Domain Specific: Social Science

Tutorial originally prepared for Sunbelt 2008 by Ann McCranie, Department of Sociology, Indiana University, Bloomington, amccrani@indiana.edu.

For this example, we will use PSYCHCONSULT, an extract from the Staff Study of the Indianapolis Network Mental Health Study. This is a file in the Network Workbench (*.nwb) format, a basic edge-list format that can include node and edge attribute information in a text file. It is a directed (asymmetric) unvalued (unweighed) network that represents the consultation choices among the staff that work in a psychiatric hospital.

1 Load Data

Load the PSYCHCONSULT data after launching the NWB Tool with FILE--> LOAD. Choose the PSYCHCONSULT.nwb data located in the SAMPLEDATA/NETWORK folder. This folder will be located in your NWB Installation Directory.

Once you have loaded this network, you will see it appear in the right-hand "Data Manager" window. You may right-click on this network and choose "View" to look at the contents. You may also open this file separately in a text editor to explore it or make changes. Please note that as you work, new files will be created in the Data Manager window. You may choose to save these files in various formats, and you will need to make sure that you have highlighted the network file that you wish to work in.

2 Basic Network Properties

As a matter of practice, you may want to learn a little about your network and confirm that it was read correctly into NWB. The Network Analysis Toolkit provides a quick overview of your network: Analysis-> Network Analysis Toolkit (NAT).

If you run this on the PSYCHCONSULT network, you will find that you have a directed network with 113 nodes and no isolated nodes. There are two node attributes present: the node label (which is, in this case, the job title of all of the employees) and the area (in this network, the unit in which the employee generally worked). You can also see that you have 861 edges, no self-loops or parallel edges, and no edge attributes. A common edge attribute is weight (value), but this network is unweighted.

The network is weakly connected - each node is connected to another node in the main component with no isolates. It is not strongly connected, however, as some nodes are unreachable (they send, but do not receive ties). You will also see the network's density reported.

If you should find isolates or self-loops in your data, they could pose problems for several algorithms that are currently implemented. NWB offers options for dealing with these issues: Preprocessing --> Remove Self Loops and Preprocessing--> Delete Isolates.

These options will create a new network file in the Data Manager window. You can then select this network and save it with a new name.

3 Network Analysis

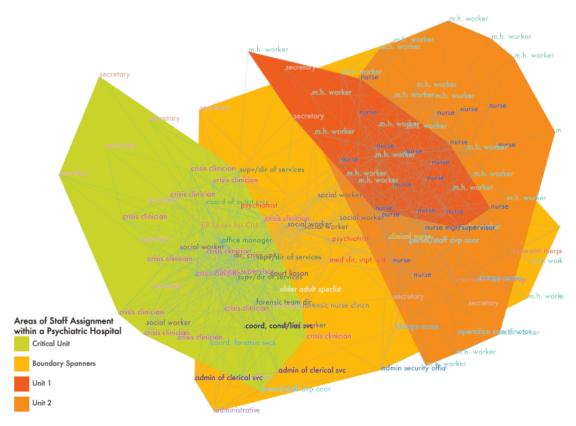
NWB implements a few basic algorithms that you can use with an unweighted and directed network like PSYCHCONSULT. Make sure your network is highlighted in the Data Manager window.

• In-degree and out-degree centrality can be calculated with Analysis --> Unweighted & Directed --> Node Indegree.

Note that this will actually create two files: a text file with a sequence of the in-degree centrality of the nodes and a new network file that has appended the in-degree as an integer attribute. Choose this network file, apply the Node Outdegree centrality algorithm and you can create a new network with both measures as attributes.

• Reciprocity can be calculated with Analysis --> Unweighted & Directed --> Dyad Reciprocity. This will give you a network-level reciprocity measure. In this network, 17.5 percent of dyads are reciprocal.

4 Visualization



There are several visualization options under development in the NWB tool. To replicate the one shown at this poster presentation, you will need to use the GUESS package, which is an implementation of the opensource program developed by Eytan Adar. To learn more about this package, visit

http://graphexploration.cond.org/index.html and be sure to look at the manual and wiki site. With the original PSYCHCONSULT file you loaded into NWB highlighted (should be the top of the Data Manager) choose Visualization --> GUESS. For this relatively small network, the loading time will be a few seconds. You will see a second window appear with a network. In this new window, choose Layout --> Kamada-Kawai.

You may choose to repeat this layout multiple times. The basic shape and layout of the network will remain the same, but you will notice the orientation changing. You can also drag and enlarge the window that the network is in. To see specific information about nodes or edges, choose View --> Information Window.

As you pass your mouse over the edges and nodes in the network, you will see specific information about these nodes. In order to zoom into the network, right-click on the black space around the network and drag to the right. Drag left in order to zoom out. Dragging with the left mouse button will move the entire network. If you "lose" the network, choose View --> Center.

Currently there are only a few menu-based interfaces for the rich options of GUESS. For instance, you can change the background color under Edit -> Background Color. To take advantage of some of the other options of GUESS, you can actually type commands into the console (located in the bottom at >>>) or you can create a script file - a simple text file with the extension *.py, such as PSYCHCONSULT.py Either type the following commands into the console or create a .py file in a text editor. To run the script file, chose Script -> Run Script... and choose your newly created script file.

g.nodes.labelvisible=true for node in g.nodes: node.x=node.x*10 node.y=node.y*10 (label=="psychiatrist").color=red (label=="med dir, inpt. unit").color=red (label=="nurse").color=blue clusts = groupBy(area) for c in clusts: createConvexHull(c,randomColor(50))

After you have entered these commands or run this script file, your network might disappear off-screen. Choose View --> Center to return to the network.

These commands make the labels visible, change the sizes of the nodes and edges, colors the labels (the same color being assigned to nodes that have the same label of job type, and colors psychiatrists and the medical director red, while nurses are colored blue). The script also creates "hulls," or demarcations of areas of the network based on the attribute of area. You can experiment with the random colors assigned to the hulls by rerunning this script or line.

To save your visualization, choose FILE--> EXPORT IMAGE.