. In this workflow we will be working with Padgett's Florentine families dataset which includes 16 different Italian families from the early 15th century. Each family is represented by a node in the network and families are connected by edges that represent either a marriage or business/lending ties. Each node (family) has several attributes: wealth (in thousands of lira), number of priorates (seats on the civic council between 1282-1344), and total ties (total number of business ties and marriages in the dataset).

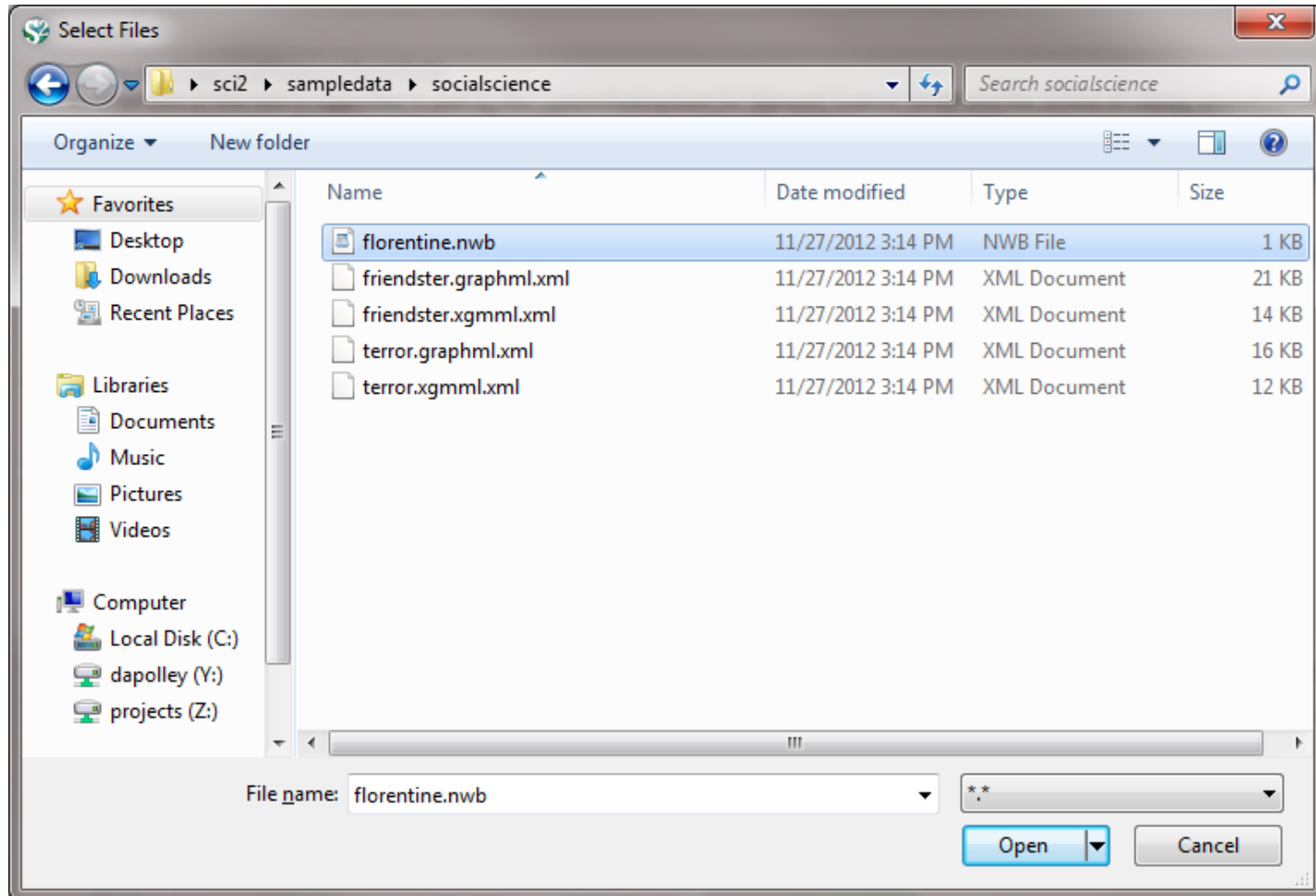
“Substantively, the data include families who were locked in a struggle for political control of the city of Florence around 1430. Two factions were dominant in this struggle: one revolved around the infamous Medici family, the other around the powerful Strozziis.”

More info at <http://svitsrv25.epfl.ch/R-doc/library/ergm/html/florentine.html>

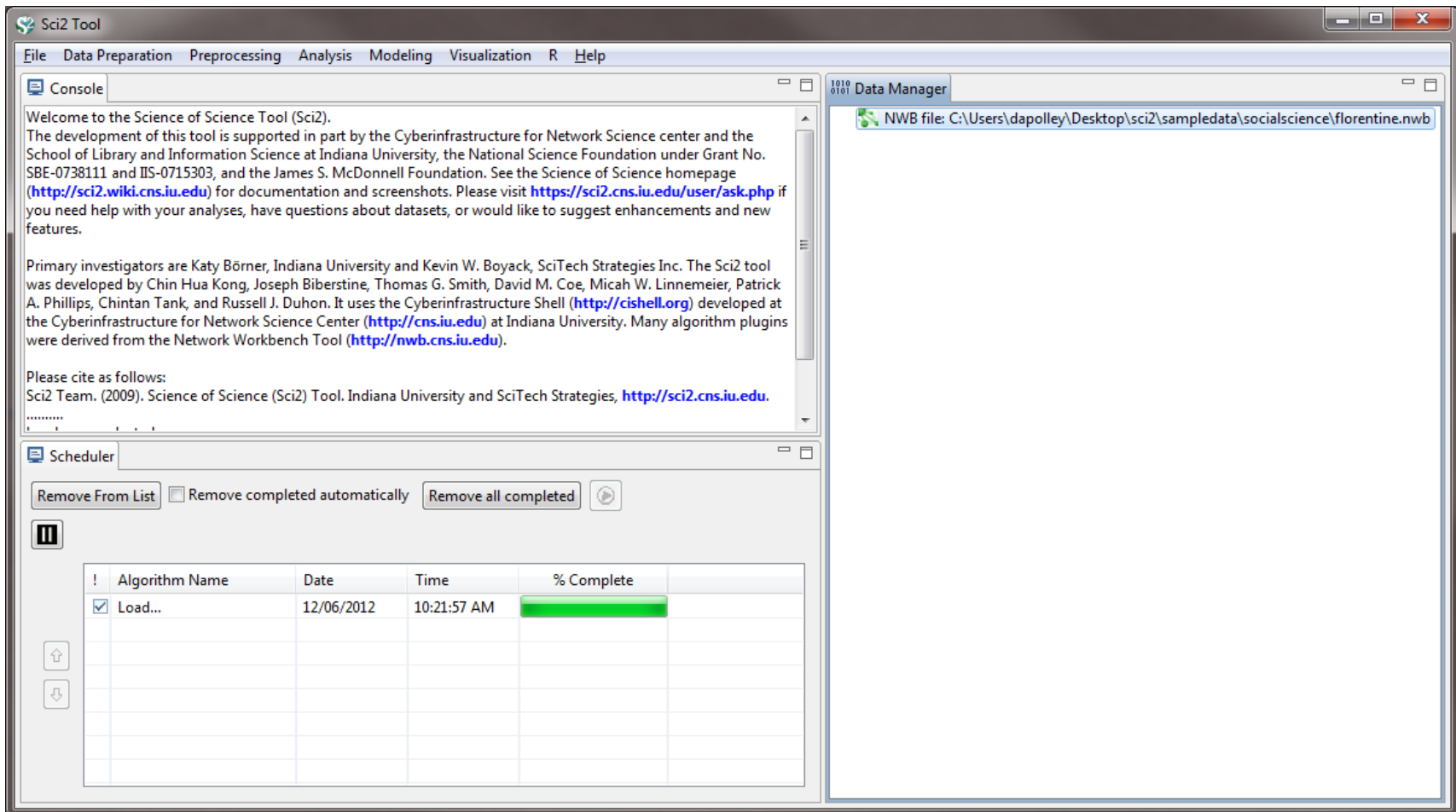
Visualizing the Florentine Dataset

```
*Nodes
id*int label*string wealth*int totalities*int priorates*int
1 "Acciaiuoli" 10 2 53
2 "Albizzi" 36 3 65
3 "Barbadori" 55 14 0
4 "Bischeri" 44 9 12
5 "Castellani" 20 18 22
6 "Ginori" 32 9 0
7 "Guadagni" 8 14 21
8 "Lamberteschi" 42 14 0
9 "Medici" 103 54 53
10 "Pazzi" 48 7 0
11 "Peruzzi" 49 32 42
12 "Pucci" 3 1 0
13 "Ridolfi" 27 4 38
14 "Salviati" 10 5 35
15 "Strozzi" 146 29 74
16 "Tornabuoni" 48 7 0
*UndirectedEdges
source*int target*int marriage*string business*string
9 1 "T" "F"
6 2 "T" "F"
7 2 "T" "F"
9 2 "T" "F"
5 3 "T" "T"
```

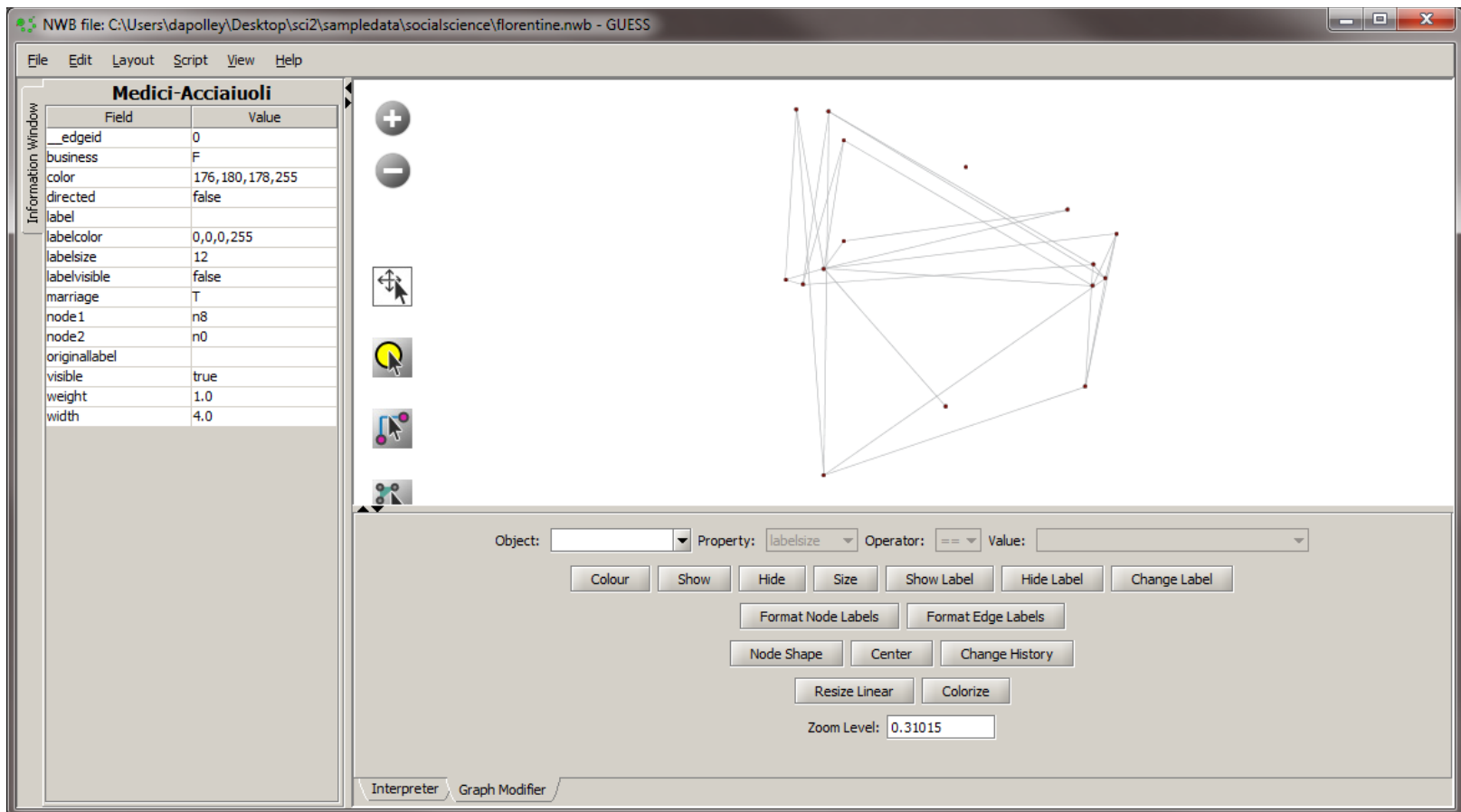
First, load the florentine.nwb by following *File > Load > **yoursci2directory/sampleddata/scientometrics/endnote/florentine.nwb***.



Once you have loaded the data in Sci2, it will appear in the Data Manager.



When the network is loaded in GUESS it will be laid out randomly.



Medici-Acciaiuoli

Field	Value
__edgeid	0
business	F
color	176,180,178,255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
marriage	T
node1	n8
node2	n0
originallabel	
visible	true
weight	1.0
width	4.0

Object: Property: Operator: Value:

Colour Show Hide Size Show Label Hide Label Change Label

Format Node Labels Format Edge Labels

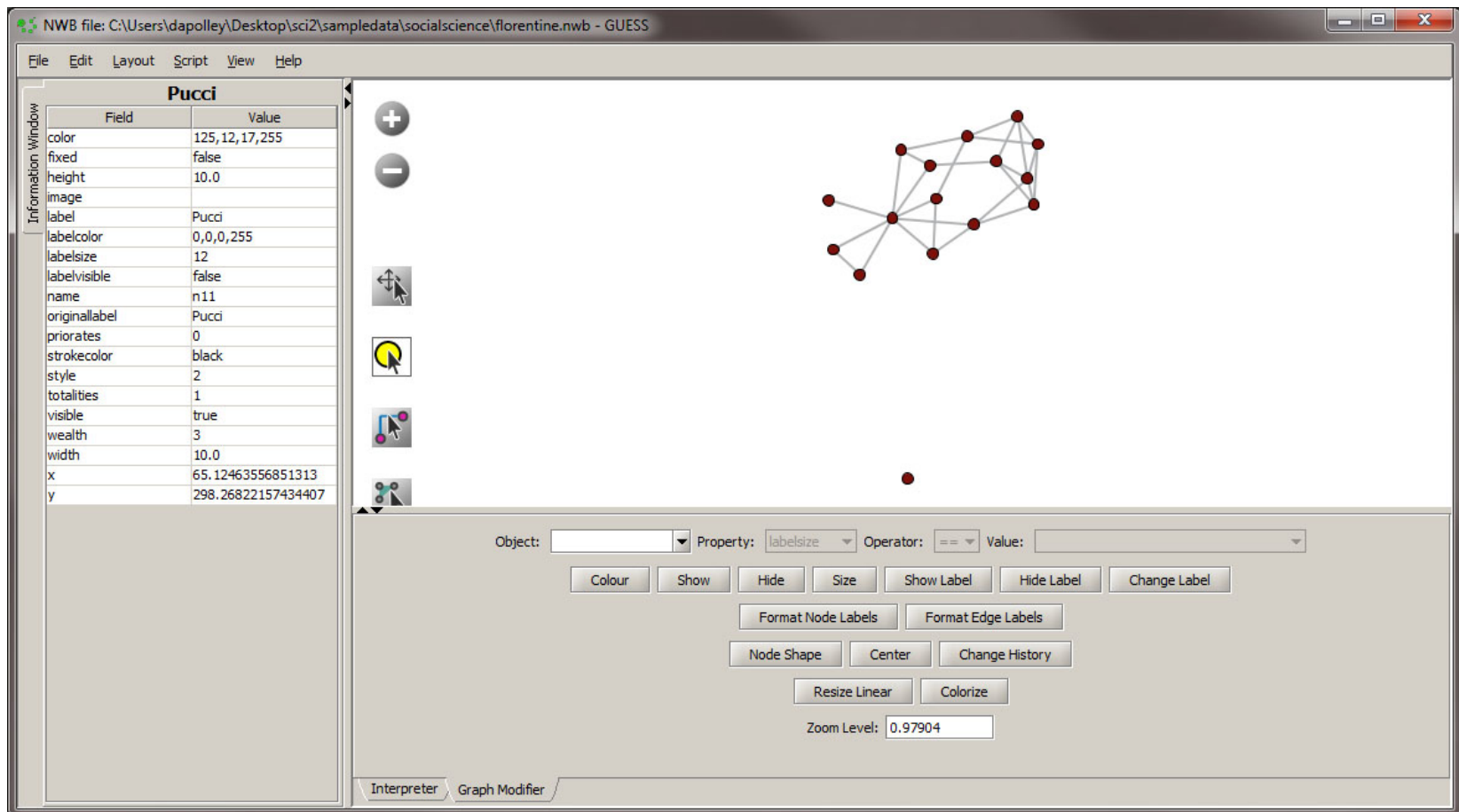
Node Shape Center Change History

Resize Linear Colorize

Zoom Level:

Interpreter Graph Modifier

The first step in enhancing this network visualization is to apply a different layout. For this visualization we will use the GEM layout *Layout > GEM*. You will notice that the GEM layout is random, you can run it multiple times and the network will appear slightly different each time.



Information Window

Field	Value
color	125,12,17,255
fixed	false
height	10.0
image	
label	Pucci
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
name	n11
originallabel	Pucci
priorates	0
strokecolor	black
style	2
totalities	1
visible	true
wealth	3
width	10.0
x	65.12463556851313
y	298.26822157434407

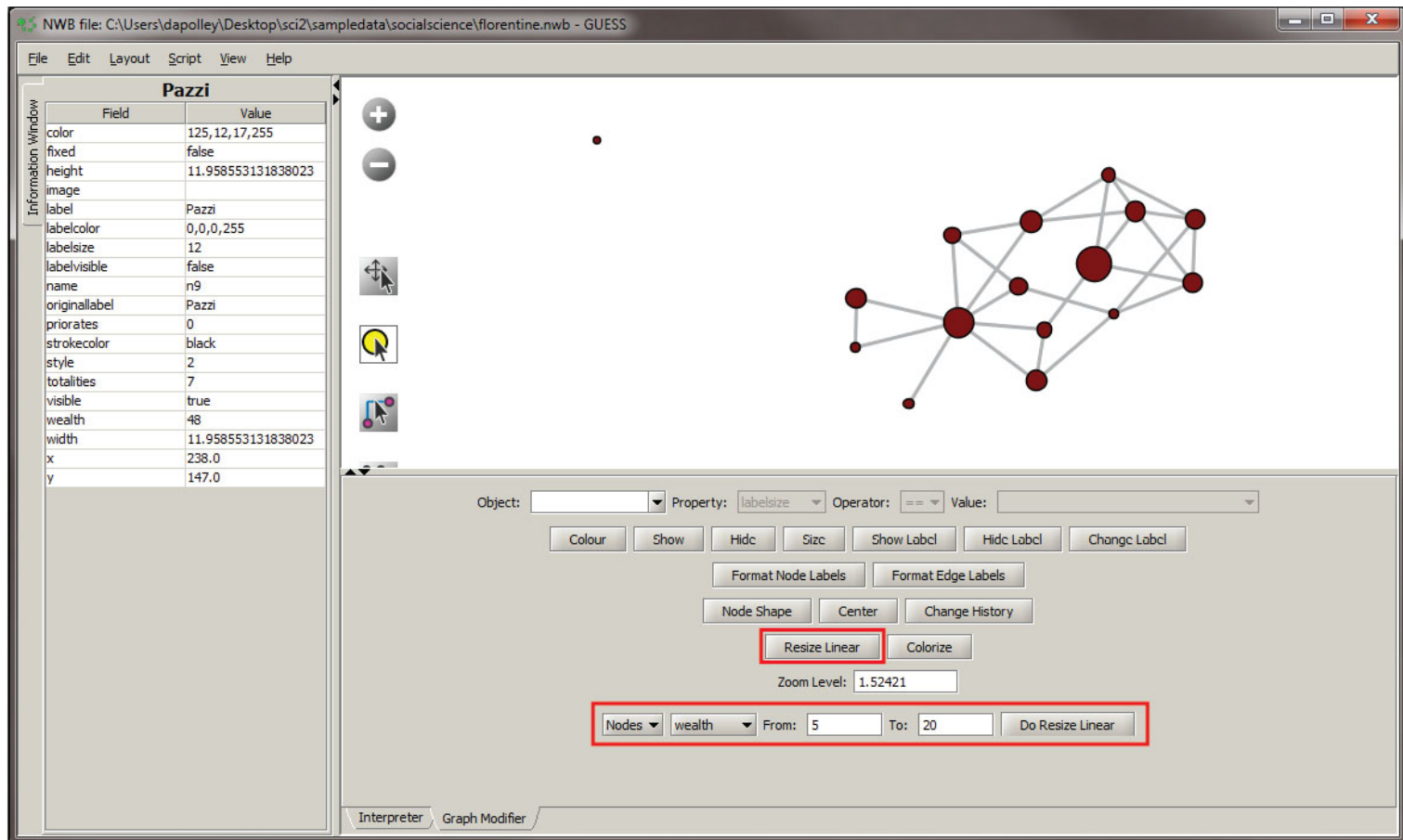
Object: Property: Operator: Value:

Buttons: Colour, Show, Hide, Size, Show Label, Hide Label, Change Label, Format Node Labels, Format Edge Labels, Node Shape, Center, Change History, Resize Linear, Colorize

Zoom Level:

Interpreter | Graph Modifier

The next step will be to resize the nodes based on the wealth attribute. To do this resize select the *Resize Linear* button and set the parameters to those shown below.



The screenshot shows the GUESS software interface. On the left is the 'Information Window' for the 'Pazzi' dataset, displaying a table of node attributes. The main window shows a network graph with nodes of varying sizes. The bottom panel is the configuration interface, where the 'Resize Linear' button is highlighted with a red box. Below it, the 'Nodes' dropdown is set to 'wealth', and the 'From' and 'To' fields are set to 5 and 20, respectively. The 'Do Resize Linear' button is also highlighted with a red box.

Field	Value
color	125,12,17,255
fixed	false
height	11.958553131838023
image	
label	Pazzi
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
name	n9
originallabel	Pazzi
priorates	0
strokecolor	black
style	2
totalties	7
visible	true
wealth	48
width	11.958553131838023
x	238.0
y	147.0

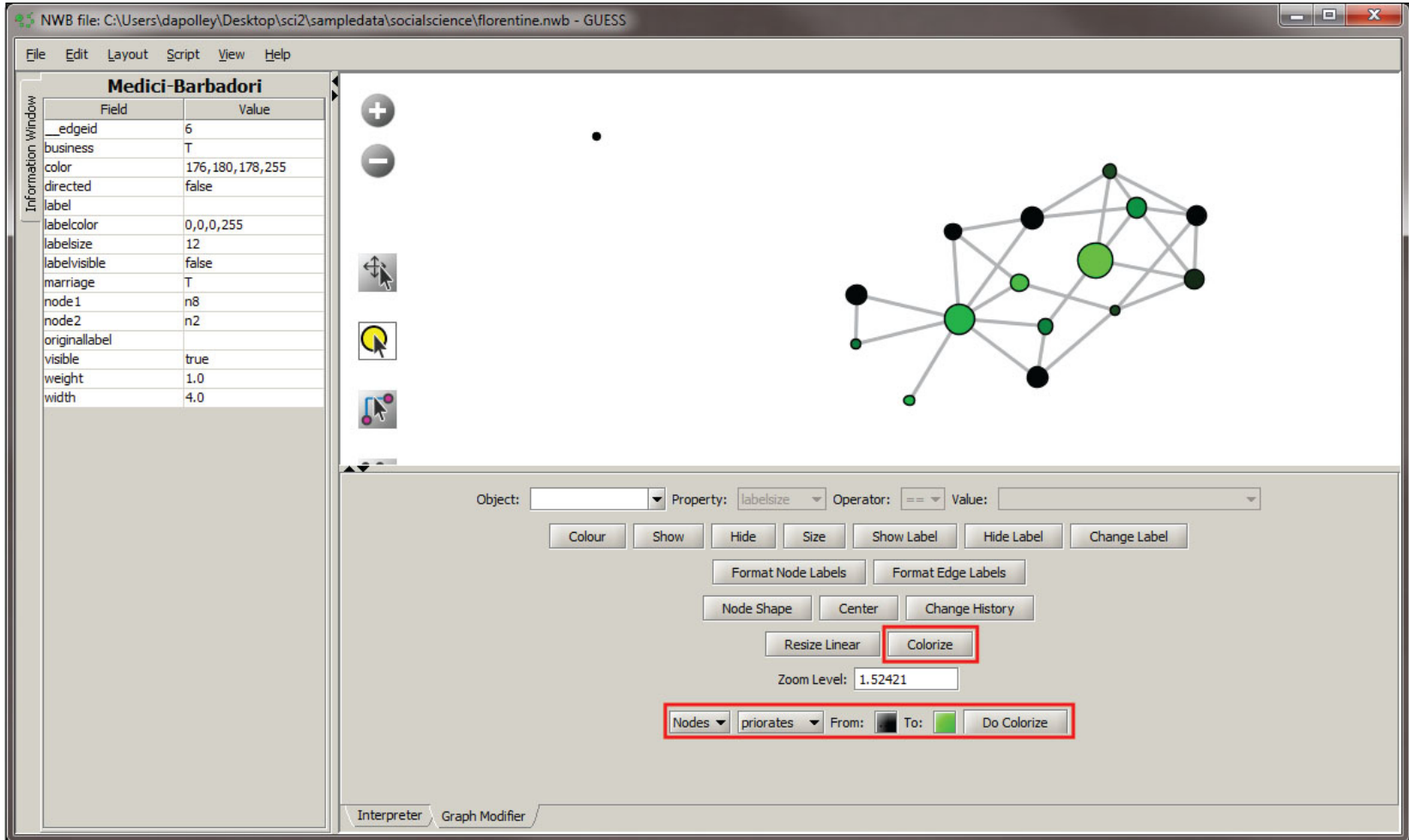
Object: Property: Operator: Value:

Buttons: Colour, Show, Hide, Size, Show Label, Hide Label, Change Label, Format Node Labels, Format Edge Labels, Node Shape, Center, Change History, **Resize Linear**, Colorize

Zoom Level:

From: To: **Do Resize Linear**

Next we will colorize the nodes based on priorates to add an additional dimension to this visualization.



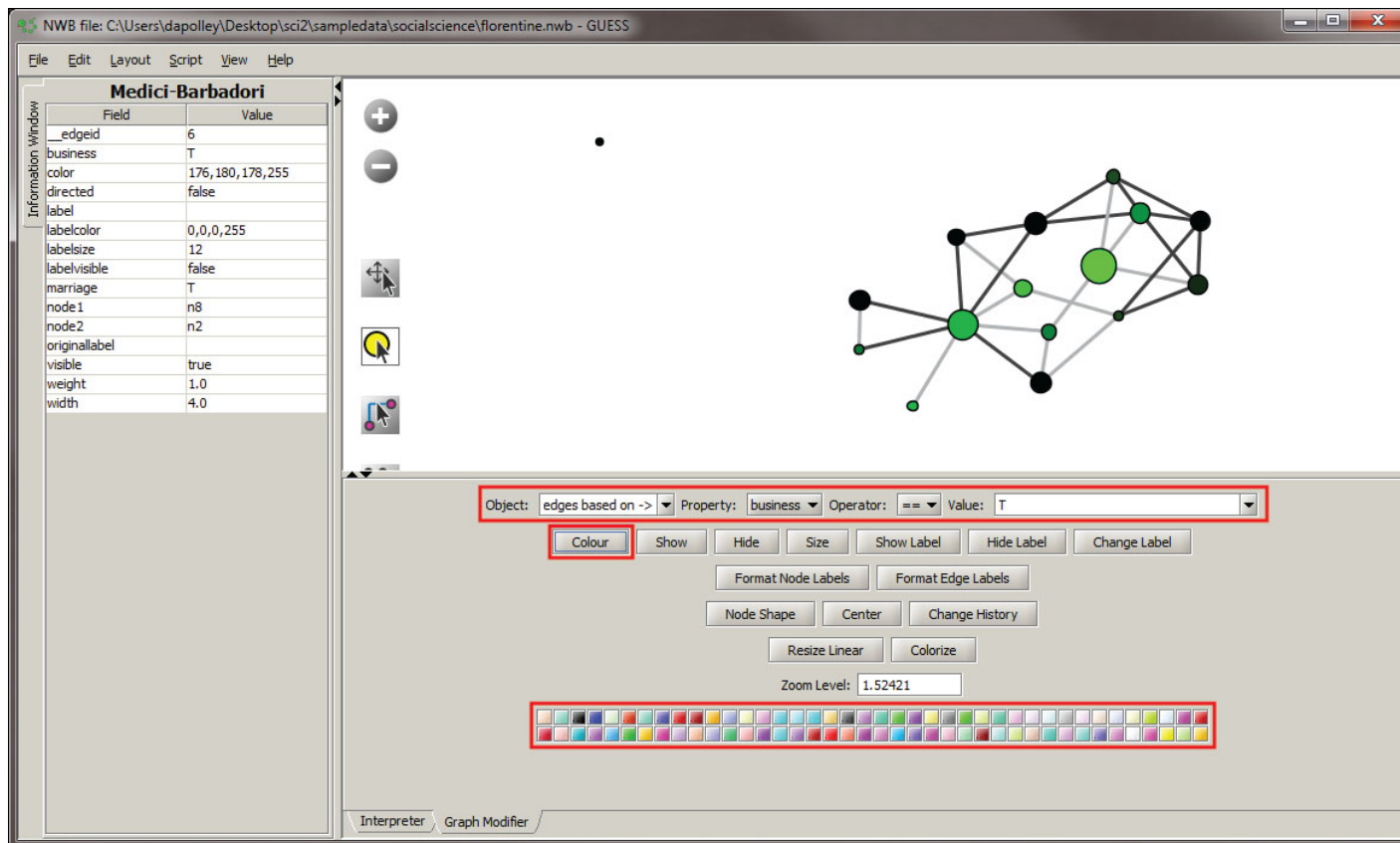
The screenshot shows the GUESS software interface. On the left is an 'Information Window' for the 'Medici-Barbadori' dataset, displaying a table of properties and values. The main window shows a network graph with nodes of varying sizes and colors (black and green). The bottom panel contains configuration options for the graph, with a red box highlighting the 'Colorize' button and the 'Nodes' dropdown set to 'priorates'.

Field	Value
__edgeid	6
business	T
color	176, 180, 178, 255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
marriage	T
node1	n8
node2	n2
originallabel	
visible	true
weight	1.0
width	4.0

Configuration Panel (highlighted area):

- Object: [] Property: labelsize Operator: == Value: []
- Buttons: Colour, Show, Hide, Size, Show Label, Hide Label, Change Label
- Buttons: Format Node Labels, Format Edge Labels
- Buttons: Node Shape, Center, Change History
- Buttons: Resize Linear, **Colorize**
- Zoom Level: 1.52421
- Nodes** | priorates | From: [black] To: [green] | Do Colorize

Next we will color the edges to show the type of relationship between the families. To do this, you will need to select the *Object* edges *based on ->*, set the property to *marriage*, the operator to == , and the value to *T*. Next, click the *Color* button and you can select the color of your choice from the pallet that will appear at the bottom of the Graph Modifier pane.



NWB file: C:\Users\dapolley\Desktop\sci2\sampladata\socalscience\fiorentine.nwb - GUESS

File Edit Layout Script View Help

Medici-Barbadori

Information Window

Field	Value
__edgeid	6
business	T
color	176, 180, 178, 255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
marriage	T
node1	n8
node2	n2
originallabel	
visible	true
weight	1.0
width	4.0

Object: edges based on -> Property: business Operator: == Value: T

Colour Show Hide Size Show Label Hide Label Change Label

Format Node Labels Format Edge Labels

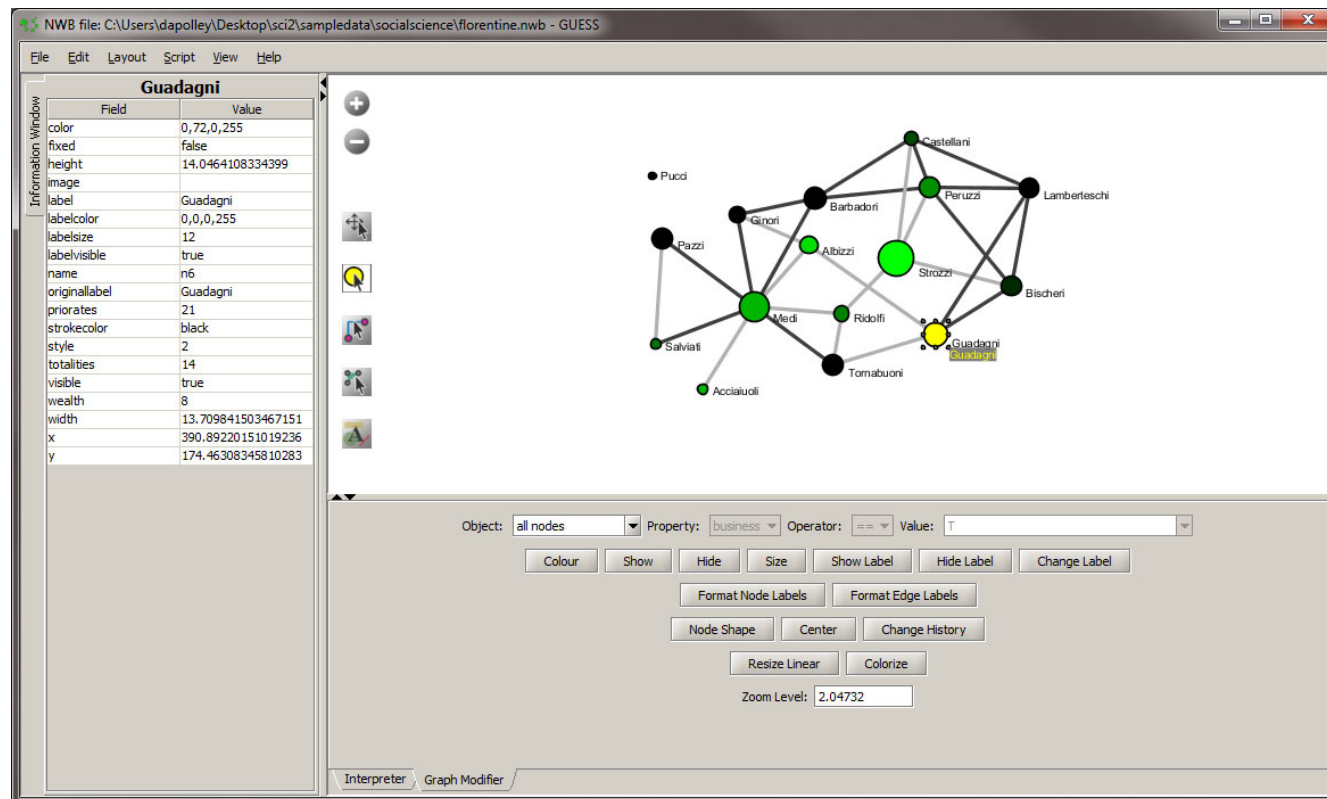
Node Shape Center Change History

Resize Linear Colorize

Zoom Level: 1.52421

Interpreter Graph Modifier

You can repeat this process for the *business* property if you want to, or you can leave the edges that represent business ties the default color. In this workflow we will leave them the default color, light gray. The final step is to show all the labels. To do this, you will need to select the "Object" all nodes and the click the *Show Label* button and the labels will appear in the visualization.



NWB file: C:\Users\dapolley\Desktop\sci2\sampladata\socialscience\florentine.nwb - GUESS

File Edit Layout Script View Help

Information Window

Field	Value
color	0,72,0,255
fixed	false
height	14.0464108334399
image	
label	Guadagni
labelcolor	0,0,0,255
labelsize	12
labelvisible	true
name	n6
originallabel	Guadagni
priorates	21
strokecolor	black
style	2
totalities	14
visible	true
wealth	8
width	13.709841503467151
x	390.89220151019236
y	174.46308345810283

Object: all nodes Property: business Operator: == Value: T

Colour Show Hide Size Show Label Hide Label Change Label

Format Node Labels Format Edge Labels

Node Shape Center Change History

Resize Linear Colorize

Zoom Level: 2.04732

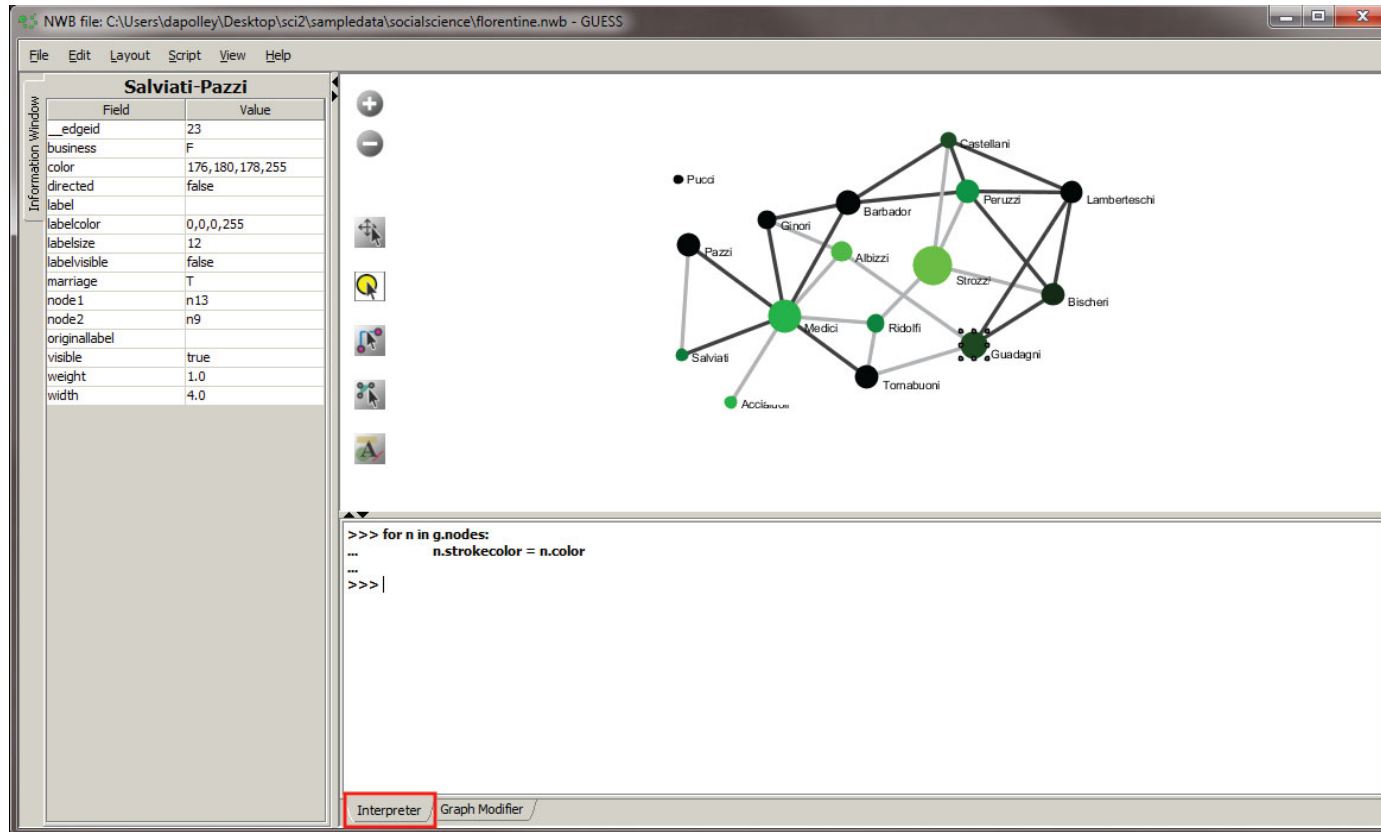
Interpreter Graph Modifier

Since the GEM layout is random and all the nodes are spaced more or less evenly apart, you do not have to worry about disrupting the layout. However, other layout algorithms may space the nodes according to specific attributes of the network. Manually moving around nodes in this case would disrupt the layout of the network and distort the meaning of the visualization.

The last thing we want to do to our network is color the border of the nodes the same as the nodes themselves. This is not as crucial for networks with only a few nodes, but as the size of your network increases it can become difficult to read with the thick black lines around every node. To color those the same as the node go to the *Interpreter* tab at the bottom of the GUESS window and type in the following commands:

```
for n in g.nodes:  
    n.strokecolor = n.color
```


This code basically tells GUESS that for every node (n) in this graph of nodes ($g.nodes$) make the border color of the nodes ($n.strokecolor$) equal to the node color ($n.color$). After you type the first line you will need to hit the "Tab" key before you start typing the second line of code.



The screenshot shows the GUESS software interface. On the left, there is an "Information Window" for the "Salviati-Pazzi" node, displaying a table of fields and values:

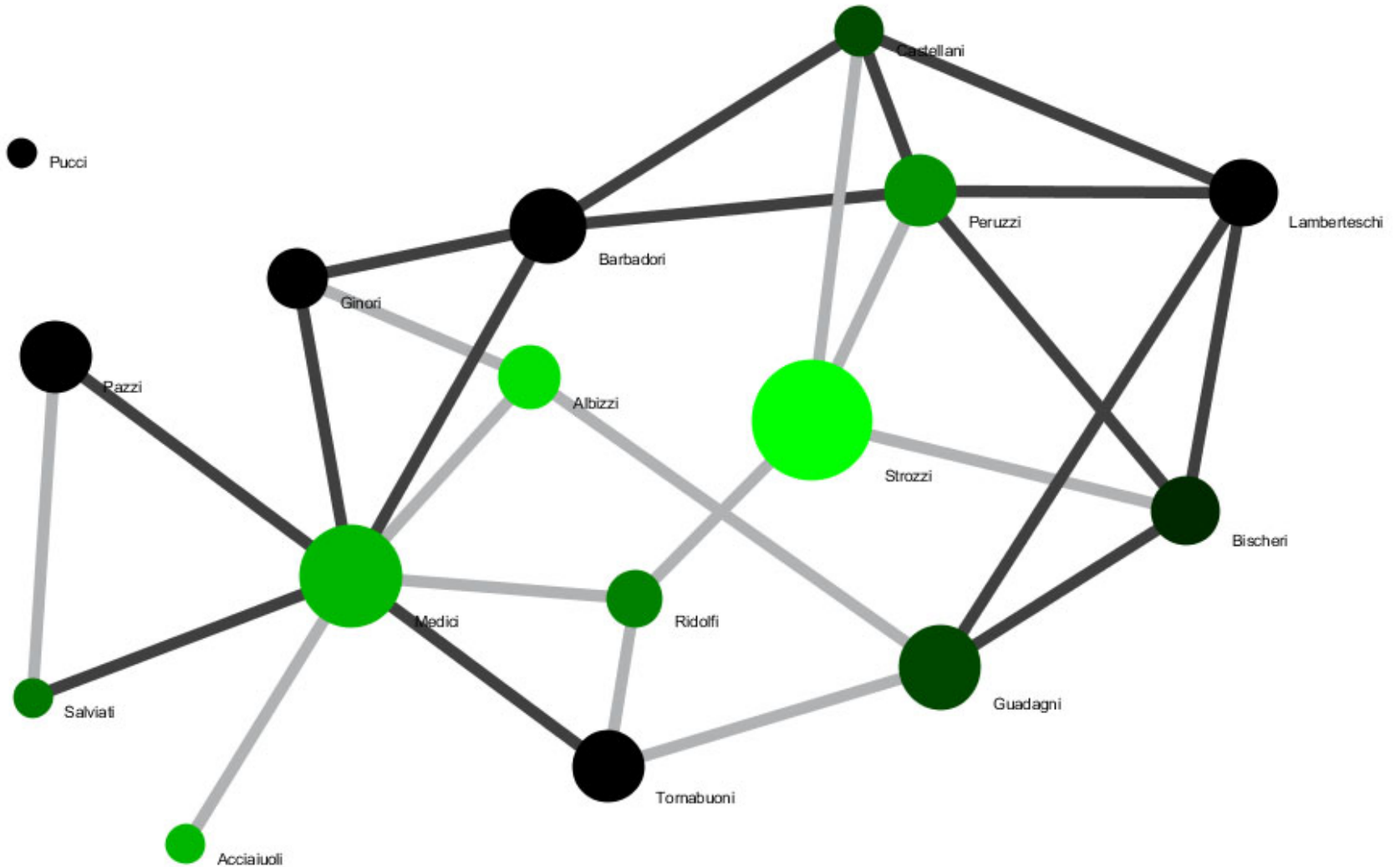
Field	Value
_edgeid	23
business	F
color	176, 180, 178, 255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
marriage	T
node1	n13
node2	n9
originallabel	
visible	true
weight	1.0
width	4.0

The main window displays a network graph with nodes labeled: Pucci, Ginori, Barbador, Castellani, Peruzzi, Lamberteschi, Pazzi, Albizzi, Strozzi, Bischeri, Salviati, Medici, Ridolfi, Guadagni, Acciaiuoli, and Tomabuoni. The nodes are connected by edges, and some nodes are highlighted in green.

At the bottom, the "Interpreter" window shows the following code:

```
>>> for n in g.nodes:
...     n.strokecolor = n.color
>>>
```

The "Interpreter" button is highlighted with a red box.

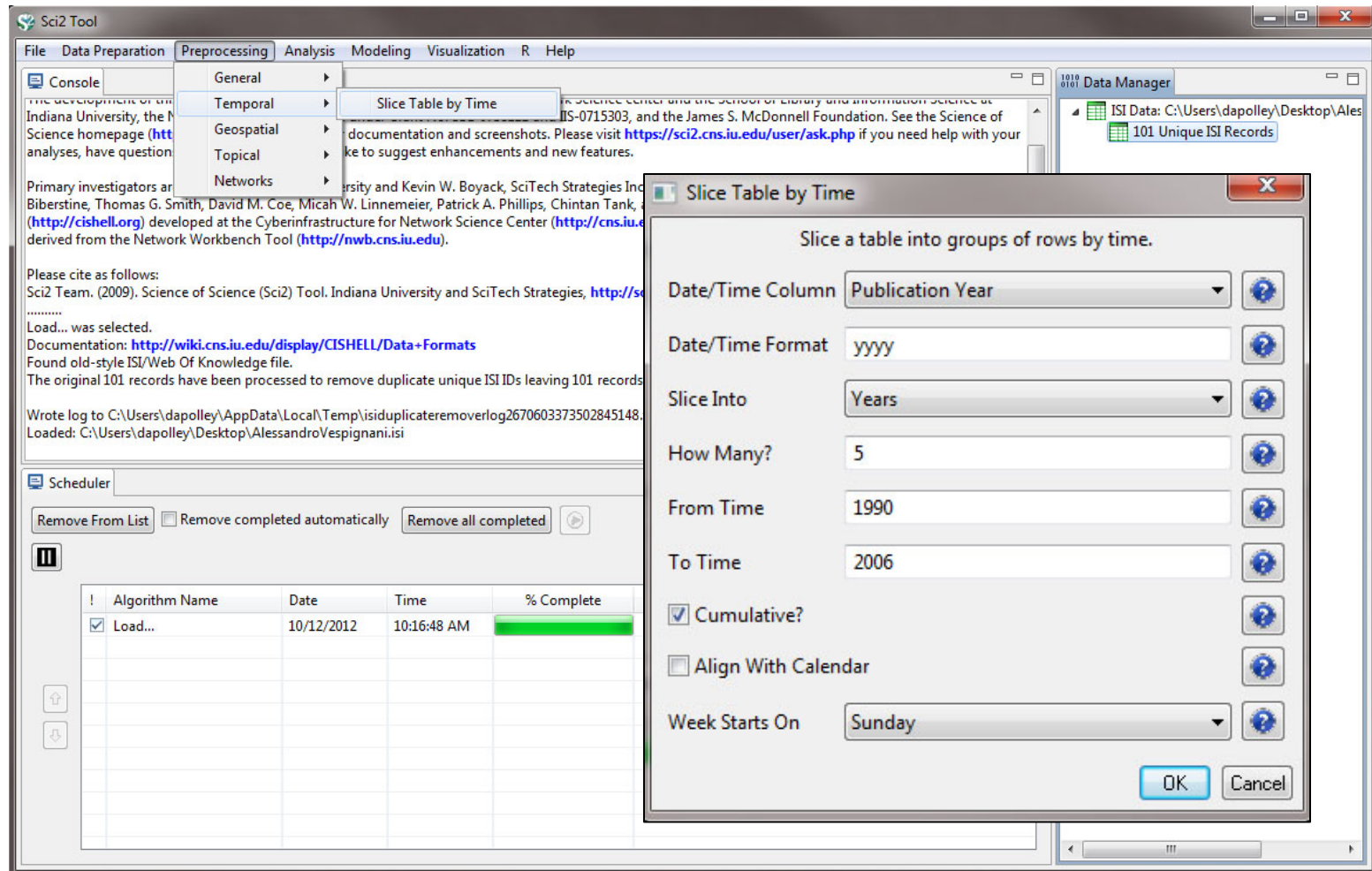


Questions?

Temporal Analysis: *Evolving Co-Authorship Network*

For this analysis we will be studying the evolution of Alessandro Vespignani's co-authorship network over time. We will see his network of collaborators grow from 1990 to 2006, giving us a sense of how his scholarly output has grown. Each node in the network will represent an author in the data set and the edges that connect them will be weighted based on how many times they have collaborated.

Select *Preprocessing* > *Temporal* > *Slice Table by Time* and choose the parameters shown at the right.



The screenshot shows the Sci2 Tool interface with the 'Preprocessing' menu open, highlighting the 'Temporal' > 'Slice Table by Time' path. A dialog box titled 'Slice Table by Time' is open, showing the following configuration:

- Date/Time Column: Publication Year
- Date/Time Format: yyyy
- Slice Into: Years
- How Many?: 5
- From Time: 1990
- To Time: 2006
- Cumulative?
- Align With Calendar
- Week Starts On: Sunday

The background window shows a console with the following text:

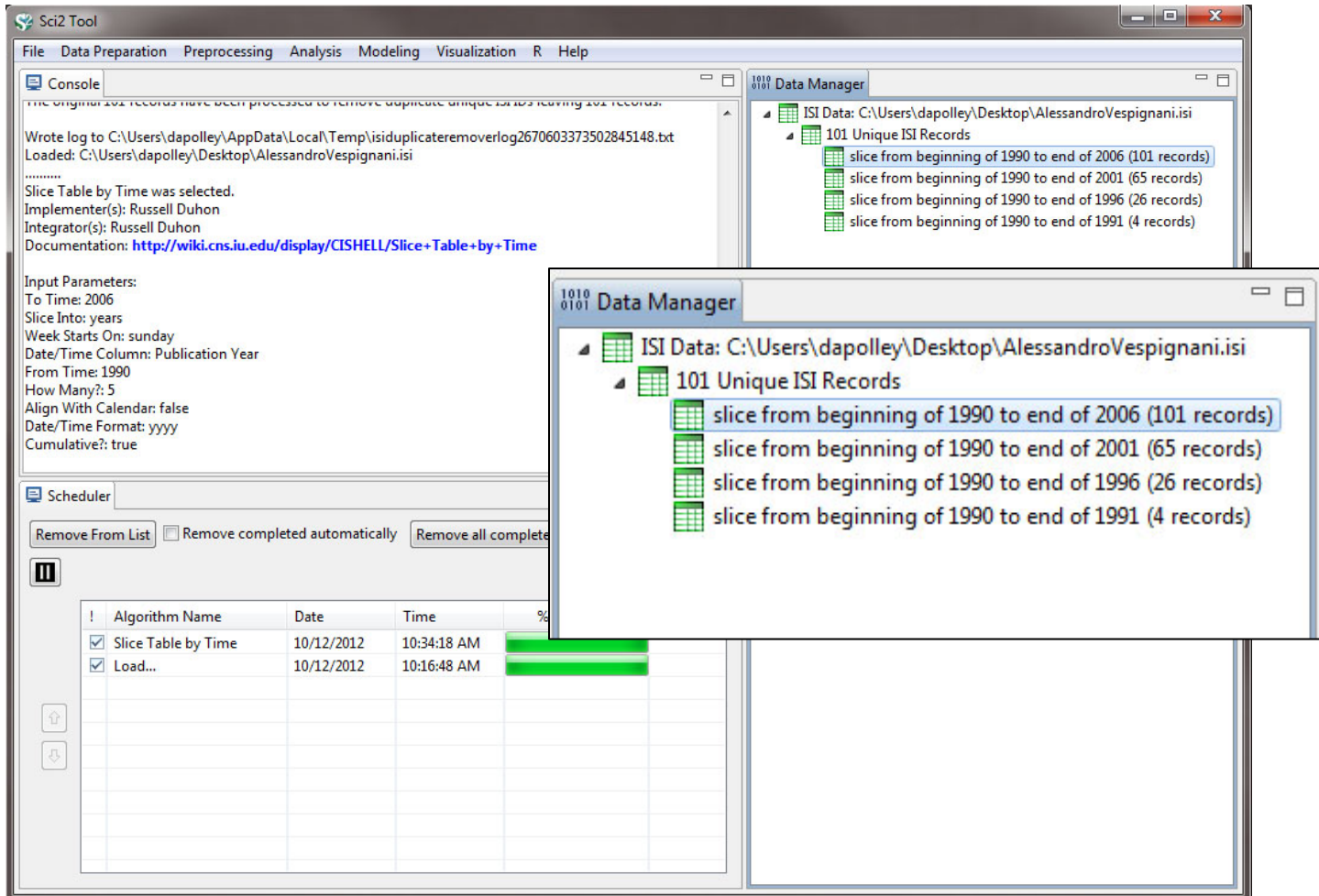
```

Please cite as follows:
Sci2 Team. (2009). Science of Science (Sci2) Tool. Indiana University and SciTech Strategies, http://sci2.cns.iu.edu/
.....
Load... was selected.
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Data+Formats
Found old-style ISI/Web Of Knowledge file.
The original 101 records have been processed to remove duplicate unique ISI IDs leaving 101 records.
Write log to C:\Users\dapolley\AppData\Local\Temp\isiduplicateremoverlog2670603373502845148.
Loaded: C:\Users\dapolley\Desktop\AlessandroVespignani.isi
  
```

Below the console is a scheduler table:

!	Algorithm Name	Date	Time	% Complete
<input checked="" type="checkbox"/>	Load...	10/12/2012	10:16:48 AM	100%

Now that the algorithm has been run, you will notice the original dataset has been divided into four tables that cumulatively display the evolution of this data.



The screenshot shows the Sci2 Tool interface. The 'Console' window displays the following text:

```

The original 101 records have been processed to remove duplicate unique IDs leaving 101 records.
Wrote log to C:\Users\dapolley\AppData\Local\Temp\isiduplicateremoverlog2670603373502845148.txt
Loaded: C:\Users\dapolley\Desktop\AlessandroVespignani.isi
.....
Slice Table by Time was selected.
Implementer(s): Russell Duhon
Integrator(s): Russell Duhon
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Slice+Table+by+Time

Input Parameters:
To Time: 2006
Slice Into: years
Week Starts On: sunday
Date/Time Column: Publication Year
From Time: 1990
How Many?: 5
Align With Calendar: false
Date/Time Format: yyyy
Cumulative?: true
  
```

The 'Data Manager' window shows a tree view of the data:

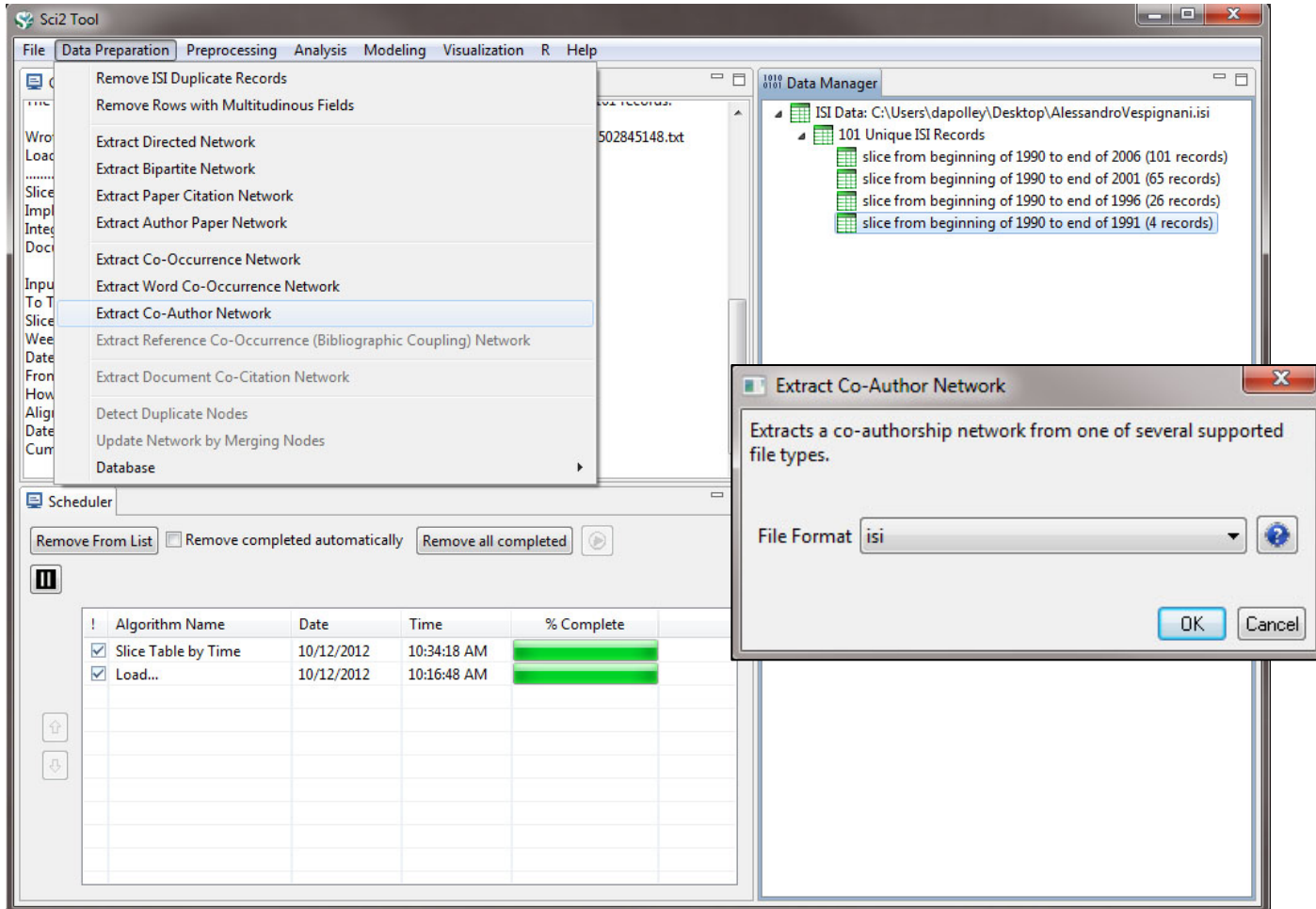
- ISI Data: C:\Users\dapolley\Desktop\AlessandroVespignani.isi
 - 101 Unique ISI Records
 - slice from beginning of 1990 to end of 2006 (101 records)
 - slice from beginning of 1990 to end of 2001 (65 records)
 - slice from beginning of 1990 to end of 1996 (26 records)
 - slice from beginning of 1990 to end of 1991 (4 records)

The 'Scheduler' window shows the following table:

!	Algorithm Name	Date	Time	%
<input checked="" type="checkbox"/>	Slice Table by Time	10/12/2012	10:34:18 AM	
<input checked="" type="checkbox"/>	Load...	10/12/2012	10:16:48 AM	

Select the first table and run *Data Preparation > Extract Co-Author Network*

Repeat this step for each of the tables in the Data Manager

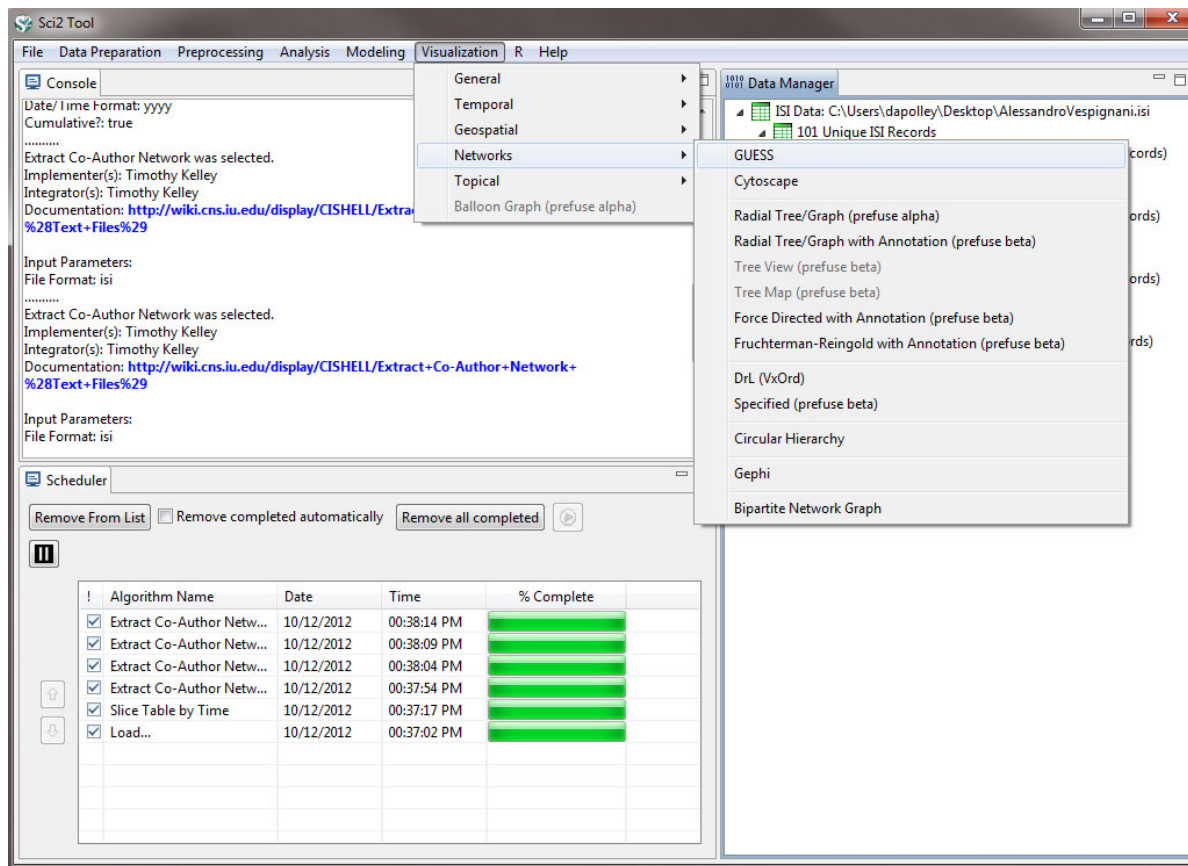


The screenshot shows the Sci2 Tool interface. The 'Data Preparation' menu is open, and 'Extract Co-Author Network' is selected. The 'Data Manager' window shows a tree view of ISI data slices. A dialog box titled 'Extract Co-Author Network' is open, showing the 'File Format' set to 'isi'.

Data Manager Tree View:

- ISI Data: C:\Users\dapolley\Desktop\AlessandroVespignani.isi
 - 101 Unique ISI Records
 - slice from beginning of 1990 to end of 2006 (101 records)
 - slice from beginning of 1990 to end of 2001 (65 records)
 - slice from beginning of 1990 to end of 1996 (26 records)
 - slice from beginning of 1990 to end of 1991 (4 records)

Select the first extracted co-author network and run *Visualization > Networks > GUESS* starting with the network that spans 1990 to 2006 because we will export these node positions and use them to layout the other networks.



The screenshot shows the Sci2 Tool interface with the 'Visualization' menu open, highlighting the 'Networks' sub-menu, which in turn has 'GUESS' selected. The console window displays the following text:

```

Date/Time Format: yyyy
Cumulative?: true
.....
Extract Co-Author Network was selected.
Implementer(s): Timothy Kelley
Integrator(s): Timothy Kelley
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Extract+Co-Author+Network+%28Text+Files%29

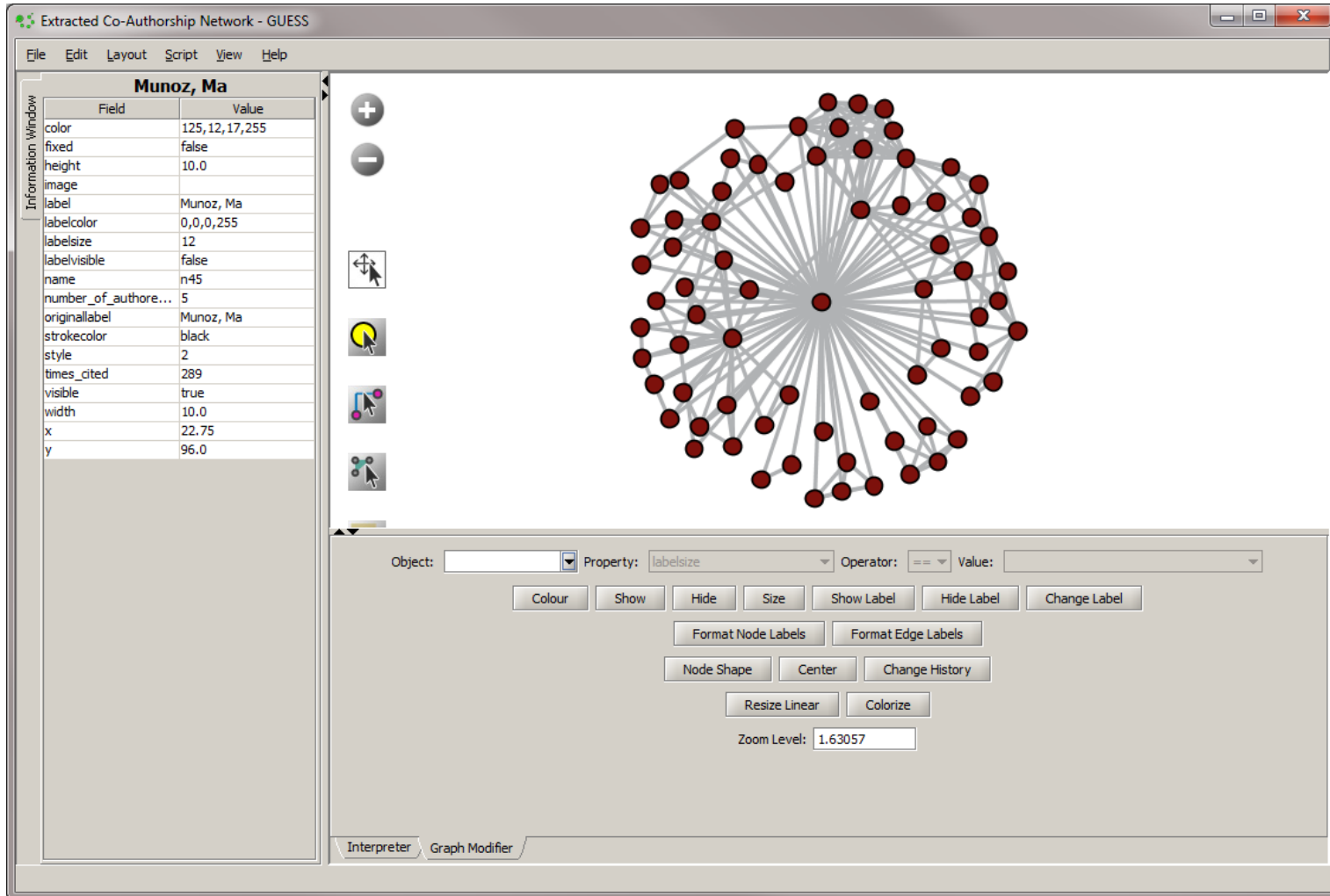
Input Parameters:
File Format: isi
.....
Extract Co-Author Network was selected.
Implementer(s): Timothy Kelley
Integrator(s): Timothy Kelley
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Extract+Co-Author+Network+%28Text+Files%29

Input Parameters:
File Format: isi
  
```

The Scheduler window shows a table of tasks:

!	Algorithm Name	Date	Time	% Complete
<input checked="" type="checkbox"/>	Extract Co-Author Net...	10/12/2012	00:38:14 PM	<div style="width: 100%; height: 10px; background-color: green;"></div>
<input checked="" type="checkbox"/>	Extract Co-Author Net...	10/12/2012	00:38:09 PM	<div style="width: 100%; height: 10px; background-color: green;"></div>
<input checked="" type="checkbox"/>	Extract Co-Author Net...	10/12/2012	00:38:04 PM	<div style="width: 100%; height: 10px; background-color: green;"></div>
<input checked="" type="checkbox"/>	Extract Co-Author Net...	10/12/2012	00:37:54 PM	<div style="width: 100%; height: 10px; background-color: green;"></div>
<input checked="" type="checkbox"/>	Slice Table by Time	10/12/2012	00:37:17 PM	<div style="width: 100%; height: 10px; background-color: green;"></div>
<input checked="" type="checkbox"/>	Load...	10/12/2012	00:37:02 PM	<div style="width: 100%; height: 10px; background-color: green;"></div>

The network will be loaded in with a random layout in GUESS
To change the layout select *Layout > Gem*



Information Window

Field	Value
color	125, 12, 17,255
fixed	false
height	10.0
image	
label	Munoz, Ma
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
name	n45
number_of_authore...	5
originallabel	Munoz, Ma
strokecolor	black
style	2
times_cited	289
visible	true
width	10.0
x	22.75
y	96.0

Object: Property: Operator: Value:

Colour Show Hide Size Show Label Hide Label Change Label

Format Node Labels Format Edge Labels

Node Shape Center Change History

Resize Linear Colorize

Zoom Level:

Interpreter Graph Modifier

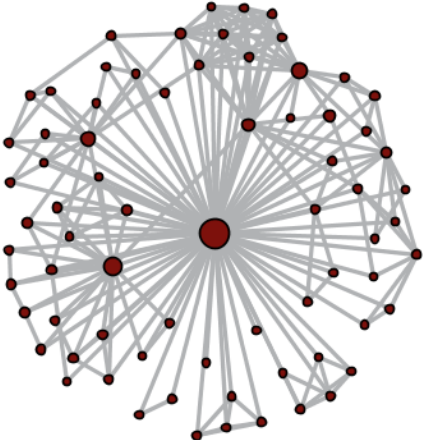
Resize the nodes based on *number_of_authored_works*
Set the parameters from 5 to 15 and click *Do Resize Linear*

Extracted Co-Authorship Network - GUESS

File Edit Layout Script View Help

Miguel, Mc-Grasso, Jr

Field	Value
__edgeid	154
color	176, 180, 178, 255
directed	false
label	
labelcolor	0, 0, 0, 255
labelsize	12
labelvisible	false
node1	n9
node2	n50
number_of_coautho...	3
originallabel	
visible	true
weight	3.0
width	4.0



Object: Property: Operator: Value:

Colour Show Hide Size Show Label Hide Label Change Label

Format Node Labels Format Edge Labels

Node Shape Center Change History

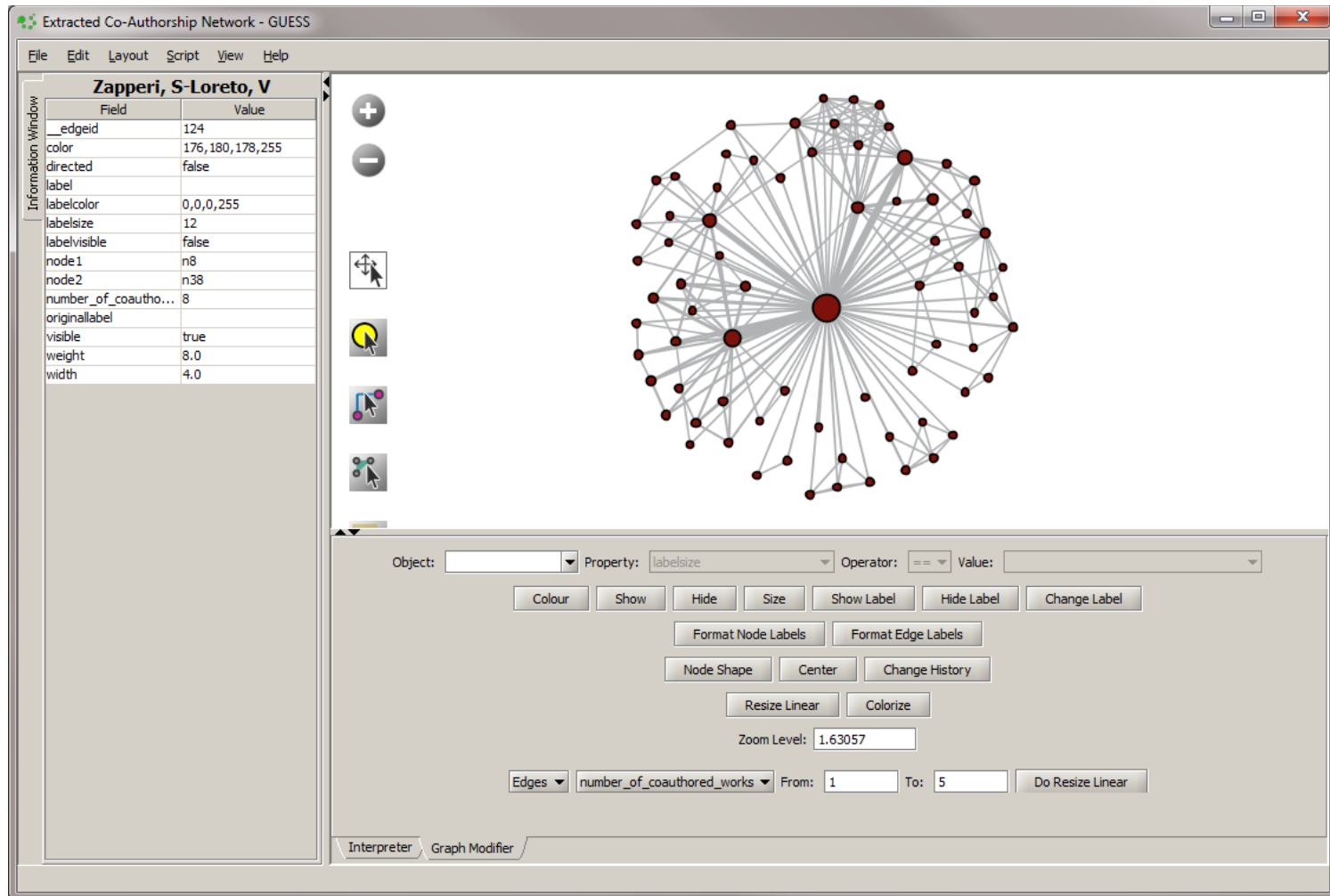
Resize Linear Colorize

Zoom Level:

Nodes From: To: Do Resize Linear

Interpreter Graph Modifier

Resize the edges based on *number_of_coauthored_works*
 Set the parameters from 1 to 5 and click *Do Resize Linear*



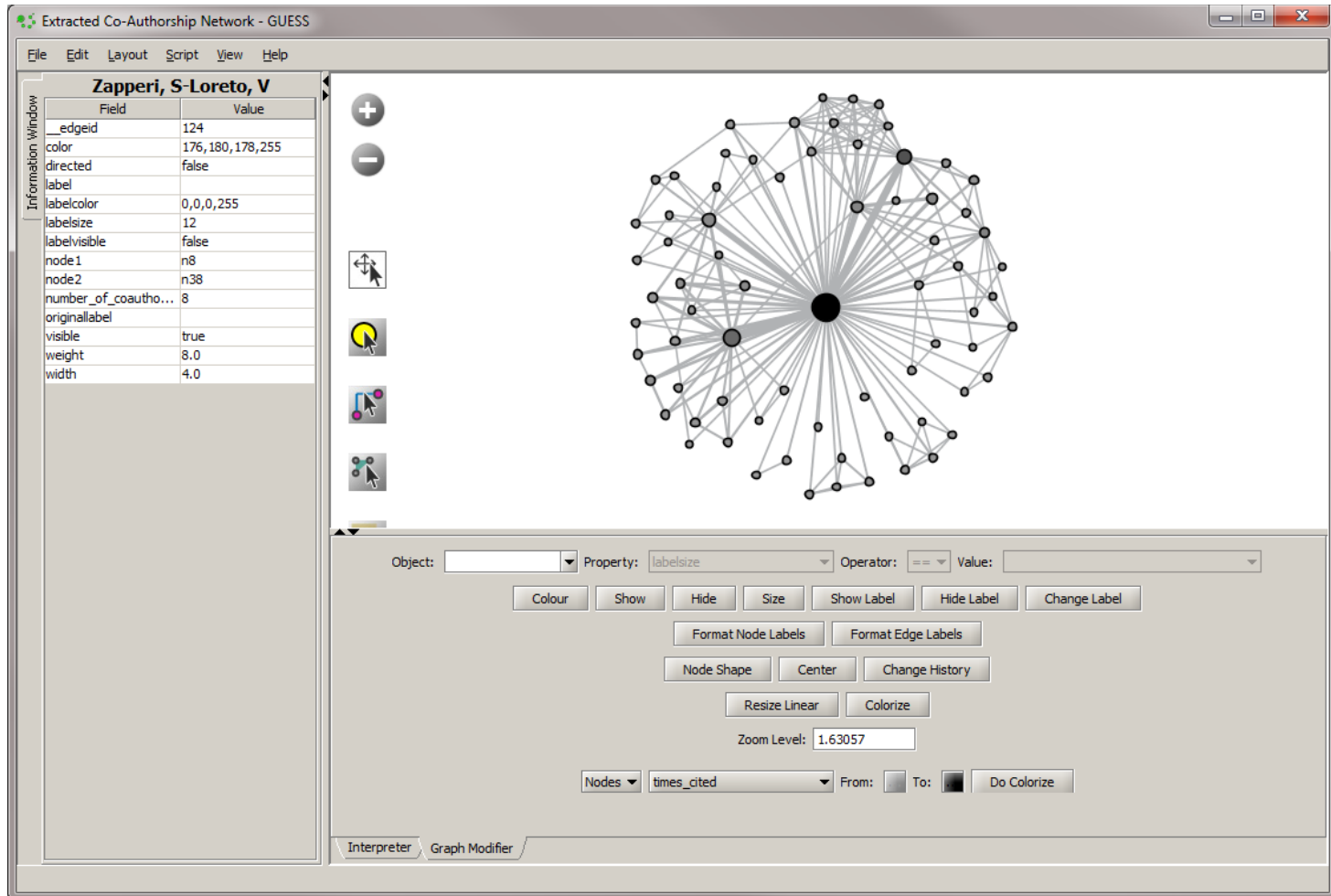
The screenshot shows the GUESS software interface with the following components:

- Information Window:** A table showing properties for the selected node 'Zapperi, S-Loreto, V'.

Field	Value
__edgeid	124
color	176, 180, 178, 255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
node1	n8
node2	n38
number_of_coautho...	8
originallabel	
visible	true
weight	8.0
width	4.0
- Network Graph:** A circular network graph with a central node and many peripheral nodes connected by edges.
- Configuration Panel:**
 - Object: [Dropdown]
 - Property: *labelsize*
 - Operator: *==*
 - Value: [Dropdown]
 - Buttons: Colour, Show, Hide, Size, Show Label, Hide Label, Change Label
 - Buttons: Format Node Labels, Format Edge Labels
 - Buttons: Node Shape, Center, Change History
 - Buttons: Resize Linear, Colorize
 - Zoom Level: 1.63057
 - Edges: *number_of_coauthored_works*
 - From: 1 To: 5
 - Do Resize Linear
- Bottom Bar:** Interpreter | Graph Modifier

Colorize the nodes based on *times_cited*

Set the parameters from *Gray* to *Black* and click *Do Colorize*



The screenshot shows the GUESS software interface with the following components:

- Information Window:**

Field	Value
__edgeid	124
color	176,180,178,255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
node1	n8
node2	n38
number_of_coautho...	8
originallabel	
visible	true
weight	8.0
width	4.0
- Network Graph:** A circular network graph with a central node and many peripheral nodes connected by edges.
- Configuration Panel:**
 - Object: Property: Operator: Value:
 - Buttons: Colour, Show, Hide, Size, Show Label, Hide Label, Change Label
 - Buttons: Format Node Labels, Format Edge Labels
 - Buttons: Node Shape, Center, Change History
 - Buttons: Resize Linear, Colorize
 - Zoom Level:
 - Nodes From: To: Do Colorize
- Bottom Bar:** Interpreter | Graph Modifier

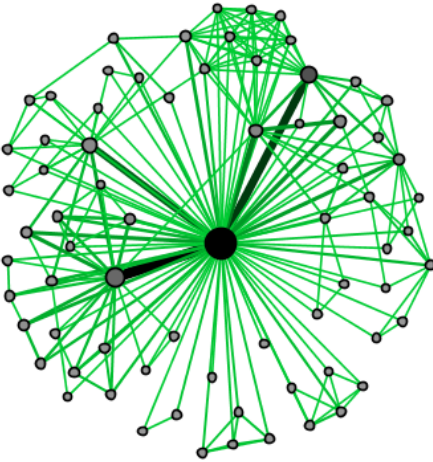
Colorize the edges based on *number_of_coauthored_works*
Set the parameters from *Green* to *Black* and click *Do Colorize*

Extracted Co-Authorship Network - GUESS

File Edit Layout Script View Help

Vespignani, A-Yekutieli, I

Field	Value
__edgeid	199
color	0,204,51,255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
node1	n0
node2	n66
number_of_coautho...	1
originallabel	
visible	true
weight	1.0
width	2.0



Object: Property: Operator: Value:

Colour Show Hide Size Show Label Hide Label Change Label

Format Node Labels Format Edge Labels

Node Shape Center Change History

Resize Linear Colorize

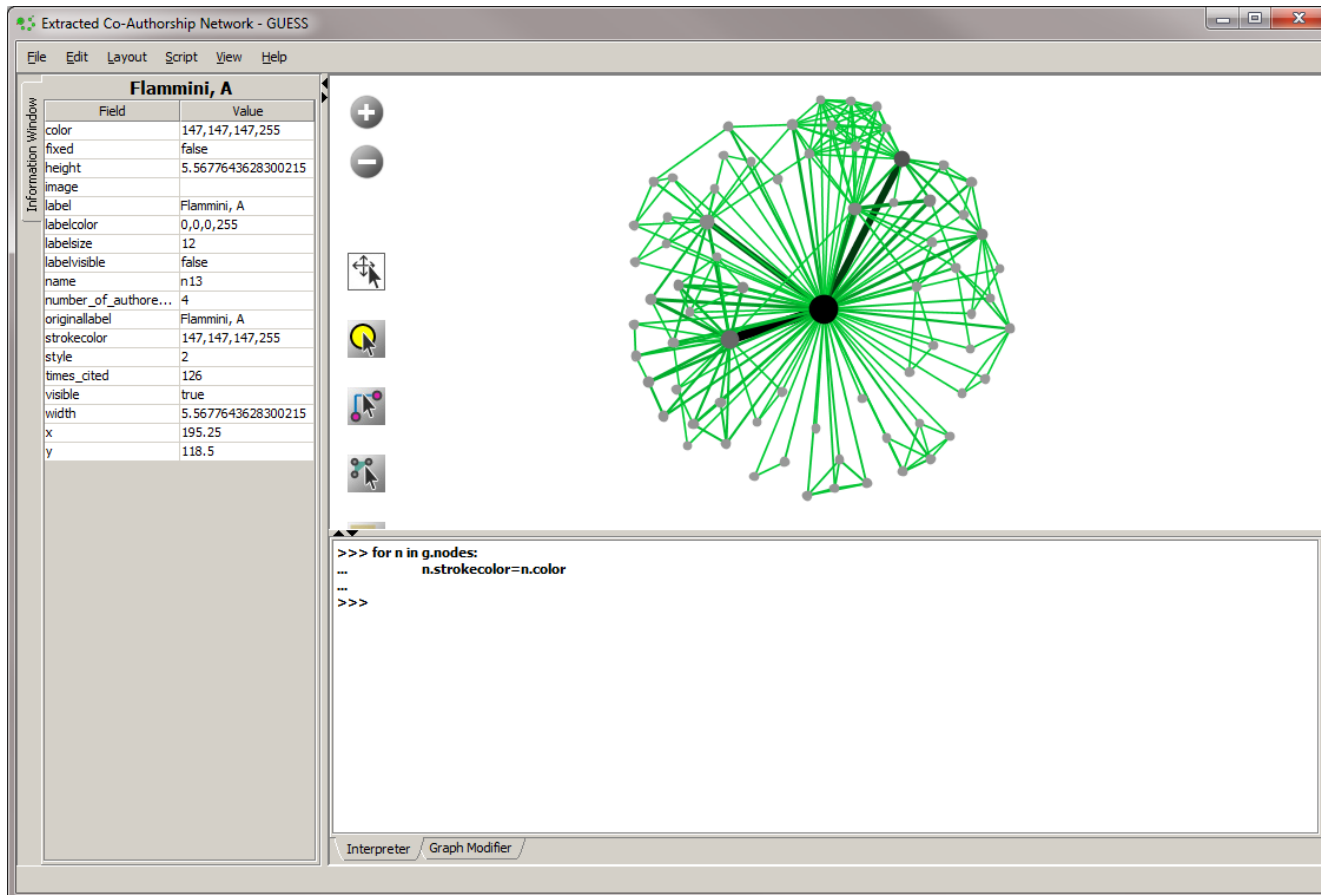
Zoom Level:

Edges From: To: Do Colorize

Interpreter Graph Modifier

If you want to remove the borders from the nodes, type the following commands in into the interpreter:

```
for n in g.nodes:  
    n.strokecolor=n.color
```



Extracted Co-Authorship Network - GUESS

File Edit Layout Script View Help

Flammini, A

Field	Value
color	147,147,147,255
fixed	false
height	5.5677643628300215
image	
label	Flammini, A
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
name	n13
number_of_authore...	4
originallabel	Flammini, A
strokecolor	147,147,147,255
style	2
times_cited	126
visible	true
width	5.5677643628300215
x	195.25
y	118.5

```
>>> for n in g.nodes:  
..     n.strokecolor=n.color  
..  
>>>
```

Interpreter Graph Modifier

Finally add the labels to the nodes by selecting object: *all nodes* and then click Show Label

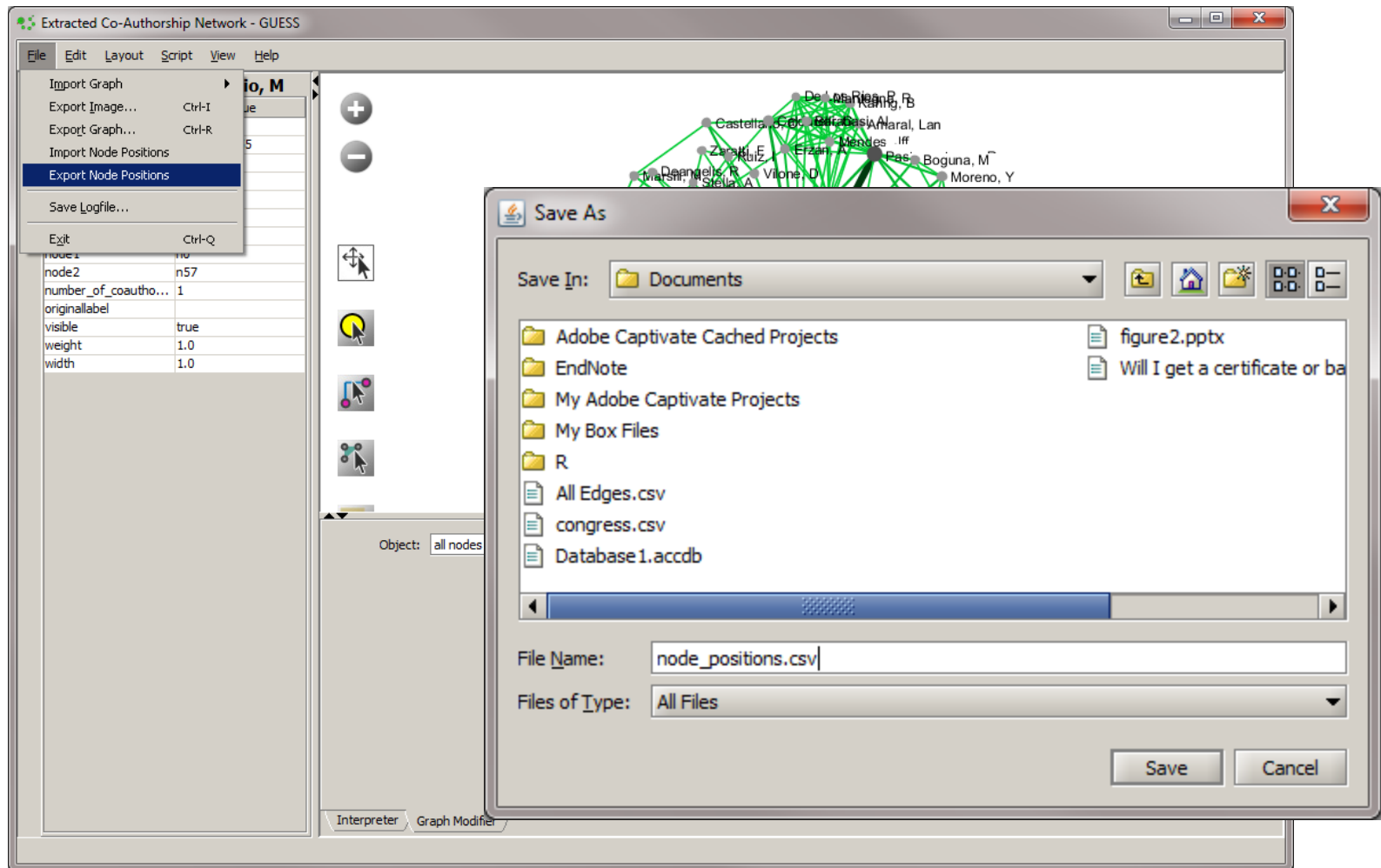
The screenshot shows the GUESS software interface. On the left is an 'Information Window' for the selected node 'Vazquez, A-Moreno, Y'. The main area displays a network graph with a central black node and many peripheral nodes connected by green lines. At the bottom, a control panel is visible with the following settings:

- Object: all nodes
- Property: labelsize
- Operator: ==
- Value: (empty)

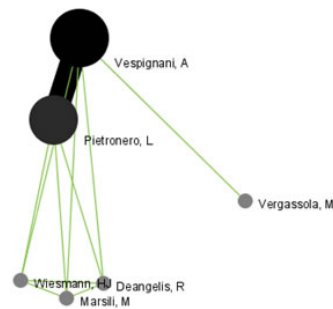
Buttons in the control panel include: Colour, Show, Hide, Size, Show Label, Hide Label, Change Label, Format Node Labels, Format Edge Labels, Node Shape, Center, Change History, Resize Linear, and Colorize. The Zoom Level is set to 1.63057.

Vazquez, A-Moreno, Y	
Field	Value
_edgeid	30
color	0,197,49,255
directed	false
label	
labelcolor	0,0,0,255
labelsiz	12
labelvisib	false
node1	n2
node2	n3
number_of_coautho...	2
originallabel	
visible	true
weight	2.0
width	2.25

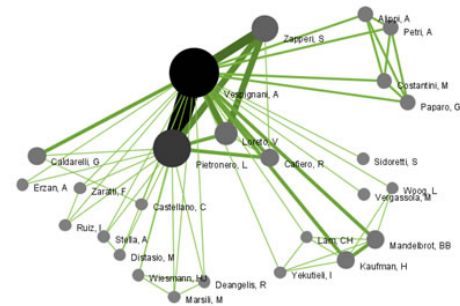
To save the node positions of the current layout so that the layout is consistent across all time slices select *File > Export Node Positions* and save the file as a CSV file.



Now when you go to visualize the other three networks you will want to import the node the node positions using *File > Import Node Positions* and the network will be laid out accordingly. When the networks are displayed side-by-side you can see an evolution.



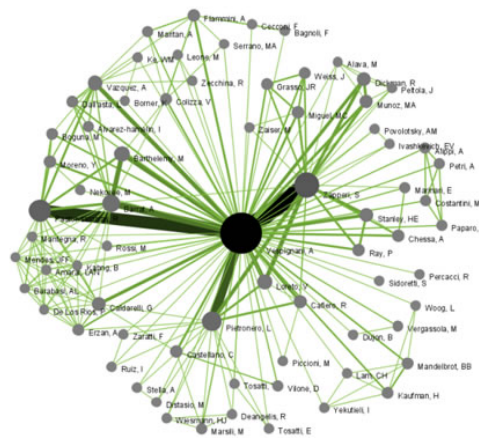
1990-1991



1990-1996



1990-2001



1990-2006

Questions?

Topical Analysis: *Word Co-Occurrence Networks*

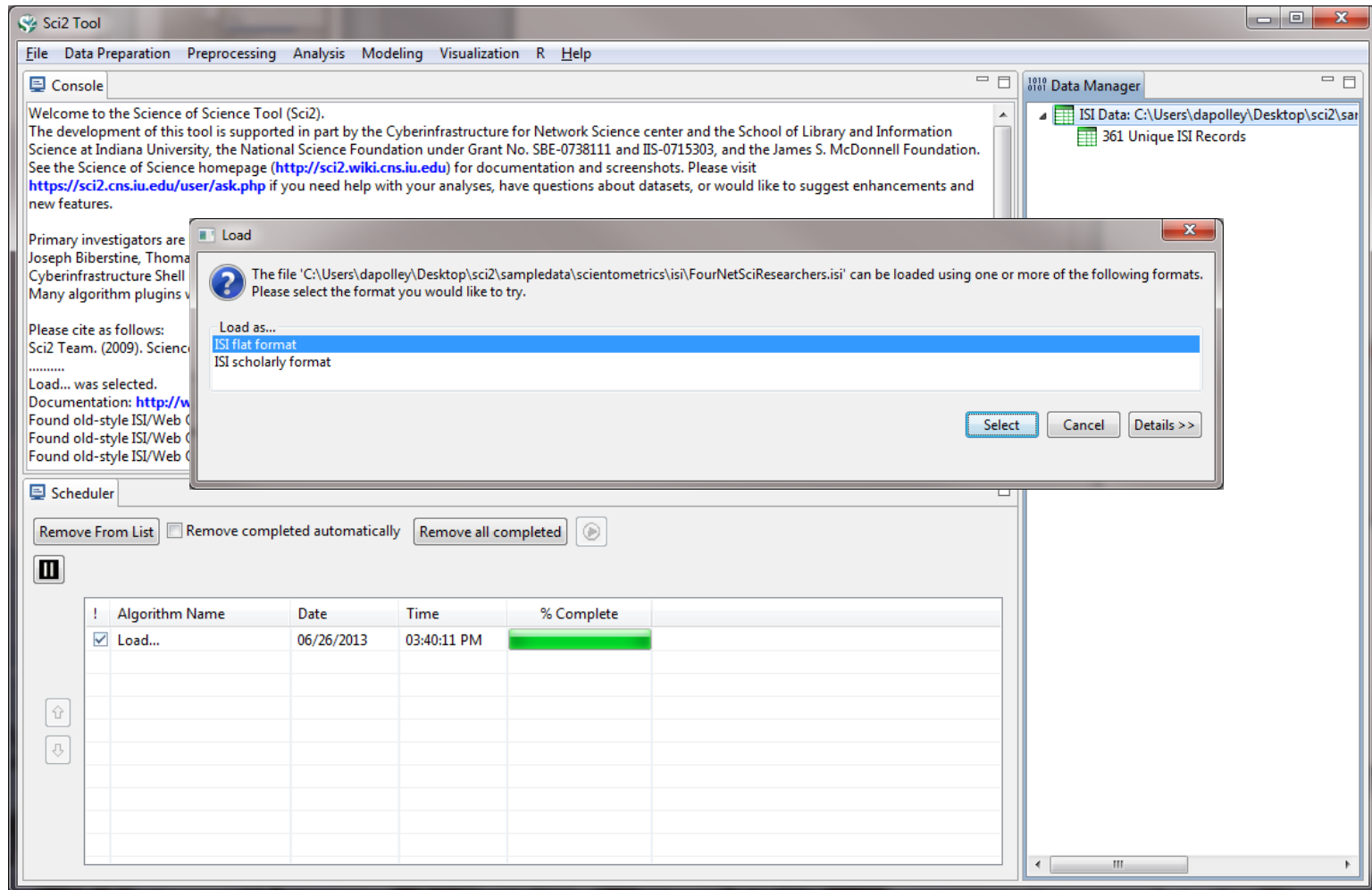
The topic similarity of works (books, journal articles etc.) within a domain can be calculated via an analysis of the co-occurrence of words in associated texts. Works that share more words in common are assumed to have higher topical overlap and are connected via linkages and/or placed in closer proximity.

Sci2's Extract Word Co-Occurrence Network algorithm creates a weighted network where each node is a word and edges connect words to each other. The strength of an edge represents how often two words co-occur in the same body of text.

Note: A bug in the Extract Word Co-Occurrence Network algorithm in Sci2 was recently fixed. If you are not using the version of Sci2 from the flash drives passed around at the workshop, then you will need to obtain the new Extract Word Co-Occurrence Network plugin from [3.2 Additional Plugins](#). The file is titled :

edu.iu.nwb.composite.extractwordfromtable_1.0.1.jar

Load the Four NetSci Researchers file (FourNetSciReseachers.isi) from the sample data folder in your Sci2 installation directory. Here is the path:
C:\Users\yourusername\Desktop\sci2\sampladata\scientometrics\isi



The screenshot shows the Sci2 Tool interface. A 'Load' dialog box is open, displaying the following text:

The file 'C:\Users\dapolley\Desktop\sci2\sampladata\scientometrics\isi\FourNetSciReseachers.isi' can be loaded using one or more of the following formats. Please select the format you would like to try.

- Load as...
- ISI flat format
- ISI scholarly format

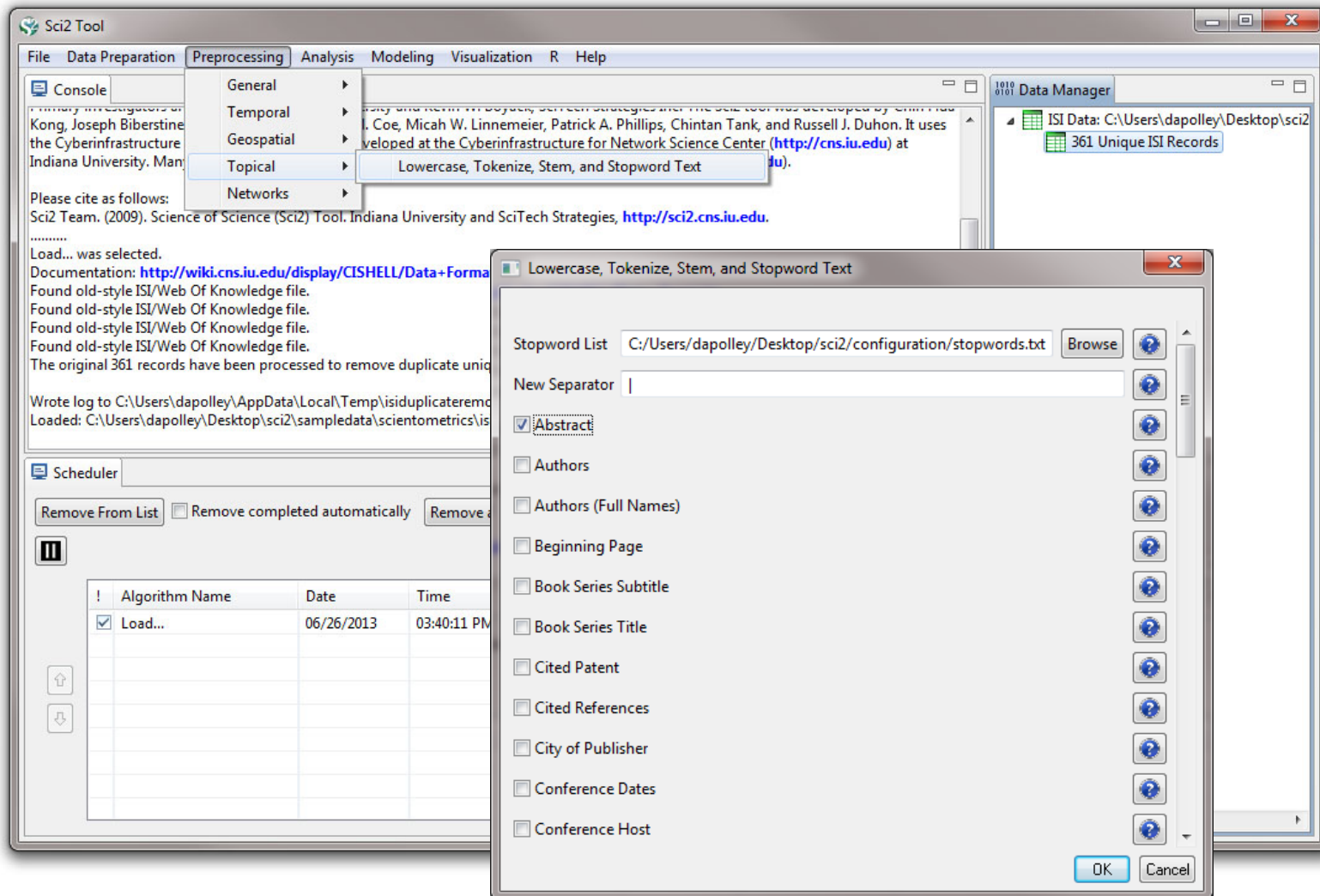
The 'Load as...' option is selected, and the 'ISI flat format' is highlighted. The dialog box has 'Select', 'Cancel', and 'Details >>' buttons.

The background shows the Sci2 Tool main window with the following components:

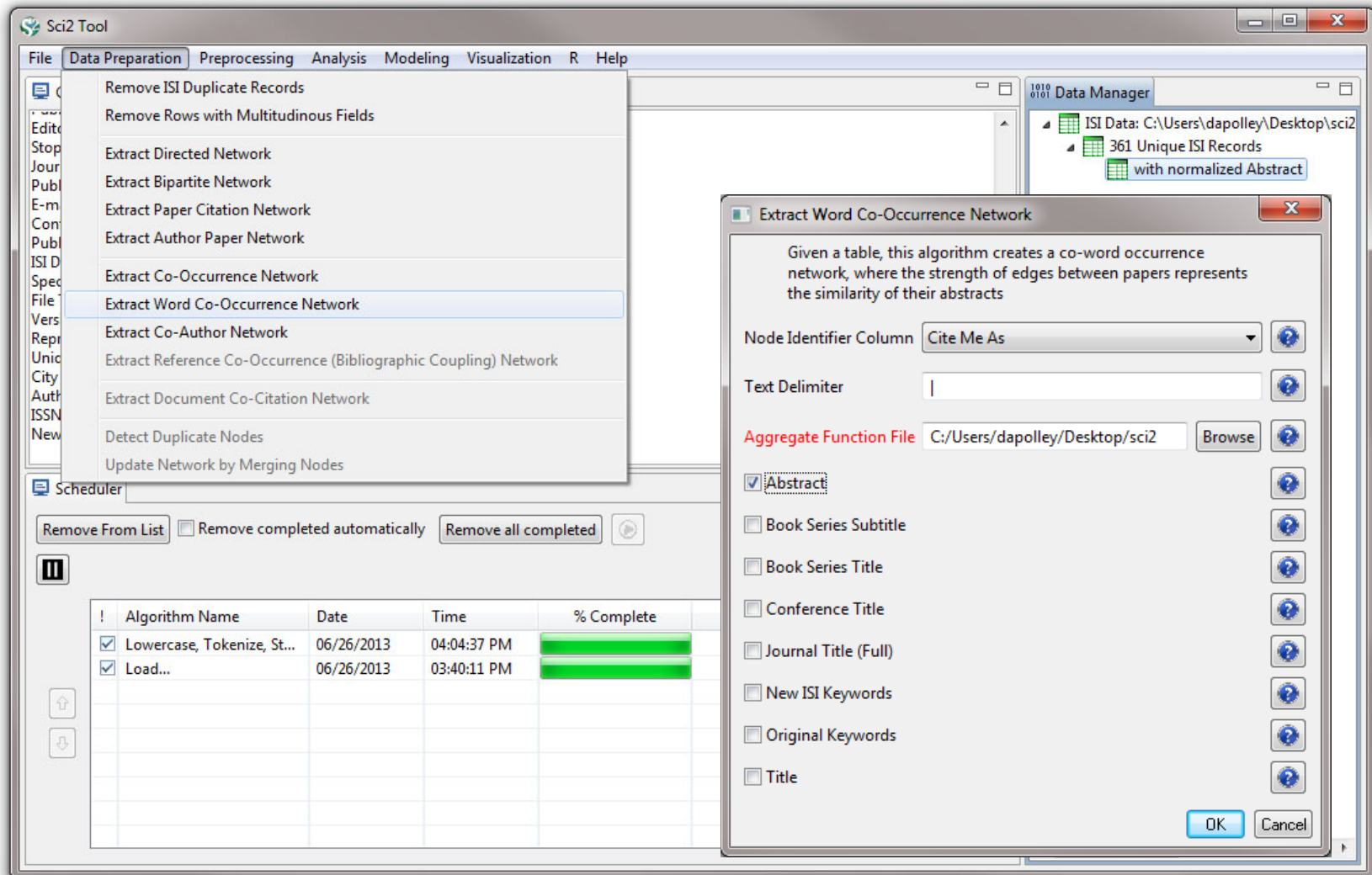
- Console:** Welcome to the Science of Science Tool (Sci2). The development of this tool is supported in part by the Cyberinfrastructure for Network Science center and the School of Library and Information Science at Indiana University, the National Science Foundation under Grant No. SBE-0738111 and IIS-0715303, and the James S. McDonnell Foundation. See the Science of Science homepage (<http://sci2.wiki.cns.iu.edu>) for documentation and screenshots. Please visit <https://sci2.cns.iu.edu/user/ask.php> if you need help with your analyses, have questions about datasets, or would like to suggest enhancements and new features.
- Data Manager:** ISI Data: C:\Users\dapolley\Desktop\sci2\sampladata\scientometrics\isi (361 Unique ISI Records)
- Scheduler:** A table showing the progress of the 'Load...' task.

!	Algorithm Name	Date	Time	% Complete
✓	Load...	06/26/2013	03:40:11 PM	100%

Normalize the text of the abstract *Preprocessing* > *Topical* > *Lowercase, Tokenize, Stem, and Stopword Text*



Create the word co-occurrence network *Data Preparation > Extract Word Co-Occurrence Network*



The screenshot shows the Sci2 Tool interface with the 'Data Preparation' menu open, highlighting 'Extract Word Co-Occurrence Network'. A dialog box titled 'Extract Word Co-Occurrence Network' is displayed, providing instructions and configuration options for creating a co-word occurrence network.

Given a table, this algorithm creates a co-word occurrence network, where the strength of edges between papers represents the similarity of their abstracts

Node Identifier Column: Cite Me As

Text Delimiter: |

Aggregate Function File: C:/Users/dapolley/Desktop/sci2

Options (checked):

- Abstract

Options (unchecked):

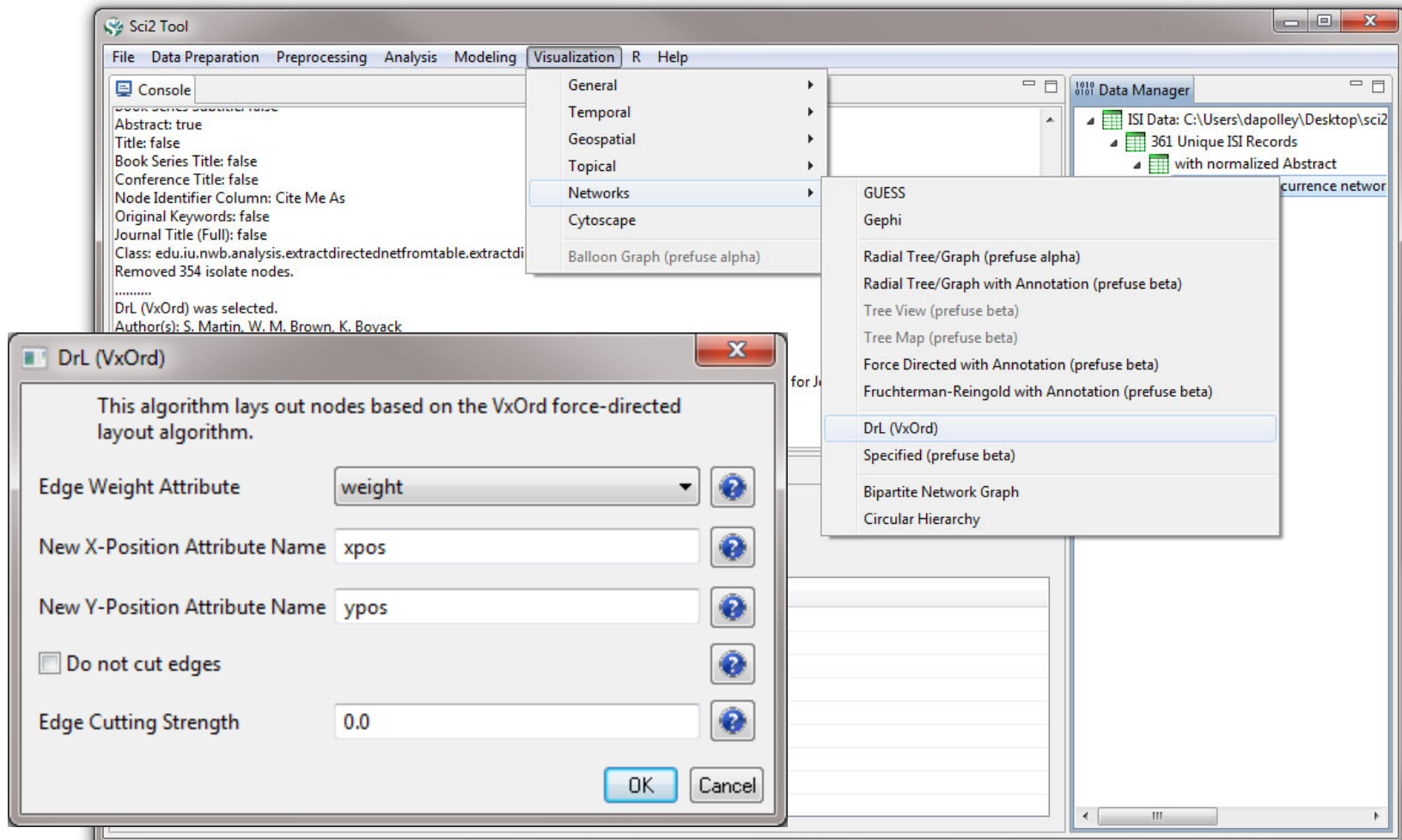
- Book Series Subtitle
- Book Series Title
- Conference Title
- Journal Title (Full)
- New ISI Keywords
- Original Keywords
- Title

Buttons: OK, Cancel

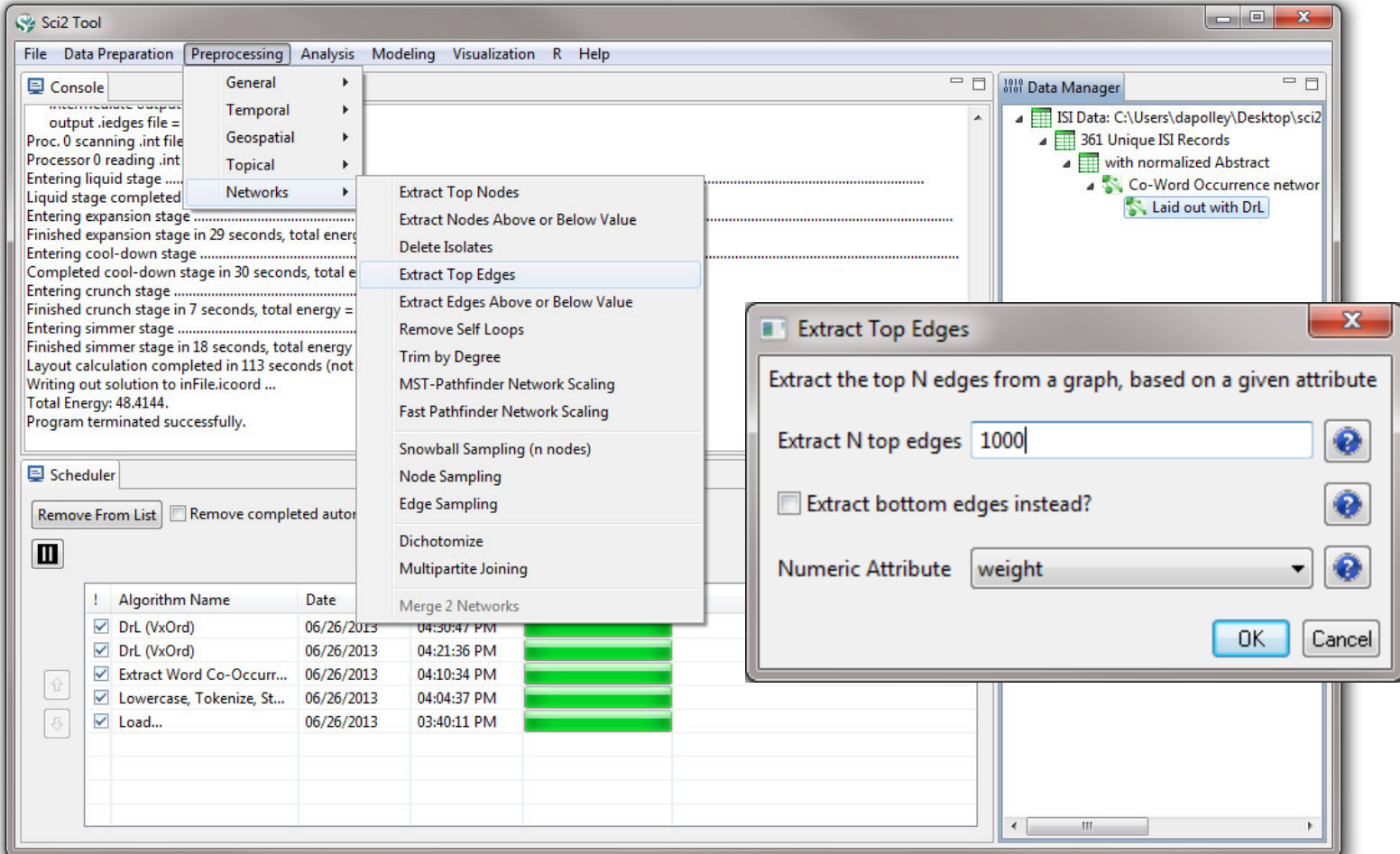
Scheduler

!	Algorithm Name	Date	Time	% Complete
<input checked="" type="checkbox"/>	Lowercase, Tokenize, St...	06/26/2013	04:04:37 PM	100%
<input checked="" type="checkbox"/>	Load...	06/26/2013	03:40:11 PM	100%

Apply *Visualization > Networks > DrL (VxOrd)* and words that are similar will be plotted relatively close to each other.



Laying out the network with Drl (VxOrd) may take some time, but once the algorithm is complete you will want to keep only the strongest edges, so select the “Laid out with Drl” and select *Preprocessing > Networks > Extract Top Edges*



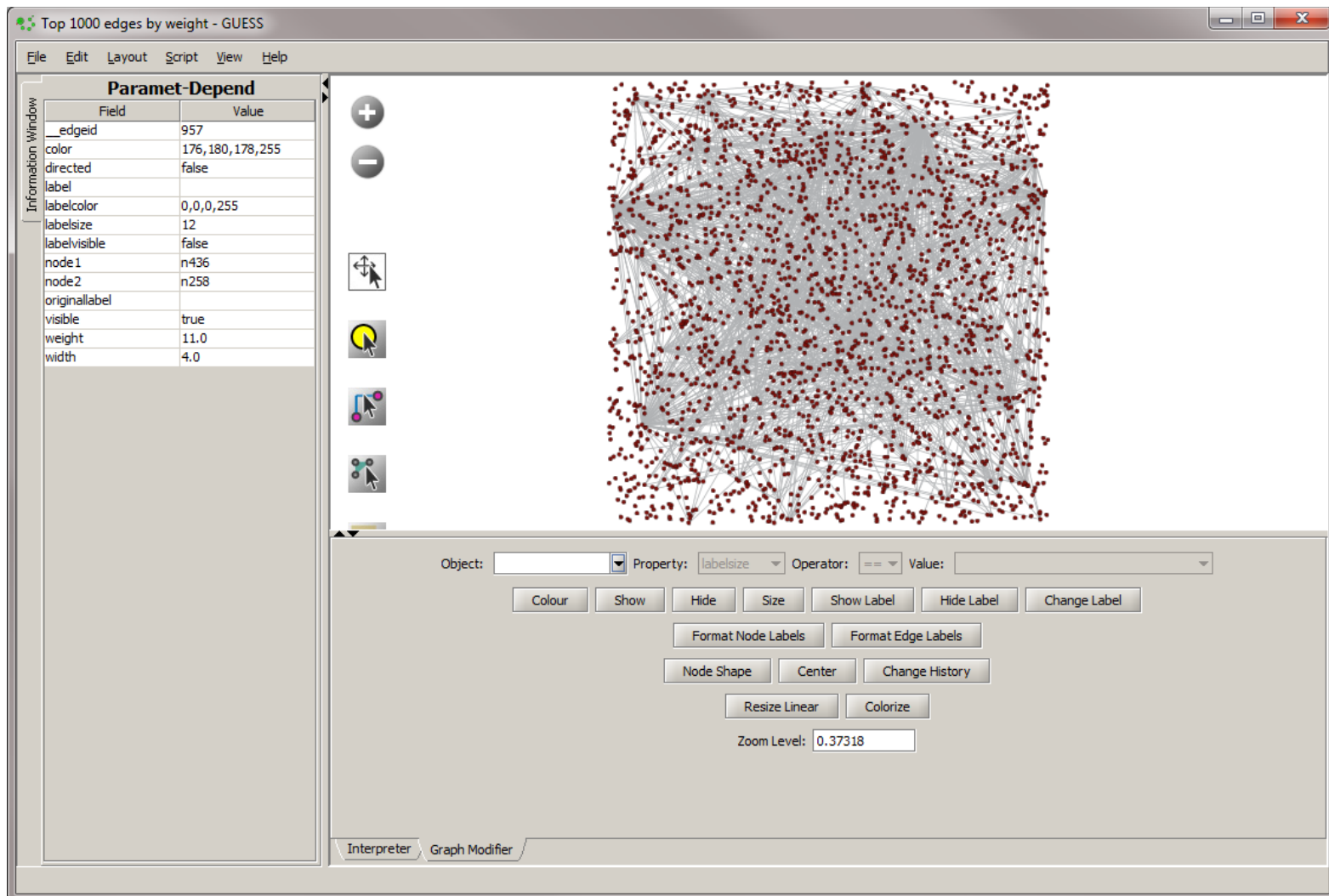
The screenshot shows the Sci2 Tool interface with the 'Preprocessing' menu open, and the 'Networks' sub-menu expanded to show 'Extract Top Edges'. The 'Data Manager' window shows a tree view of data files, including 'Laid out with Drl'. The 'Extract Top Edges' dialog box is open, showing the following options:

- Extract the top N edges from a graph, based on a given attribute
- Extract N top edges:
- Extract bottom edges instead?
- Numeric Attribute:
- Buttons: OK, Cancel

The Scheduler window at the bottom shows a list of algorithms with their execution dates and times:

Algorithm Name	Date	Time	Status
DrL (VxOrd)	06/26/2013	04:30:47 PM	Completed
DrL (VxOrd)	06/26/2013	04:21:36 PM	Completed
Extract Word Co-Occurr...	06/26/2013	04:10:34 PM	Completed
Lowercase, Tokenize, St...	06/26/2013	04:04:37 PM	Completed
Load...	06/26/2013	03:40:11 PM	Completed

Once edges have been removed, the network "top 1000 edges by weight" can be visualized by running *Visualization > Networks > GUESS*.



Top 1000 edges by weight - GUESS

File Edit Layout Script View Help

Paramet-Depend

Field	Value
_edgeid	957
color	176,180,178,255
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
node1	n436
node2	n258
originallabel	
visible	true
weight	11.0
width	4.0

Object: Property: Operator: Value:

Colour Show Hide Size Show Label Hide Label Change Label

Format Node Labels Format Edge Labels

Node Shape Center Change History

Resize Linear Colorize

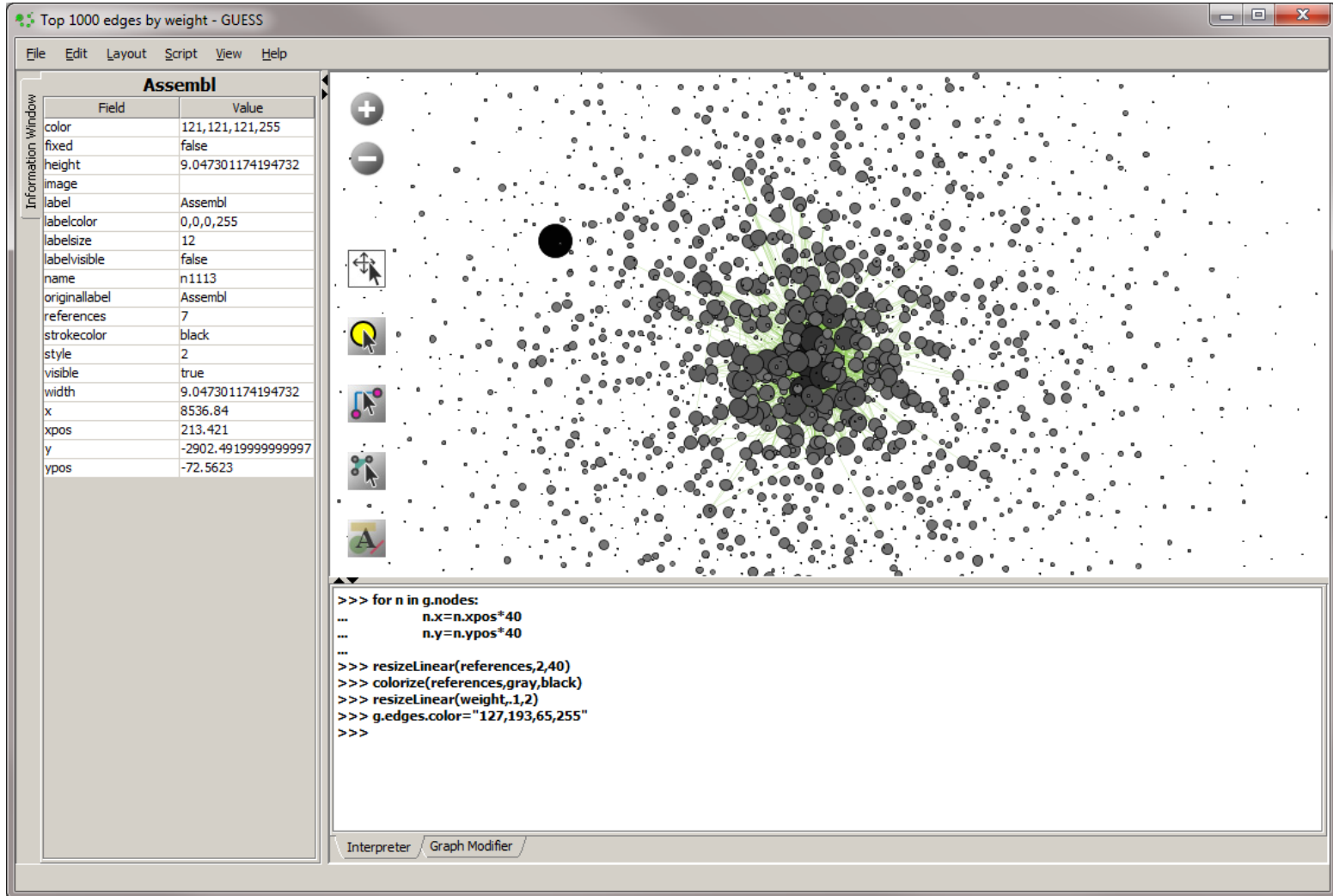
Zoom Level:

Interpreter Graph Modifier

In order to make use of the DrL (VxOrd) force directed layout we applied, we need to change to the interpreter at the bottom of the screen and type in the following commands:

```
>>> for n in g.nodes:
..     n.x = n.xpos*40
..     n.y = n.ypos*40
..
>>> resizeLinear(references,2,40)
>>> colorize(references,gray,black)
>>> resizeLinear(weight,1,2)
>>> g.edges.color = "127,193,65,255"
>>>
```

Note, GUESS will not necessarily display the graph in the middle of the screen, you may have to scroll around the screen to find the graph.



The screenshot shows the GUESS software interface. The title bar reads "Top 1000 edges by weight - GUESS". The menu bar includes "File", "Edit", "Layout", "Script", "View", and "Help".

On the left, the "Information Window" displays a table for the node "Assembl":

Field	Value
color	121,121,121,255
fixed	false
height	9.047301174194732
image	
label	Assembl
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
name	n1113
originallabel	Assembl
references	7
strokecolor	black
style	2
visible	true
width	9.047301174194732
x	8536.84
xpos	213.421
y	-2902.4919999999997
ypos	-72.5623

The main area displays a network graph with numerous nodes and edges. A large black node is visible on the left side of the graph. The graph is centered in the window, illustrating the note that it may not always be in the middle.

At the bottom, the "Interpreter" window shows the following Python code:

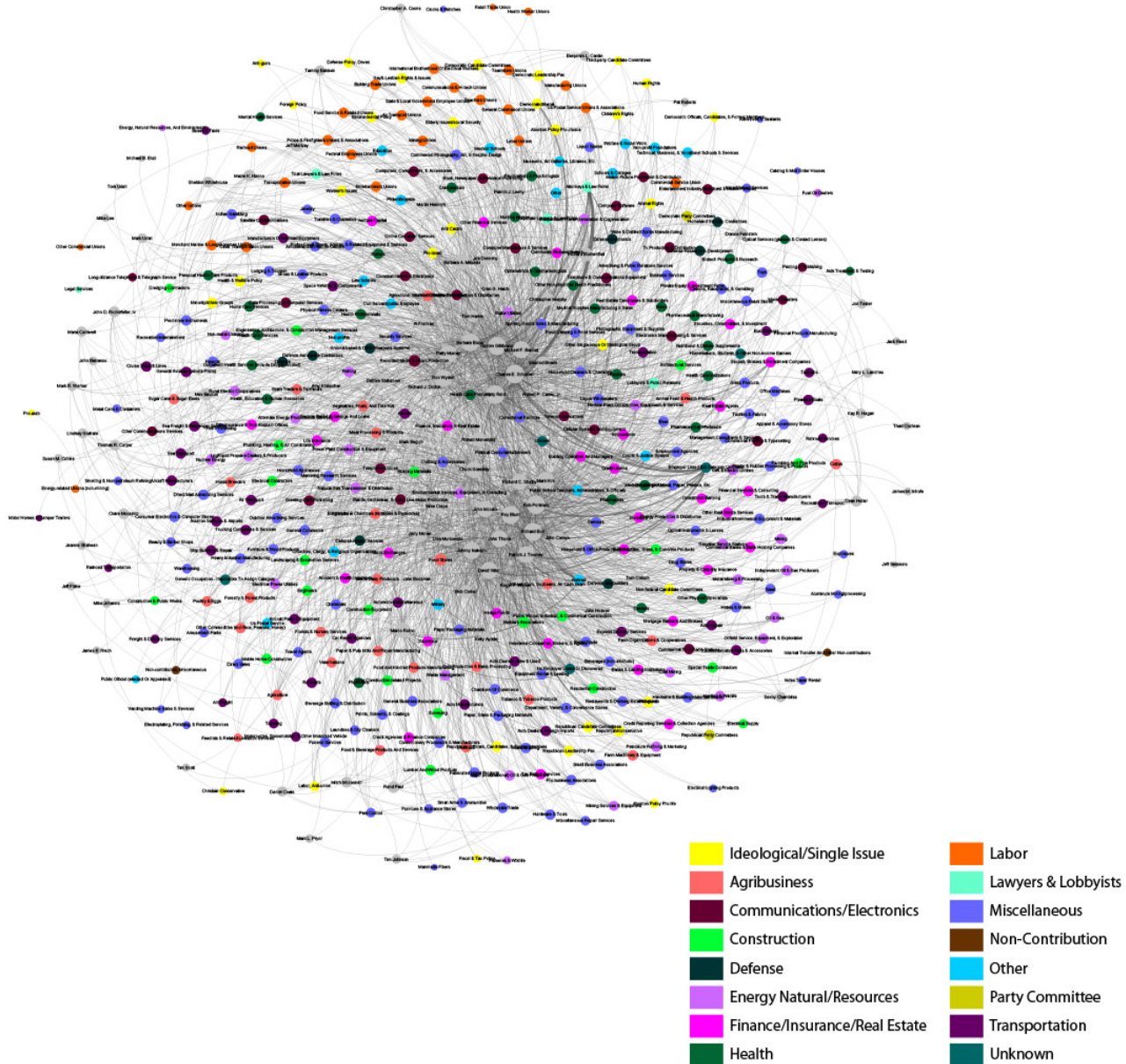
```
>>> for n in g.nodes:
...     n.x=n.xpos*40
...     n.y=n.ypos*40
...
>>> resizeLinear(references,2,40)
>>> colorize(references,gray,black)
>>> resizeLinear(weight,.1,2)
>>> g.edges.color="127,193,65,255"
>>>
```

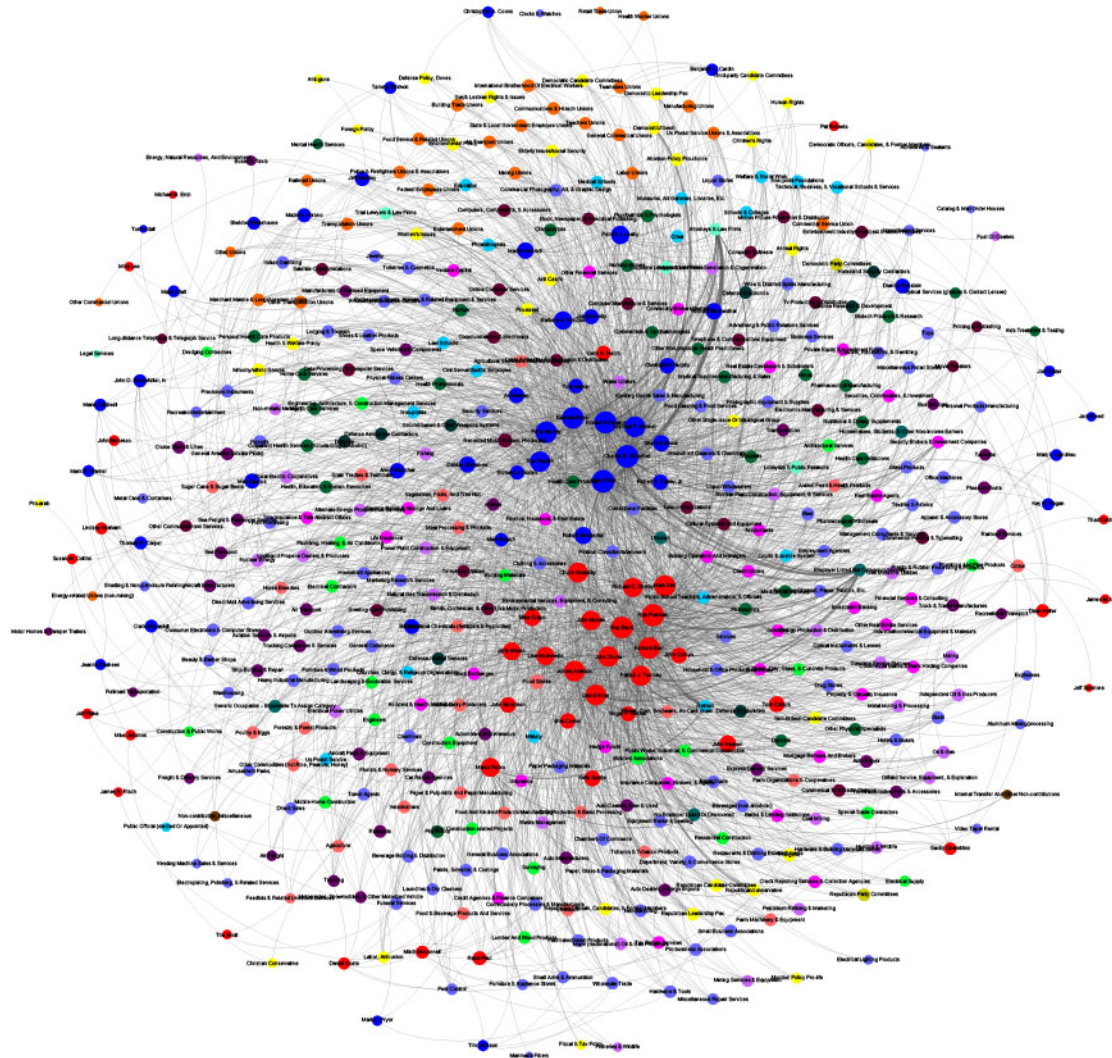
Questions?

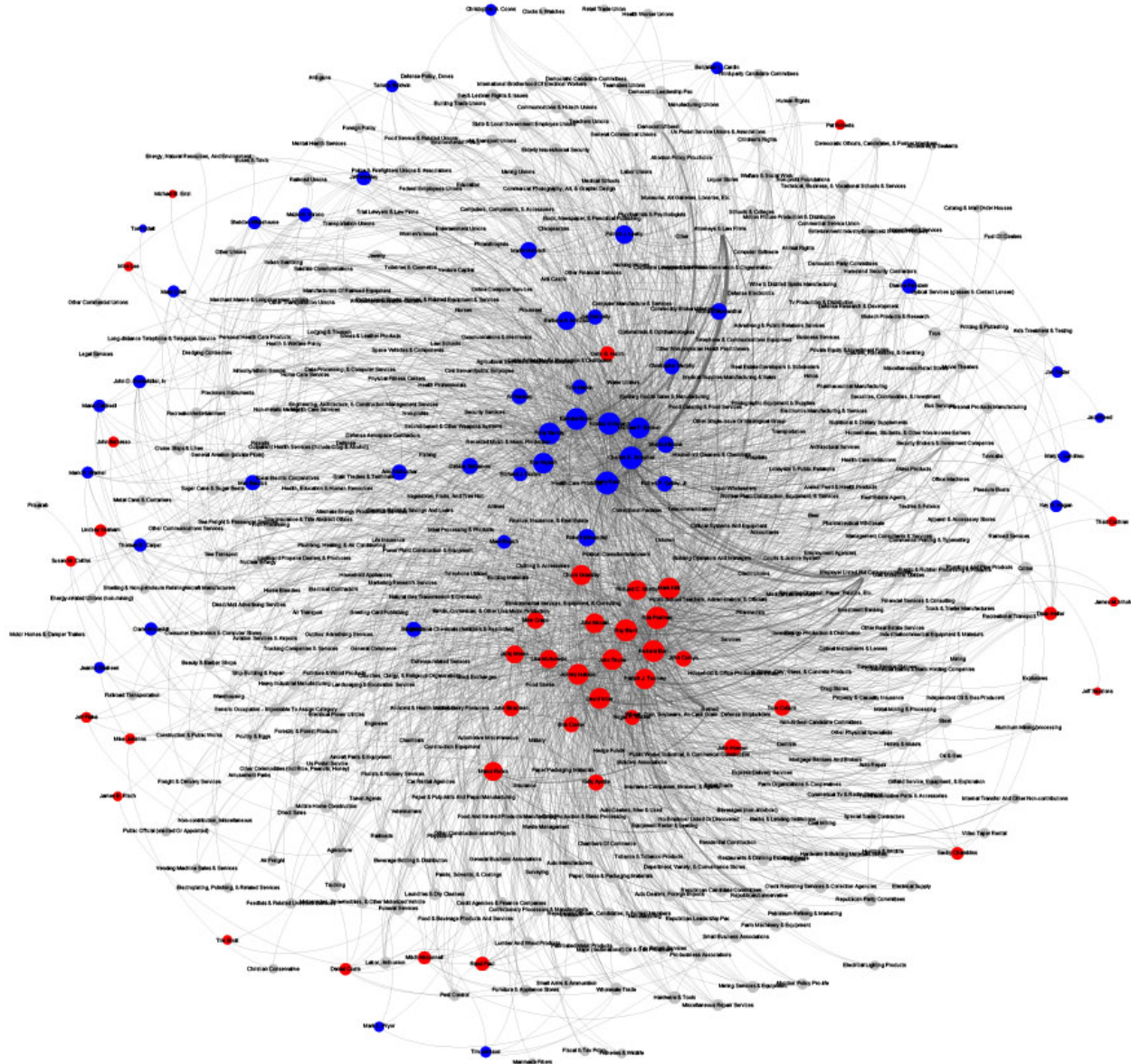
The Money Trail

These data were obtained from Open Congress (<http://opencongress.org>), a non-profit and non-partisan public resource supported by the [Participatory Politics Foundation](#) and the [Sunlight Foundation](#).

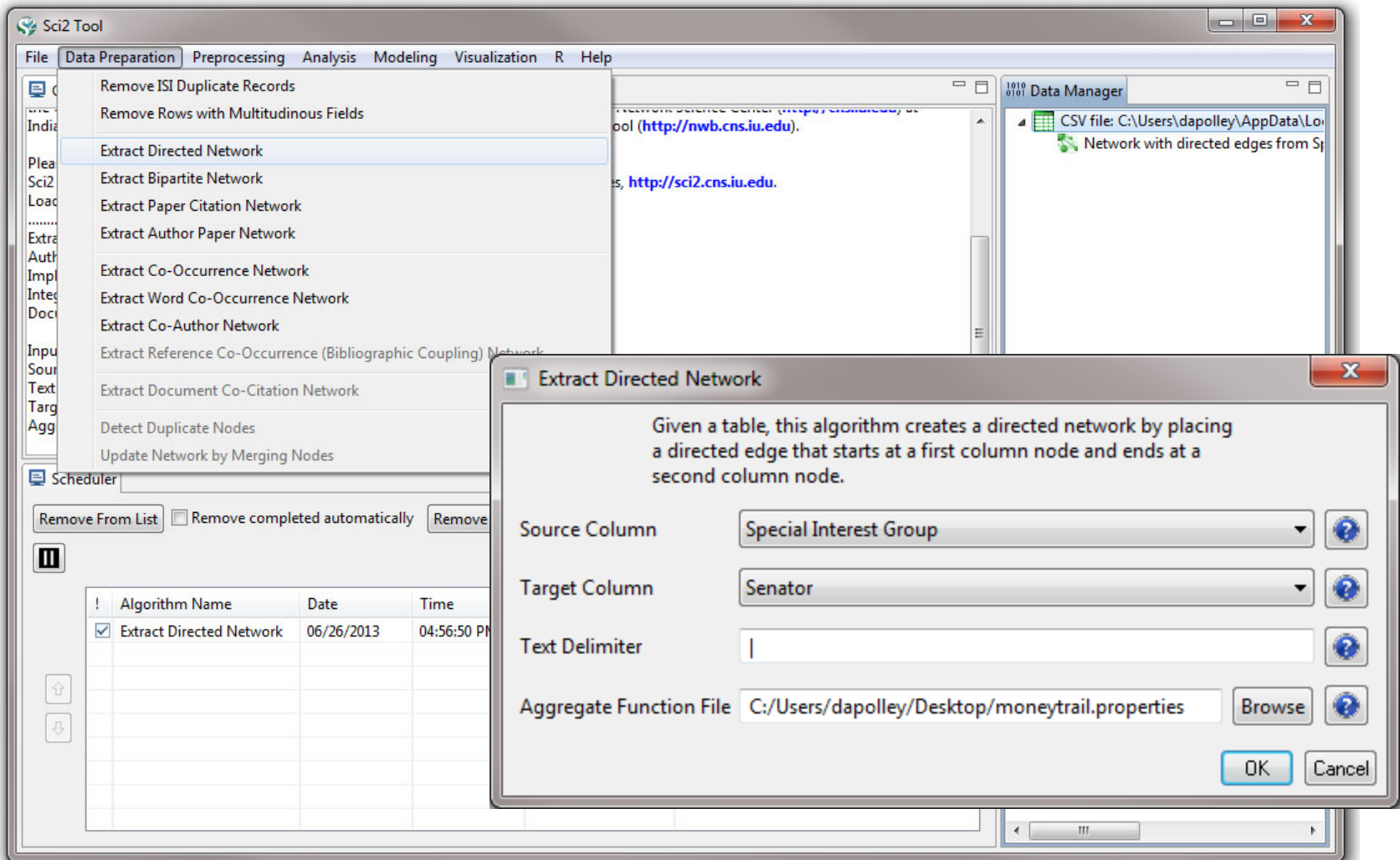
The dataset includes individual contributions from special interest groups to US Senators from 2009-2010, as reported by Congress. This is the most recent data available. The special interest groups have been assigned categories and then are grouped together by industries and economic sectors.







Extract a directed network from the special interest groups to the Senators, *Data Preparation > Extract Directed Network*



The screenshot shows the Sci2 Tool interface with the 'Data Preparation' menu open and the 'Extract Directed Network' option selected. A dialog box titled 'Extract Directed Network' is displayed in the foreground, providing instructions and configuration options for the algorithm.

Extract Directed Network

Given a table, this algorithm creates a directed network by placing a directed edge that starts at a first column node and ends at a second column node.

Source Column: Special Interest Group

Target Column: Senator

Text Delimiter: |

Aggregate Function File: C:/Users/dapolley/Desktop/moneytrail.properties

Buttons: OK, Cancel

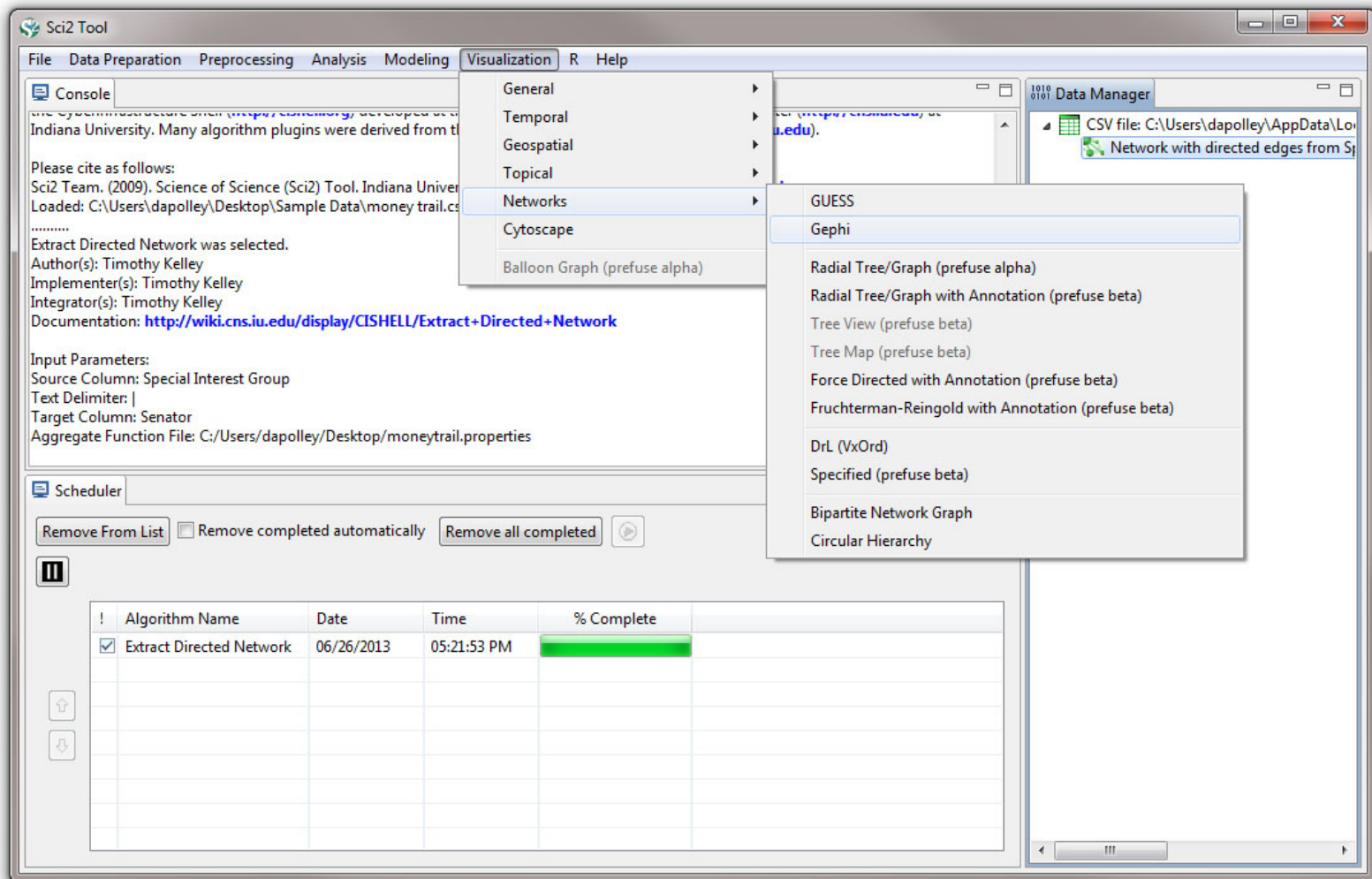
The background interface shows the 'Data Preparation' menu with the following options: Remove ISI Duplicate Records, Remove Rows with Multitudinous Fields, **Extract Directed Network**, Extract Bipartite Network, Extract Paper Citation Network, Extract Author Paper Network, Extract Co-Occurrence Network, Extract Word Co-Occurrence Network, Extract Co-Author Network, Extract Reference Co-Occurrence (Bibliographic Coupling) Network, Extract Document Co-Citation Network, Detect Duplicate Nodes, and Update Network by Merging Nodes. The 'Scheduler' tab is also visible, showing a table with the following data:

Algorithm Name	Date	Time
Extract Directed Network	06/26/2013	04:56:50 PM

Make sure to use the moneytrail.properties
aggregate function file

```
node.sector=Sector_Code.[source].mode  
node.party = Party_Code.[target].mode  
edge.weight = Amount_Received.sum
```

Visualize the network with Gephi, *Visualization > Gephi*



The screenshot shows the Sci2 Tool application window. The 'Visualization' menu is open, and 'Gephi' is selected. The console window displays the following text:

```

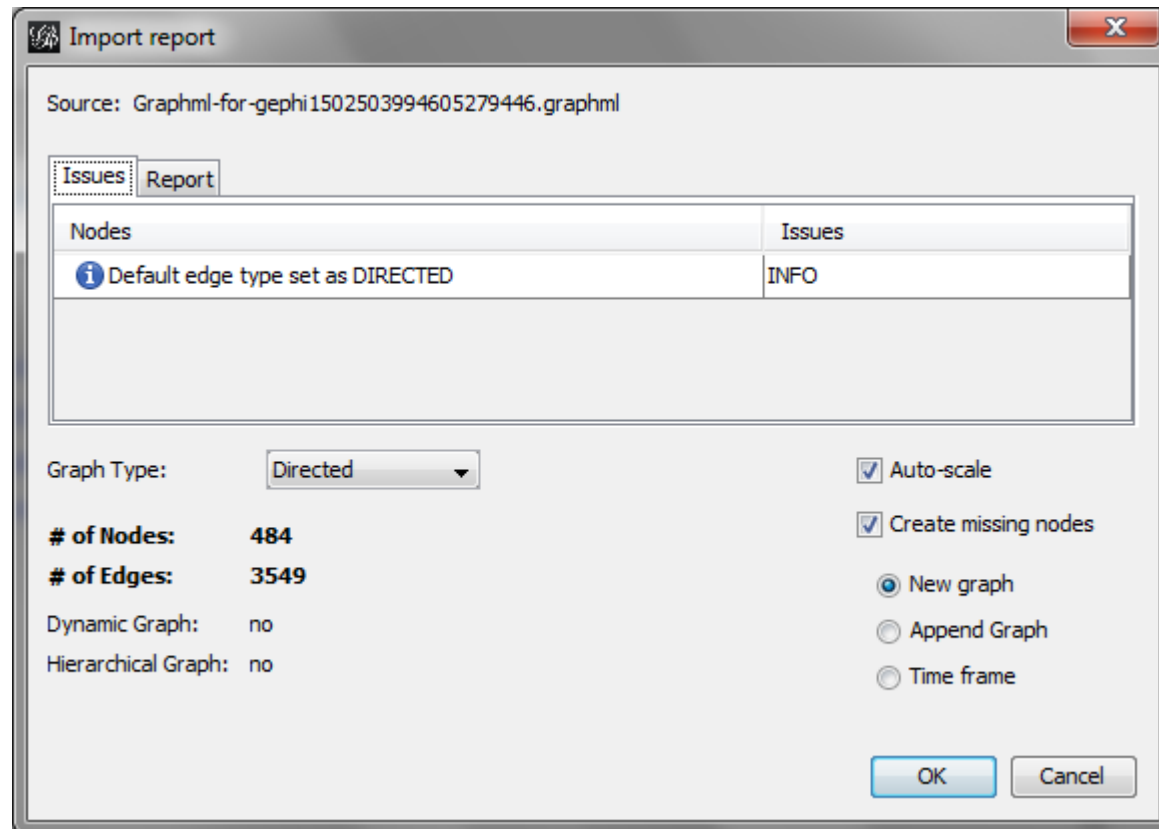
Please cite as follows:
Sci2 Team. (2009). Science of Science (Sci2) Tool. Indiana University.
Loaded: C:\Users\dapolley\Desktop\Sample Data\money trail.csv
.....
Extract Directed Network was selected.
Author(s): Timothy Kelley
Implementer(s): Timothy Kelley
Integrator(s): Timothy Kelley
Documentation: http://wiki.cns.iu.edu/display/CISHELL/Extract+Directed+Network

Input Parameters:
Source Column: Special Interest Group
Text Delimiter: |
Target Column: Senator
Aggregate Function File: C:/Users/dapolley/Desktop/moneytrail.properties
  
```

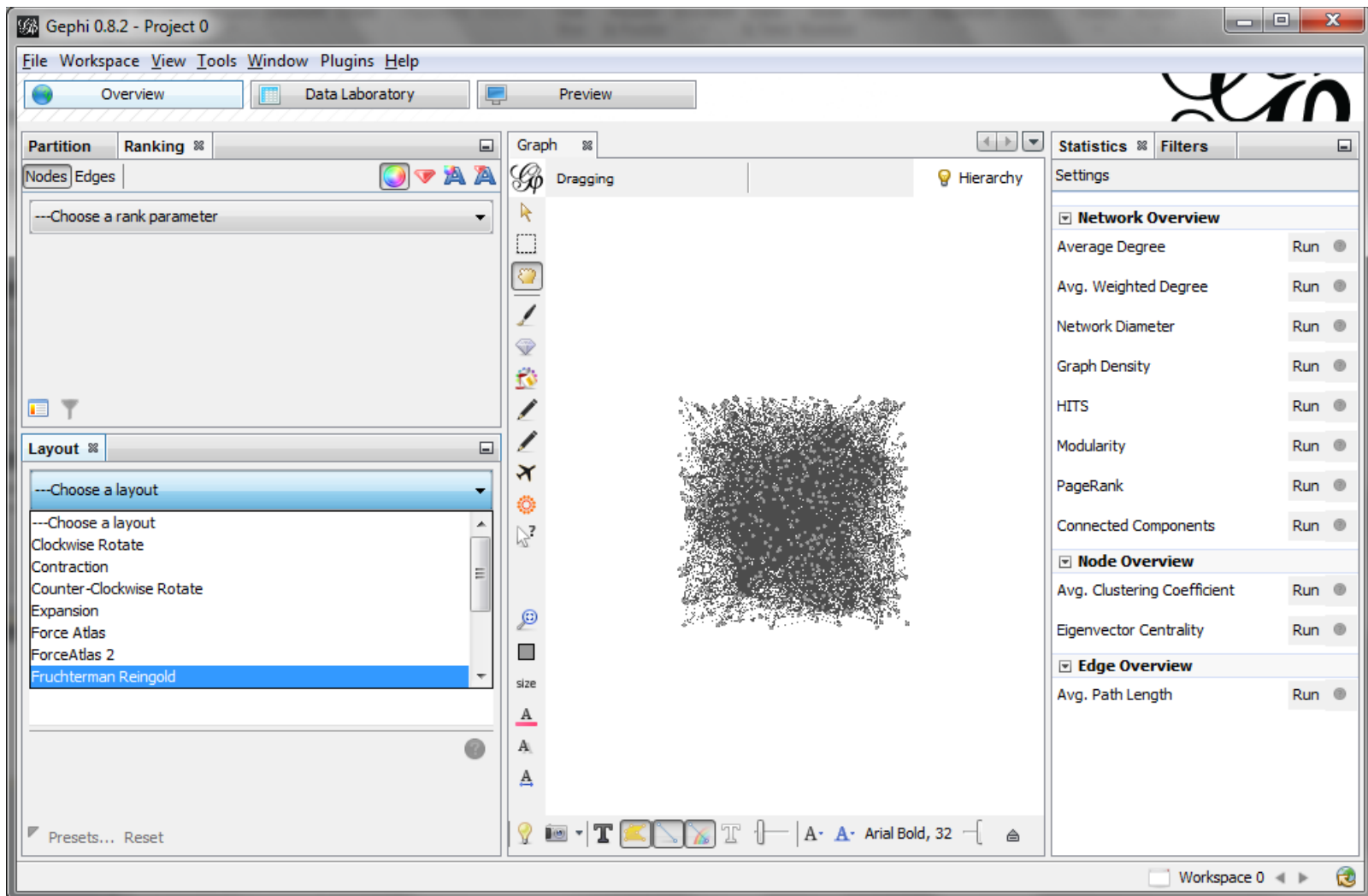
The Scheduler window shows a table with the following data:

!	Algorithm Name	Date	Time	% Complete
<input checked="" type="checkbox"/>	Extract Directed Network	06/26/2013	05:21:53 PM	<div style="width: 100%; height: 10px; background-color: green;"></div>

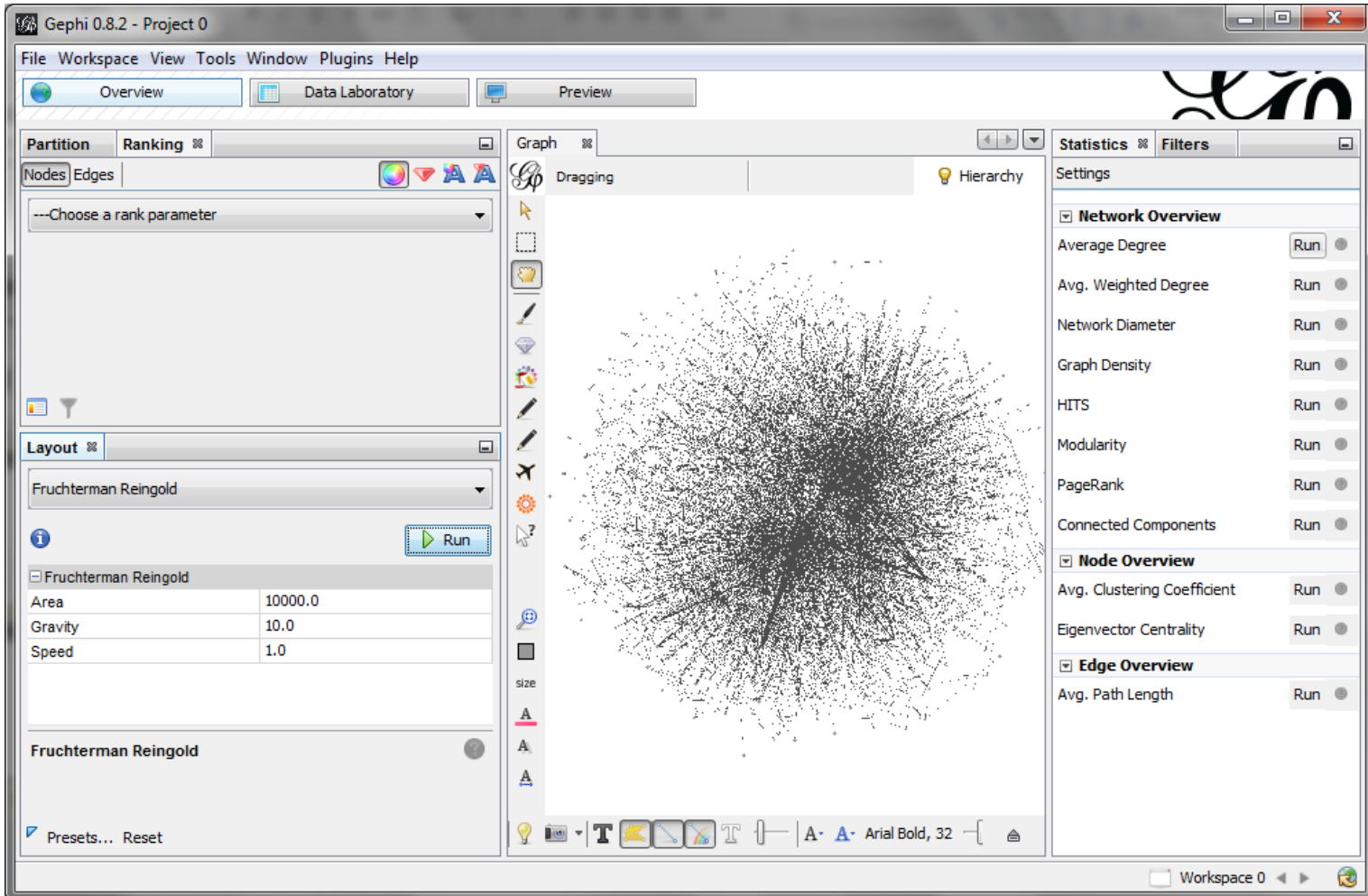
You will be presented with a load report before the network can be opened in Gephi, click OK.



The network will be laid out randomly at first, Apply the *Fruchterman Reingold* layout and click run.



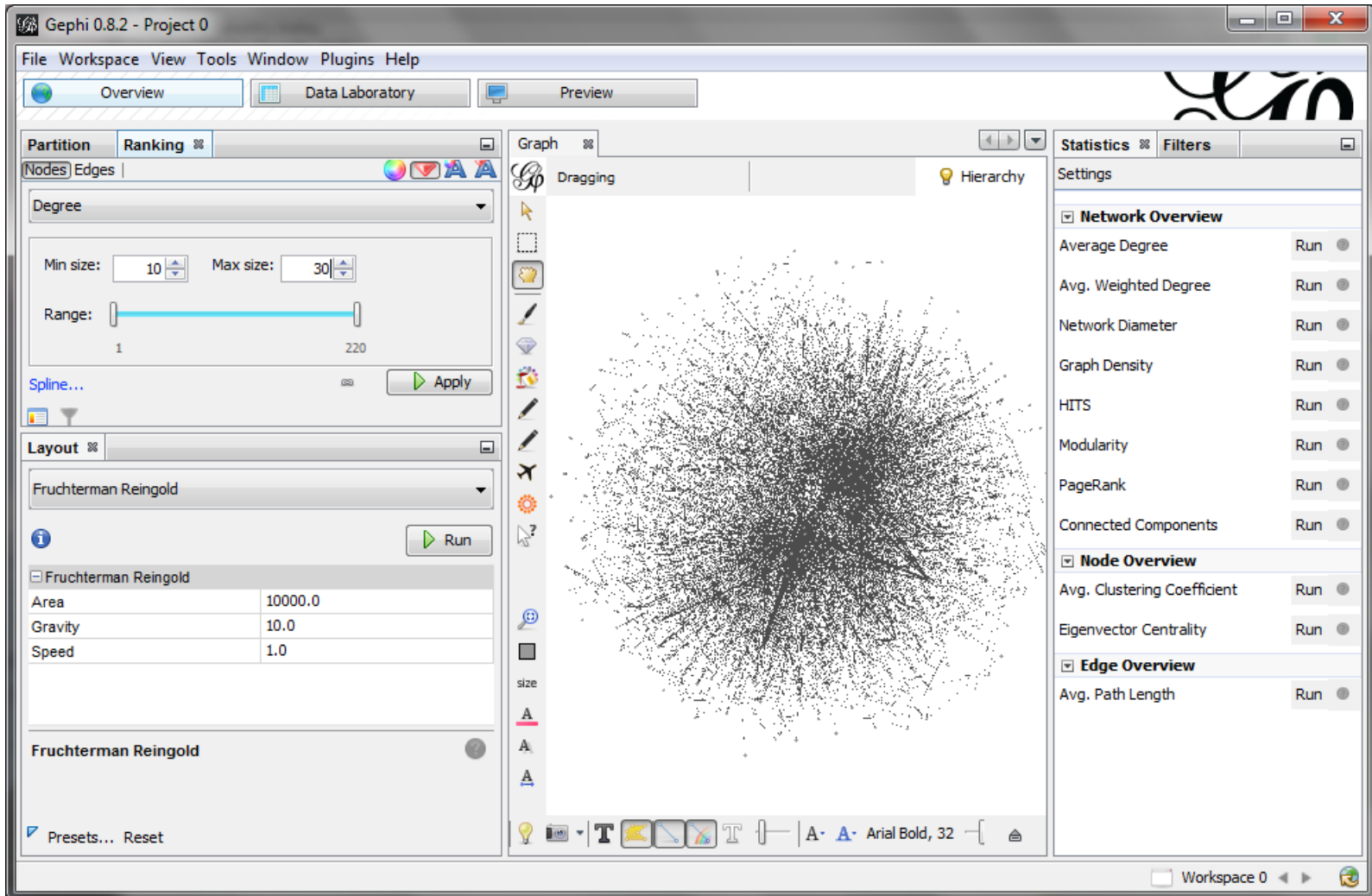
To resize the nodes based on the number of connections, calculate the average degree by using the Network Overview window.



The screenshot shows the Gephi 0.8.2 interface with a network graph in the center. The graph is a dense, circular network of nodes and edges. The interface includes a menu bar (File, Workspace, View, Tools, Window, Plugins, Help) and a toolbar with various icons. On the left, there are panels for Partitioning (Nodes, Edges) and Layout (Fruchterman Reingold). On the right, the Statistics panel is open, showing the Network Overview section with various metrics and their corresponding 'Run' buttons.

Network Overview	
Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
HITS	Run
Modularity	Run
PageRank	Run
Connected Components	Run
Node Overview	
Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run
Edge Overview	
Avg. Path Length	Run


Choose the  icon and set the Ranking Parameter to *Degree*. Then scale the nodes from 10 to 30.

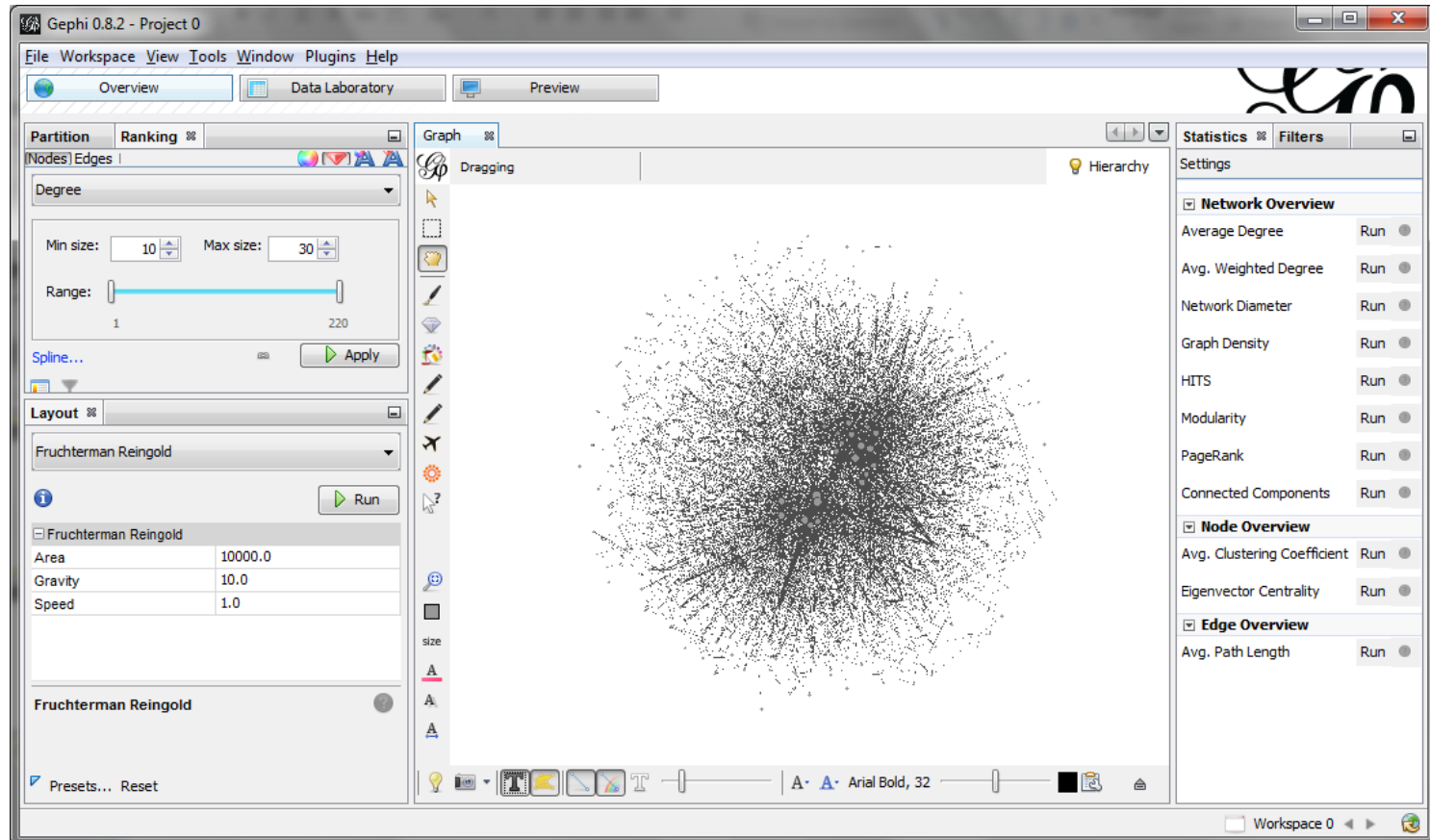


The screenshot shows the Gephi 0.8.2 interface with the following settings:

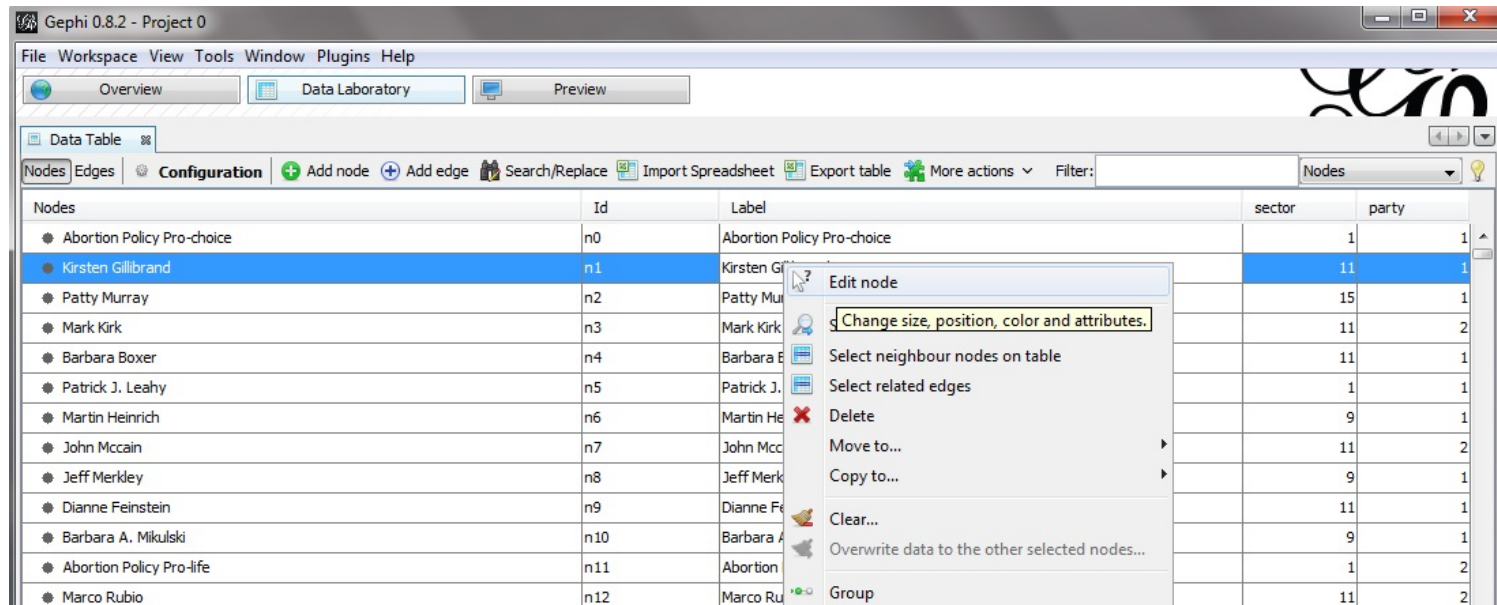
- Partition:** Ranking (selected)
- Ranking:** Degree (selected)
- Min size:** 10
- Max size:** 30
- Range:** 1 to 220
- Layout:** Fruchterman Reingold
- Network Overview Statistics:**
 - Average Degree: Run
 - Avg. Weighted Degree: Run
 - Network Diameter: Run
 - Graph Density: Run
 - HITS: Run
 - Modularity: Run
 - PageRank: Run
 - Connected Components: Run
- Node Overview Statistics:**
 - Avg. Clustering Coefficient: Run
 - Eigenvector Centrality: Run
- Edge Overview Statistics:**
 - Avg. Path Length: Run

The central graph area displays a dense network visualization with nodes scaled according to their degree.

To apply labels to the nodes. Select the label icon  from the toolbar below the visualization.



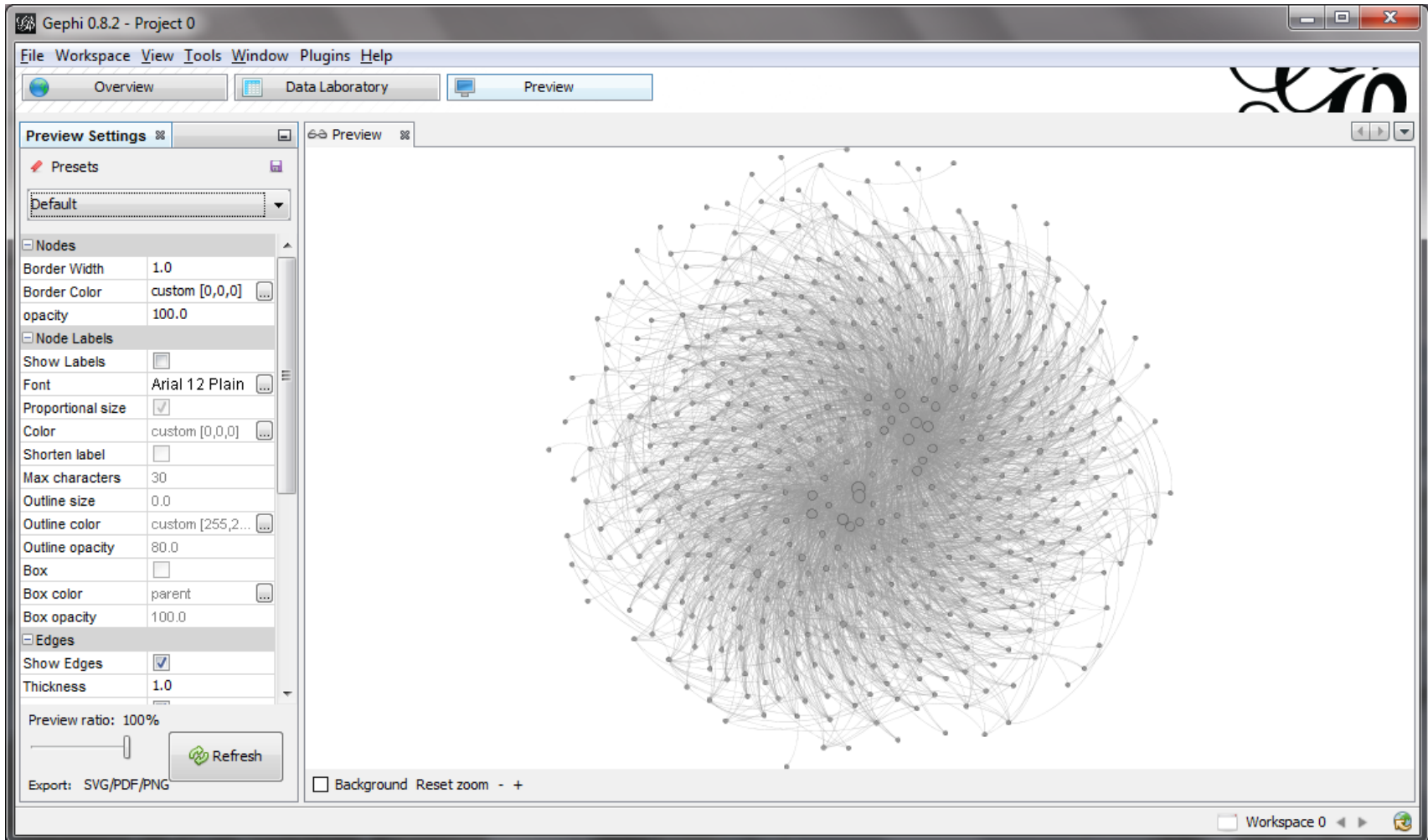
To edit node attribute such as changing the color, switch over to the *Data Laboratory* view, right-click on the nodes, and select *Edit Node*.



Nodes	Id	Label	sector	party
Abortion Policy Pro-choice	n0	Abortion Policy Pro-choice	1	1
Kirsten Gillibrand	n1	Kirsten Gillibrand	11	1
Patty Murray	n2	Patty Murray	15	1
Mark Kirk	n3	Mark Kirk	11	2
Barbara Boxer	n4	Barbara Boxer	11	1
Patrick J. Leahy	n5	Patrick J. Leahy	1	1
Martin Heinrich	n6	Martin Heinrich	9	1
John McCain	n7	John McCain	11	2
Jeff Merkley	n8	Jeff Merkley	9	1
Dianne Feinstein	n9	Dianne Feinstein	11	1
Barbara A. Mikulski	n10	Barbara A. Mikulski	9	1
Abortion Policy Pro-life	n11	Abortion Policy Pro-life	1	2
Marco Rubio	n12	Marco Rubio	11	2

You can select multiple nodes and edit their properties simultaneously. For example, you could choose all the Democratic Senators and color the nodes that represent them blue.

Switch to the Preview window to finalize your visualization. Use the Preview Settings to add the finishing touches and then export your visualization in a variety of formats.



Questions?