ORA User's Guide 2022

Neal Altman & Kathleen M. Carley
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Institute for Software Research
School of Computer Science
Carnegie Mellon University
Pittsburgh, PA 15213

 Center for the Computational Analysis of Social and Organizational Systems

CASOS technical report.

Abstract

ORA is a tool for network analysis, network visualization, and network forecasting. Entities and relationships are represented using meta-networks. By employing meta-networks ORA can handle multi-mode, multi-plex, multi-level networks. It can identify key players, groups and vulnerabilities, model network changes over time, and perform COA analysis. It contains hundreds of social network metrics, dynamic network metrics, and trail metrics, as well as procedures for grouping nodes, identifying local patterns, comparing and contrasting networks, groups, and individuals from a dynamic meta-network perspective. ORA generates formatted reports viewable on screen or in files and reads and writes networks in multiple data formats interoperable with existing network analysis packages. In addition, it has tools for graphically visualizing meta-network data and for optimizing a network's design structure. ORA uses a Java interface for ease of use and a C++ computational back end.

This report provides an overview of important ORA features and key concepts, along with resources for new users to learn how to use ORA.

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Introduction

ORA is an analysis tool designed to help the user create and evaluate one or more networks. It can be used to assess the nature of, features of, change in, and determinants of complex networks. A large variety of networks can be assessed including, but not limited to, social networks, activity networks, task networks, knowledge networks, supply chains, and communication networks. Using ORA, questions such as the following can be addressed: what is critical, are there groups of interest, are there patterns of interest, how might interventions impact the network, who is critical, are there emerging groups, how is the network changing.

This Manual

Unlike prior versions of the ORA User's Guide, this manual is an introduction to ORA not a reference guide. It covers, in brief, the following topics:

- Obtaining and installing ORA
- Additional resources for learning and using ORA
- Key concepts
- ORA components and modes of operation
    - ORA as part of a tool chain
    - Creating, modifying, and saving networks using ORA
    - Visualizing networks
    - Analyzing networks

ORA is a constantly evolving tool, and this manual will focus on ORA as it exists in the version current at the time of writing.

Obtaining ORA

Currently ORA is available for computers running Windows or macOS operating systems in two versions:

- **ORA-LITE** is a free but capacity limited[1] version for research and teaching purposes running under Windows available from the center for Computational Analysis of Social and Organizational Systems (CASOS) at Carnegie Mellon University: http://casos.cs.cmu.edu/projects/ora/

  NOTE: The Windows version of ORA-LITE can be run on a macOS system using virtual machine software (e.g., Parallels, VMWare).

- **ORA-PRO** is an unrestricted version for commercial users and academics working with large data sets, running under both Windows and macOS available for purchase from Netanomics: www.netanomics.com

ORA is distributed as a self-extracting installer. The installation process on a single system consists of the following steps:

- Obtain a copy of the current ORA installer and, for ORA-PRO, a license key.
- Load the installer on the target system.
- Execute the installer.
- The installer will step through the installation process, prompting the user for certain inputs. The only required user input is the license key for ORA-PRO, all other options have sensible default values.

As noted above, running ORA-LITE under macOS will require a virtual machine to emulate the Windows execution environment.

ORA will run on systems of any size; naturally systems with slower processing speeds and smaller amounts of memory will have less ability to handle large networks and complex analyses.

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[1] ORA-LITE is itself limited to a maximum of 2,000 nodes per entity class. Thus, a Meta-Network can have 2000 agents, 2000 organizations, and so on.

Resources for Learning ORA

A working copy of ORA itself is the best tool for learning about the tool. The Obtaining ORA section describes the available versions.

ORA Google Group

The ORA Google Group provides a forum for questions, collaborations, and information related to CASOS tools. Please visit this link for instructions on becoming a member of the ORA Google Group: How to Join the ORA Google Group.

Help

ORA includes extensive documentation as part of the installed software. The ORA help functions as the reference manual for ORA. ORA help can be accessed through the ORA GUI's menu bar by selecting Help > Help Contents. A separate help window will open:
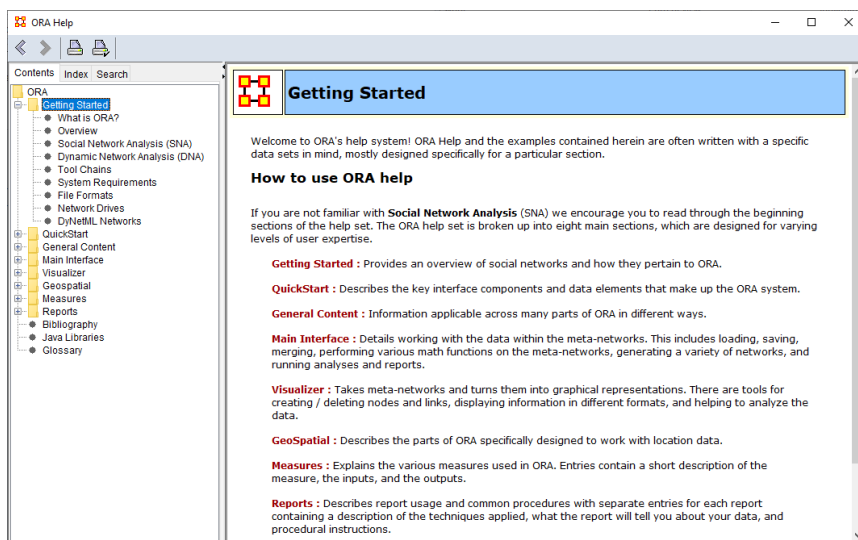
The left pane in the window is used to navigate through the help and provides several methods to access the information. The right pane displays the help content.

The Contents tab, shown in the image above, presents a hierarchical view of the help contents, which can be expanded and contracted using the ⊞ and ⊟ icons to the left. Each of the folders contains subfolders and content pages (folders also include content). The currently selected folder/page is highlighted. In the image, the Getting Started folder has been selected (the folder's text is displayed in the right pane) and the folder content list has been expanded and visible below the folder. Clicking on any item name in the left pane displays the information for that item in the right pane.

Links in the ORA content are also provided for convenience. Clicking them will move to the linked content page and update the navigation pane. The forward and back keys shown at the top left move forward and backward one page in the user's browsing history.

References to additional information available in the ORA help are shown throughout this document either using text boxes of the form:

For information on additional concepts, see the **General Content** *section of the ORA help.*

or are cited inline (in lists) using the form [see **Visualizer > Visualizer Basics > Add Deltas**]. Note that the reference is given in terms of the Contents pane hierarchy. The inline reference shown above is read as "see the **Visualizer** folder's **Visualizer Basics** subfolder's **Add Deltas** content page".

Note that despite the blue coloration, these references are not clickable links.

Data

The CASOS web site provides sample network analysis data for download (http://www.casos.cs.cmu.edu/tools/data2.php). These include CASOS developed data sets and publicly available dataset developed by the network community.

Some of the CASOS data sets are used as examples in the ORA help entries.

Training

CASOS holds an annual Summer Institute (http://www.casos.cs.cmu.edu/events/summer_institute/), a week-long event that provides an intense hands-on introduction to network analysis and visualization from a combined social-network, network-science, link-analysis, and dynamic network analysis perspective. ORA is one of several CASOS developed software tools provided for hands-on use. Participants are encouraged to bring their own data.

Netanomics can provide on-site training and consulting (https://netanomics.com/products-2/).

Key Concepts

ORA is a statistical analysis package for analyzing complex systems as Dynamic Social Networks.

Many complex systems such as organizations, intra-state alliances, food webs, etc. can be represented as an ecology of interlinked networks. Within ORA any complex system is represented as a network.

What is a network? In any data there are relations among things such as two people are cousins, or a set of people are all members of the same club. These networks might be psychological or cultural as when two people share the same belief. They might be physical as in two resources being in the same location or two computers being connected by a line, or they might be social as in people being related. There are many reasons why networks exist. Networks are ubiquitous. Everyone and everything is constrained and enabled by the networks in which they are embedded. Everyone and everything is embedded in multiple networks; e.g. you are connected to some people due to work, others due to school, others due to your kids, and so on. ORA lets you visualize, assess, and reason about these networks.

For information on additional concepts, see the **General Content** *section of the ORA help.*

Social Network Analysis (SNA)

Social Network Analysis is a scientific area focused on the study of relations, often defined as social networks.

In its basic form, a social network is a network where the people (entities) and the relations (links) are a form of connection such as friendship. Social Network Analysis takes graph theoretic ideas and applies them to the social world.

The term social network was first coined by J. A. Barnes (1954). Social network analysis is also called network analysis, structural analysis, and the study of human relations. SNA is often referred to as the science of connecting the dots.

Today, the term Social Network Analysis (or SNA) is used to refer to the analysis of any network such that all the entities are of one mode (e.g. all people, or all roles, or all organizations), or at most two mode (e.g. people and the groups they belong to). The metrics and tools in this area, since they are based on the mathematics of graph theory, are applicable regardless of the type of nodes in the network or the reason for the connections.

For most researchers, the entities are actors. As such, a network can be a cell of terrorists, employees of global company or simply a group of friends. However, entities are not limited to actors. A series of computers that interact with each other or a group of interconnected libraries can comprise a network also.

Dynamic Network Analysis (DNA)

Dynamic Network Analysis (DNA) is an emergent scientific field that brings together traditional social network analysis (SNA), link analysis, and multi-agent systems. There are two aspects of this field. The first is the statistical analysis of DNA data. The second is the utilization of simulations to address issues of network dynamics. DNA networks vary from traditional social networks in that they are larger, multi-mode, multi-plex networks, and may contain varying levels of uncertainty.

DNA statistical tools are generally optimized for large-scale networks and admit the analysis of multiple networks simultaneously in which there are multiple types of nodes (multi-node) and multiple types of links (multiplex). In contrast, SNA statistical tools focus on one or at most two mode data and facilitate the analysis of only one type of link at a time.

DNA statistical tools tend to provide more measures to the user because they have measures that use data drawn from multiple networks simultaneously. From a computer simulation perspective, nodes in DNA are like atoms in quantum theory in that they can be, though need not be, treated as probabilistic.

Whereas nodes in a traditional SNA model are static, nodes in a DNA model have the ability to learn. Properties change over time; entities can adapt: A company's employees can learn new skills and increase their value to the network; or, kill one terrorist and three more are forced to improvise. Change propagates from one entity to the next and so on. DNA adds the critical element of a network's evolution and considers the circumstances under which change is likely to occur.

Nodes and Networks

ORA is a tool for analyzing networks. This document is not intended to be a full introduction to network concepts but instead will focus on how ORA represents and organizes networks. For this purpose, a network representation is a set of nodes and relations. Typical networks include social networks (who interacts with whom), financial networks (who lends money to whom); Gantt charts (what task needs to be done before what), supply chains (what resources are needed to build what other resources), semantic networks (what ideas are linked to what ideas), proximity networks (what states border on what states), and so on.

Network analysis has generally focused on two dimensional networks, representing the relations either between a single group (e.g., the connections between the members of a family, where only one set of nodes is used (i.e., a list of family members) or the relations between two sets of groups (e.g., the connections between authors and articles they have written) where two different sets of nodes are used (i.e., a list of authors and a list of articles).

ORA fully supports these kinds of networks but recognizes that is often useful to group related networks and treat them as a single unit. For instance, networks derived from a collection of bibliographic citation data might include Article x Author, Article x Publication Venue, Article x Topic, Co-Authorship, etc. ORA therefore places all nodes and networks into a container class, the meta-network.

Meta-Networks

A **meta-network** is a container for nodesets and networks. It may contain zero to many nodesets and networks.

A meta-network contains the following components:

Nodeset : A collection of nodes and their attributes. All nodes are assigned to a nodeset and nodes within a nodeset are considered to be of the same kind. A nodeset is always assigned a nodeset class.

> **Node** : An individual "thing", either material or immaterial, such as a real-world item (person, place, tool), a concept or belief (process, procedure, system) or any other unit of interest (a word, event, geological era).

> **Attribute** : Additional information about a node. Attributes are defined at the nodeset level while attribute data is held at the node level (e.g. the attribute age is defined for an agent nodeset and

each node will hold a numeric value recording that agent's age). An attribute may hold multiple values for a node or be restricted to a single value.

Attributes are typed using predefined types: "Text", "Text Category", "URI", "Number Category", "Number", "Date". The attribute type identifies the field contents for certain ORA tools.

An attribute ID is required, which must be unique within a nodeset. Certain attribute IDs have special meanings to certain ORA components: "Alias", "Longitude", "Latitude", "MGRS", "Node Image", "Node Type", "Title" and "UTM". For instance, if Latitude and Longitude attributes are present, then the GeoSpatial visualizer will assume they contain latitude and longitude values and use them to place nodes on maps.

Attributes can be created by the user and by various ORA tools and are employed for a variety of purposes:

- Observational information about node itself.
- Identifying the node in context (e.g., location in space, creation time, duration, frequency of occurrence).
- Pointing to external resources relevant to the node (e.g., images, external links).
- Characterizing the node's function/importance in network(s) (e.g., computed ORA measures, membership in groups).

Nodeset Class : Classification of a nodeset according to a predefined set of classes. Nodesets (and hence the contained nodes) can be classified as "Agent", "Organization", "Knowledge", "Resource", "Belief", "Event", "Task", "Location", "Role", "Action" or "Unknown" (Role and Action are deprecated and should not be used in new nodesets). Multiple nodesets in a meta-network can be assigned to the same nodeset class. Many predefined ORA analyses use the nodeset class to determine inputs.

Network : A representation of the links between the nodes of nodeset(s). A network may record links between a single nodeset or two different nodesets. For example an agent x agent network might code kinship links and an agent x organization network might indicate group affiliation.

Link : A connection or relation between any two nodes. Any given node may have zero to many links. A link may be marked present/absent (binary) or the strength of the connection may be indicated by a link value.

Dynamic Meta-Networks

A **dynamic meta-network** is a container for meta-networks. A dynamic meta-network may contain zero to many meta-networks. Constituent meta-networks are often timestamped to indicate ordering (although this is optional and some, none or all constituent meta-networks can be timestamped). Dynamic meta-networks facilitate dynamic network analysis, the study of network change, particularly network change over time. Certain ORA analytical tools are designed to take dynamic meta-networks as input. ORA provides assistance in creating dynamic meta-networks both manually and by reading in appropriately structured data files.

ORA components and modes of operation

ORA a tool for performing network analysis. The functionality it provides can be broadly divided into categories:

- Creating networks
- Modifying networks
- Visualizing networks
- Analyzing networks

A user may exercise this functionality in two ways:

- Interactively through a graphical user interface (GUI)
- Non-interactively, guided by user-provided scripts, in batch mode

Normally users work through the GUI, but batch mode is useful for processing large data sets and executing repetitive analyses. Batch enabled ORA is only available for purchase from Netanomics.

While ORA is a stand-alone tool, it is often employed as part of a series of tools and procedures in a tool chain to achieve a desired goal.

ORA GUI

The ORA interface is organized into two sections which are placed in resizable and dockable panes. Each pane will have one or more individual parts. On each tab are two buttons: undock and close. In the upper right corner of each pane are three buttons: undock, maximize, and close. This will allow you to arrange the interface to suit your needs.
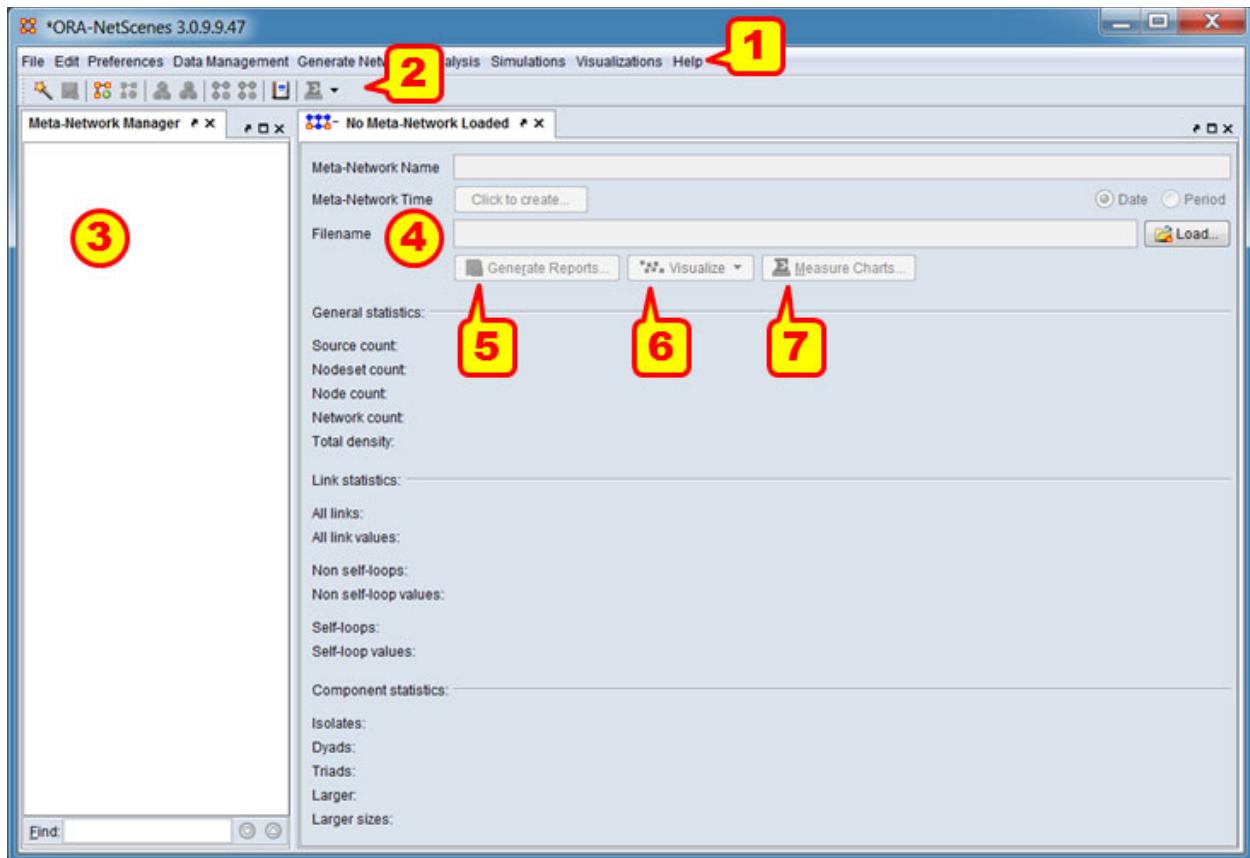
In the image above some key elements of the ORA Editor are displayed (the default layout, with no open meta-networks, is shown).

1) **Menu** : Commands for performing the majority of tasks. The menu items are separated into categories each containing commands and sub-categories.

2) **Toolbar** : Buttons for frequently used functions to work with meta-networks, nodesets and networks.

3) **Meta-Network Manager** : This pane displays all currently open meta-networks. Selecting meta-networks or their constituent components displays information in the editor (4).

4) **Editor** : This pane displays information on the selected nodesets and networks in multiple tabs.

5) **Generate Reports** : This button opens a Generate Reports pane for the currently selected meta-network.

6) **Visualize** : This button/pulldown menu activates a visualizer for the currently selected network (by default a 2-D visualizer; the pulldown provides additional visualizer choices).

7) **Measure Charts** : This button opens chart interface to create charts of measures computed from the currently selected meta-network.

NOTE: A **View Trails…** button will also appear when dynamic meta-networks are selected, to enable over-time analysis supported by this meta-network type.

For a tutorial on performing basic operations using the ORA GUI see the **QuickStart > Main Interface** *section of the ORA help.*

Tool Chains

ORA can be combined with other, separate, tools, each applied in sequence for a specific purpose to perform an analysis. Such an ordered collection of separate tools constitutes a tool chain. In the simplest instance, data can be gathered using one tool, with the resulting data set output from the tool fed into ORA as a meta-network for analysis using a report. Data sets are exchanged between tools, which link the tools together.

For example, to analyze social media text, NetMapper (a text mining tool that extracts networks and usage statistics from social media posts and plaintext) and ORA can be chained by exchanging data:
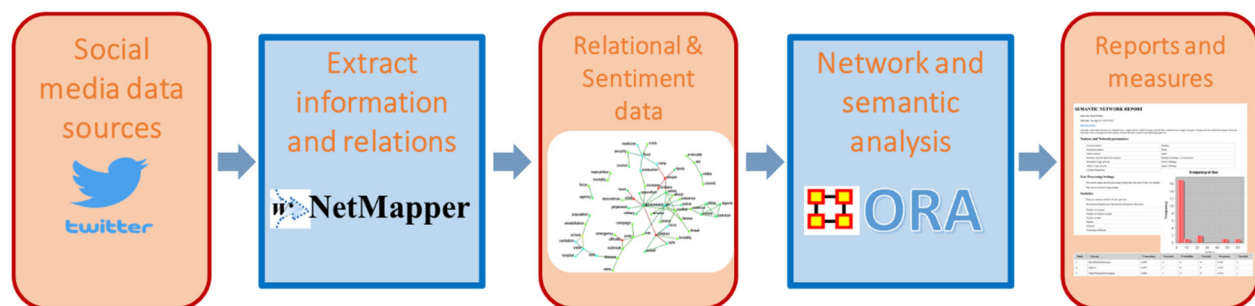
(Since ORA and NetMapper are developed in parallel, they share file formats and data encodings, simplifying operational details.)

When building a tool chain, even an ad hoc one, certain considerations apply:

- **What data set format(s) are used between each tool?** – Understanding the source and input formats of each step of the tool chain will determine if any translation/transformation will be required. Since ORA reports require meta-networks as input, for many data types a transformation from a record-based to a network representation will be required. ORA provides a wide variety of importers for handling input data transformation, from general to specific; as a consequence there are often multiple methods to handle input data. Reviewing the full range of applicable ORA data importers and selecting the most suitable importer is recommended.
- **Will data require verification and editing?** – Depending on the data type and source, cleaning and editing may be required. While this can be done opportunistically, consider where editing should occur and how to ensure that editing is consistent and potentially reproducible.
- **Will data be updated?** – When a data set will only be created once, particularly in exploratory work, the tool chain will likely be developed dynamically. However, when data will be updated, it is useful to establish clear labeling and versioning procedures. This becomes especially important when data is transferred between individuals or separate groups.
- **Will data be preserved after use?** – If the input data will be preserved for future use, consider what format(s) will be used. Saving after editing and translation to an ORA meta-network simplifies future processing within ORA but may make applying additional tools more difficult. Preserving the source data before input to ORA provides potentially greater flexibility but

complicates further processing in ORA and would be unsuitable if editing has occurred with ORA.

Tool Chain Example

As an example, a researcher decides to study collaboration by creating co-authorship networks from a collection of citations, then running ORA's Bibliography and Citation report. They plan to extract citations from an existing collection of references held in a reference manager tool, selecting citations by date and keyword, exporting them as a file using one of the bibliographic file formats supported by ORA, then creating a bibliographic meta-network using ORA's Data Import Wizard's Bibliography & Citations importer and running the Bibliography and Citation report.
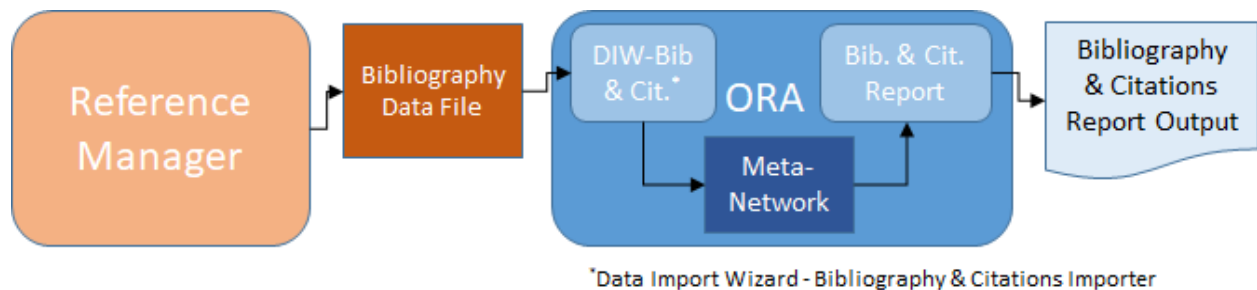
Initial tool chain

This tool chain works as designed, but the report results are unexpected. Looking at the co-authorship network, the researcher realizes that an individual author's name often appears in multiple forms: "C. Smith", "Constanza Smith", "C. E. Smith", and so on, which are treated as separate authors by ORA. It is clear that the these author names must be coalesced into a common form. The researcher must then decide how this will be accomplished. If the citation collection in the reference manager is open for editing, the change could be made there. But changes made in the reference manager data set might affect other uses, requiring a higher standard of editorial care. The bibliographic file could be edited prior to import into ORA (i.e., by adding an editing tool to the tool chain). This leaves the original source intact but might be time consuming if the data will be updated on a regular basis. Similarly, the co-authorship network could be updated in ORA, but this would require mastery of ORA's network editing as well as requiring a full understanding of the meta-network structure.
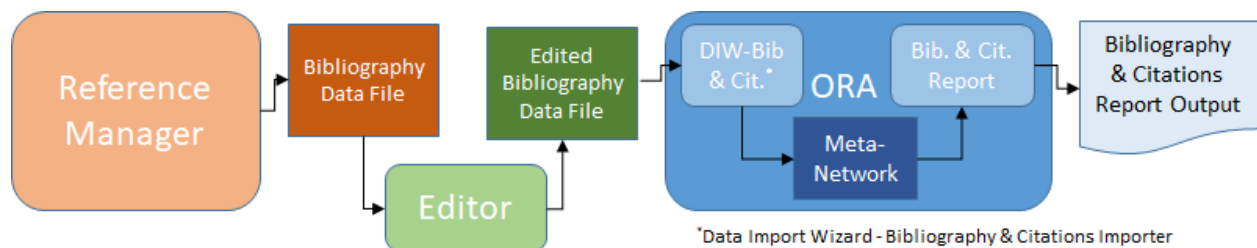
Revised tool chain (separate editing option)

The specific solution adopted would depend on the research plan and skill set of the researcher as well as the purpose and integrity required of the original data, but the example shows that creating even a simple tool chain may require iteration and evolution.

Creating networks

ORA facilitates several approaches to creating meta-networks.

The ORA interface allows the user to interactively create meta-networks and populate them with data. ORA also provides methods for importing external data files and performing any requisite conversions between the external data formats and ORA's meta-networks. Data import facilitates the use of tool chains and greatly simplifies the processing of large data sets.

- **Creating Within ORA**
  - o **Manual Creation of Meta-Networks** – ORA allows the user to create meta-networks and their constituent components (networks, nodesets and attributes) interactively either collectively or component by component. [see **Main Interface > Tasks**]
  - o **Generation of Complete Networks** – ORA can create networks populated with links conforming to a predefined distribution or derived from other networks using various commands found in the Generate Networks menu. [see **Main Interface > Generate Networks**]
  - o **Direct Entry of Links and Attribute Values** – Users can manually add (and change) links and attribute data.
    - ▪ **Using the ORA GUI** – The ORA graphical user interface provides text-oriented editing. [see **QuickStart > Main Interface**, section 9. EDITING NODES AND ATTRIBUTES]
    - ▪ **Using the ORA 2-D Visualizer** – The ORA 2D visualizer permits the creation of networks and links using a drawing interface. The resultant meta-network can be saved to the Meta-Network Manager. [see **Visuzlizer > Actions > Add Network from Scratch**]
- **Importing and Transforming Data Files**
  - o **Data Import Wizard** – The DIW accepts input data (normally contained in files) and converts it to ORA meta-networks. The importers range from general purpose, where the user describes the import file data format and meta-network layout in detail, to importers designed to work with a specific file format (often outputs from other tools) creating a predefined meta-network. [see **QuickStart > Main Interface**, section 6. IMPORT FILES INTO ORA TO CREATE NODESET AND NETWORK and **Main Interface > File > Data Import Wizard**]
  - o **File Operations** – View, join, or merge files from within ORA using the File Operations command, found under the Data Management menu. [see **Main Interface > Data Management**]
  - o **Large Scale Load** – Examine, characterize, and selectively load parts of large files using the Large Scale Load command, found in the File menu. [see **Main Interface > Large Scale Load**]

Modifying networks

Meta-networks can be modified by the user before further use. There are two separate approaches provided by ORA: editing and filtering. Editing makes a permanent change to the network structure and content. Filtering temporarily modifies the input data prior to analyses, leaving the input meta-network unchanged. Filtering is a common feature provided for ORA reports.

- **Editing** – Editing can be performed through the ORA graphical user interface.
  - o **Manual Editing** – The user makes changes to individual data items or selected ranges. [see **QuickStart > Main Interface**, section 9. EDITING NODES AND ATTRIBUTES]

- o **Transforming** – Apply operations to transform meta-networks using matrix algebra, transformation, or applying set operations. [see **Main Interface > Data Management**]
- o **Regenerating Derived Data** – For certain input data types, ORA creates derived data from existing networks or attributes. If the user makes editing changes to these parents, the derived data can be recomputed automatically from the parent data using the Meta-Network Derived Data command found in the Data Management menu. For example, bibliography and citation data contains derived networks for Author x Topic, Co-Authorship, etc. which can be recomputed. [see **Main Interface > Data Management > Meta-Network Derived Data**]

- **Filtering** – Filtering operations, if available, are presented in the report's input parameters for each report.
  - o **Filter Data** – Select the nodesets and networks to analyze in reports. [see **Reports > Common Procedures > Filter Data**]
  - o **Negative Links** – Select the input to use for measures that take positive and negative links. [see **Reports > Common Procedures > Negative Links**]
  - o **Transform Data** – Select one or more data transformations to apply to each input meta-network. [see **Reports > Common Procedures > Transform Data**]
  - o **Remove Nodes** – Select nodes to remove them from each meta-network before generating reports. [see **Reports > Common Procedures > Remove Nodes**]

Visualizing networks

Networks lend themselves to visualization and ORA provides multiple network visualizers.

- **2D Visualizer** – Often referred to simply as "the Visualizer", the 2D visualizer produces a graphical model of a meta-network comprised of links and nodes. Moreover, you can interact with your meta-network model by removing key actors, isolating certain links, focusing on any particular relationship between two nodes using tools such as the Path Finder. You can apply a host of grouping algorithms, look at node's Sphere of Influence, Locate Nodes, which may be hidden in complex clusters of nodes and links. [see **Visualizer**]
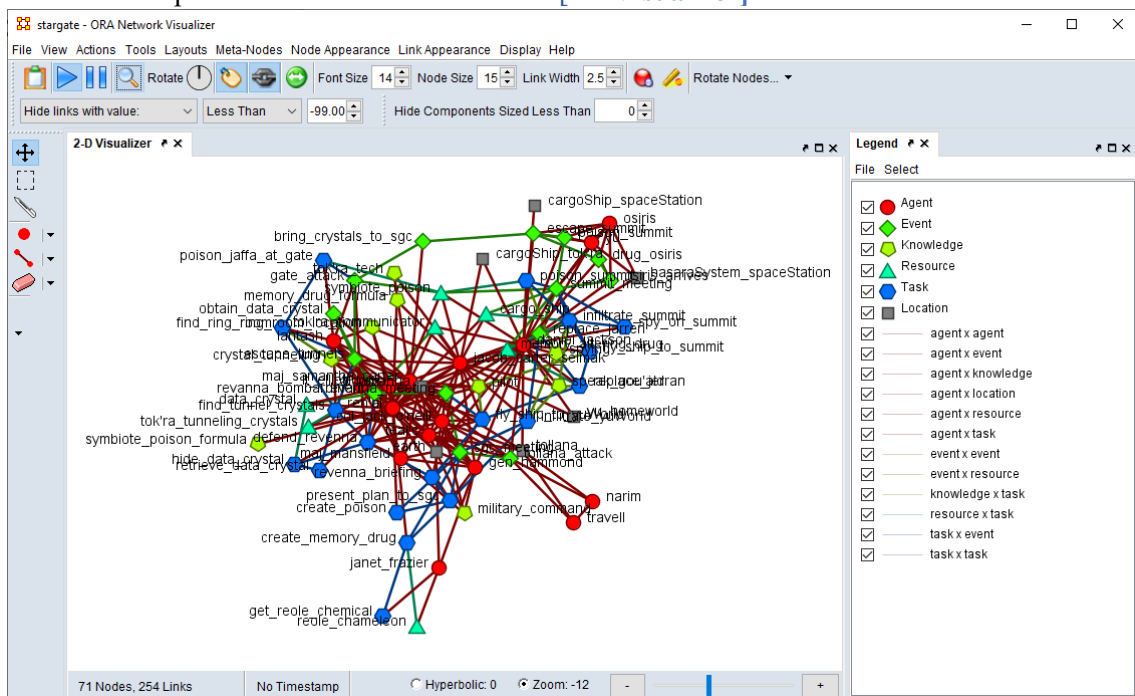
- **GIS** - is concerned with plotting who or what was where on a global basis. It plots nodes on a map and then connects those nodes. [see **Geospatial > GIS**]
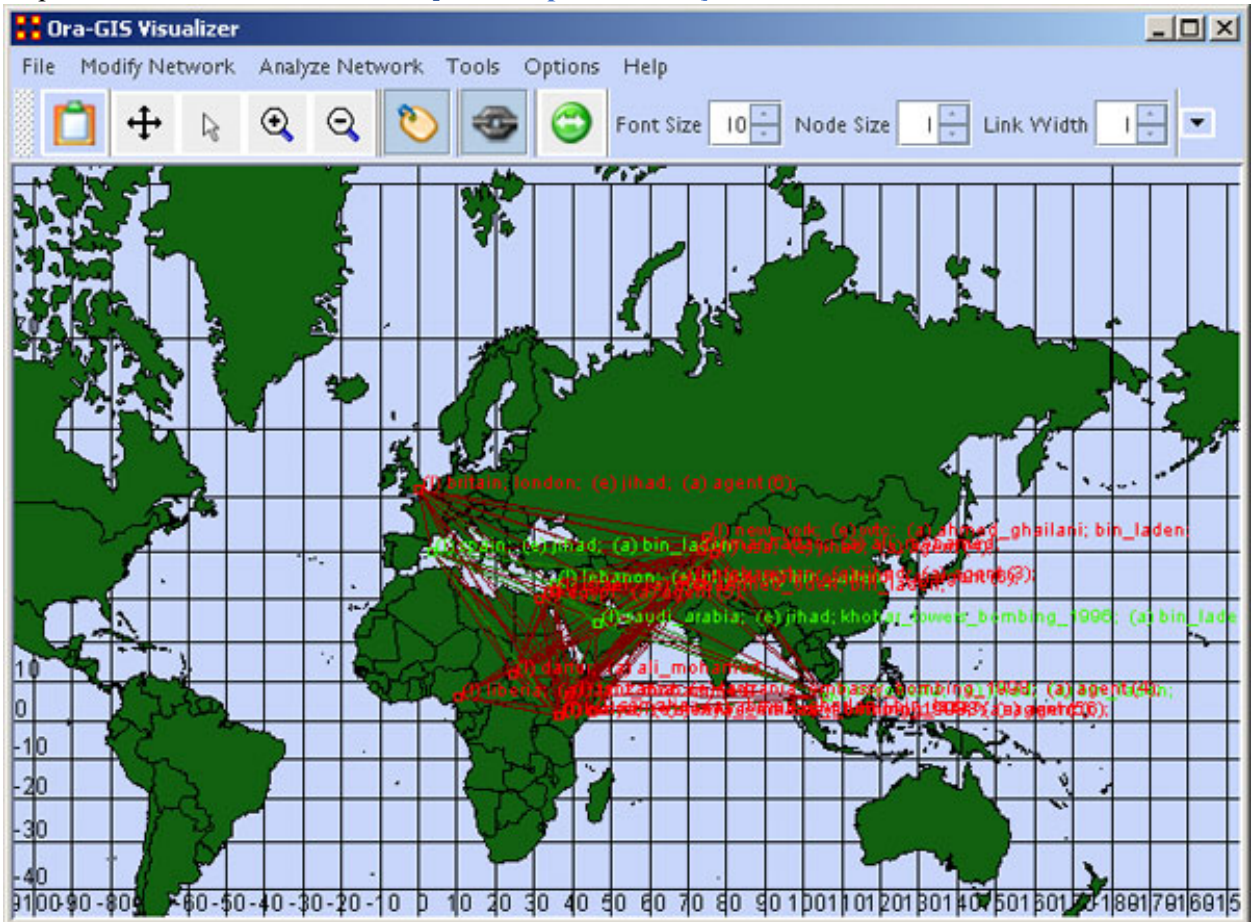
- **Loom** also deals with nodes in locations but is keyed on the timeframes in which nodes appear. There are locations in which two agents appear in but which were there at different times and never met. [see **Geospatial > Loom-View Trails**]
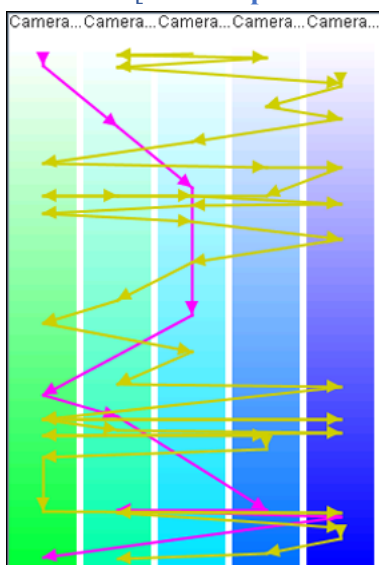
- **View Measures Over Time** charts measures computed from dynamic meta-networks, period by period. [see **Main Interface > Visualization > View Measures Over Time**]
- **View Networks Over Time** visualizes dynamic meta-networks, period by period. [see **Main Interface > Visualization > Networks Over Time > View Network Over Time**]
- **View Network Distance over Time** computes network distances for the selected networks or dynamic meta-networks.
- **Vector Maps** creates a vector map of a dynamic meta-network, using attributes or measures to define x and y coordinates.
- **Change Detection** is used identify changes in a network to exploit subtle organization change. [see **Main Interface > Visualization > Change Detection**]
- **Network Drill Down** allows for any path to be followed. [see **Main Interface > Visualization > Network Drill Down**]
- **Node Cloud** visualizes data as a word cloud. [see **Main Interface > Visualization > Node Cloud**]
- **Color Grid** is designed to allow you to quickly see what connections are in a network. [see **Main Interface > Visualization > Color Grid**]
- **Region Viewer** supports viewing attribute value distributions by region. [see **Main Interface > Visualization > Region Viewer**]
- **Path Finder** identifies paths between two nodes, including the shortest path.
- **Sphere Finder of Influence** shows the sphere of influence (ego network) of nodes.

Analyzing networks

ORA provides both prepackaged analyses and methods for performing interactive analyses fully controlled by the user. At the heart of many analyses are network measures. These may be computed individually or multiple measures may be computed simultaneously.

ORA includes two kinds of analyses:

- **Analyses –** Preexisting analytical methods drawn from network science, listed by name in the Analysis menu.
- **Reports –** Analyses created for ORA; reports are prepackaged methods for analyzing meta-networks, ranging from general purpose to reports intended for specifically structured inputs from defined sources (e.g., social media data drawn from specific platforms).

Measures

ORA contains over one hundred and eighty distinct measures. These range from classic network measures of general utility (e.g., "density", "centrality") to highly specialized measures (e.g., "Task Resource Needs Congruence", "Twitter, Average Mentions Per Tweet").

What is a Measure?
A measure is a function that takes as input one or more networks and outputs a single value or a vector of values. The measure value tells something about the structure of the networks.

Consider the measure Density. This measure takes as input a single network and outputs a single value between zero and one which is the ratio of the number of links in the network to the number of total possible links.

Each measure available in ORA is described in individual help entries which include a description, usually with references and formula, as well as indicating the expected input and the results output. The relative computational cost of the measure is also characterized.

How to Compute Measures

Measures can be applied in multiple ways in ORA. Some common methods include:

- **Automatically** - Basic measures are automatically computed and displayed for networks under the Info tab in the ORA GUI's editor pane whenever a network is selected.
- **Reports** - ORA reports (and analyses) apply a pre-selected set of measures to characterize or analyze various types of input. For example, the K-Centrality report applies a set of centrality measures at the node and network level. The measures used by a report can often be customized by the user and users can create custom reports employing chosen measures. Report outputs, including measure values, can be exported from ORA in a number of human and machine-readable formats. [see **Reports]**
- **Measure Charts** - Measures can be computed and charted interactively using the Measure Charts tool. [see **Main Interface > Visualization > Measure Charts]**
- **Attribute Measures** - Measures can be computed and appended to meta-network nodesets as attributes using the Create new attribute measures… command when a nodeset is selected in the GUI.

For detailed descriptions of the measures listed below, see the **Measures** *section of the ORA help*

Fast Measures

These measures are fast to compute and generally count nodes and links.

Measure Name	Uses link weights	Input Mode	Output values
Agent Socio Economic Power	No	Multi Mode	Node Level
Capability	Yes	One or Two Mode	Node Level
Column Breadth	No	One or Two Mode	Network Level
Column Count	No	One or Two Mode	Network Level
Column Diversity	Yes	One or Two Mode	Network Level
Column Exclusivity	No	One or Two Mode	Node Level
Column Exclusivity Complete	No	One or Two Mode	Node Level
Column Gini Means Difference	Yes	One or Two Mode	Node Level
Column Redundancy	No	One or Two Mode	Network Level
Column Significant Discrimination	Yes	One or Two Mode	Node Level
Complexity	No		Network Level
Density	No	One or Two Mode	Network Level
Diagonal	Yes	One Mode	Node Level
In-Degree Average Neighbor	Yes	One Mode	Node Level
In-Degree Centrality	Yes	One or Two Mode	Node Level
In-Degree Network Centralization	Yes	One or Two Mode	Network Level
Interdependence	No	One Mode	Network Level
Interlockers	No	One Mode	Node Level
Isolate	No	One Mode	Node Level
Isolate Count	No	One Mode	Network Level
Knowledge Based Access Index	No	Multi Mode	Node Level
Lateral Link Count	Yes	One Mode	Network Level
Link Count	No	One or Two Mode	Network Level
Network Assortativity	Yes	One Mode	Network Level
Node Count	No	One Mode	Network Level
Nodeset Size	No		Network Level

Measure Name	Uses link weights	Input Mode	Output values
Out-Degree Average Neighbor	Yes	One Mode	Node Level
Out-Degree Centrality	Yes	One or Two Mode	Node Level
Out-Degree Network Centralization	Yes	One or Two Mode	Network Level
Personnel Cost	No	Multi Mode	Node Level
Pooled Link Count	No	One Mode	Network Level
Radials	No	One Mode	Node Level
Resource Based Access Index	No	Multi Mode	Node Level
Row Breadth	No	One or Two Mode	Network Level
Row Count	No	One or Two Mode	Network Level
Row Diversity	Yes	One or Two Mode	Network Level
Row Exclusivity	No	One or Two Mode	Node Level
Row Exclusivity Complete	No	One or Two Mode	Node Level
Row Gini Means Difference	Yes	One or Two Mode	Node Level
Row Redundancy	No	One or Two Mode	Network Level
Row Significant Discrimination	Yes	One or Two Mode	Node Level
Sequential Link Count	No	One Mode	Network Level
Span Of Control	No	One Mode	Network Level
Super Friends	Yes	One Mode	Node Level
Super Spreaders	Yes	One Mode	Node Level
Total Degree Network Centralization	Yes	One Mode	Network Level
Total-Degree Average Neighbor	Yes	One Mode	Node Level
Total-Degree Centrality	Yes	One Mode	Node Level
Twitter, Average Mentions Per Tweet	Yes	Multi Mode	Node Level
Twitter, Number of Followers	No		Node Level
Twitter, Total Mentions Degree	Yes	Multi Mode	Node Level
Twitter, Total Reciprocal Mentions Unweighted	Yes	Two Mode	Node Level
Twitter, Trusted Source	Yes	Two Mode	Node Level
Twitter, Wants To Be Influencer	Yes	Two Mode	Node Level
Uni-directional Link Count	No	One Mode	Network Level
Weighted Density	Yes	One or Two Mode	Network Level
Weighted Link Sum	Yes	One or Two Mode	Network Level

Normal Measures

These measures take an average or normal amount of time to compute and usually involve a single matrix multiplication or a single pass over all links.

Measure Name	Uses link weights	Input Mode	Output values
Actual Workload	No	Multi Mode	Node Level
Agent Knowledge Needs Congruence	No	Multi Mode	Node Level
Agent Knowledge Waste Congruence	No	Multi Mode	Node Level
Agent Resource Needs Congruence	No	Multi Mode	Node Level
Agent Resource Waste Congruence	No	Multi Mode	Node Level
Authority Centrality	Yes	One or Two Mode	Node Level
Average Speed	Yes	One Mode	Network Level
Bi-directional Link Count	No	One Mode	Network Level
Bonacich Power Centrality	Yes	One Mode	Node Level
Boundary Spanner	No	One Mode	Node Level
Bridge Modularity Vitality	No	One Mode	Node Level
Brokerage	No	One Mode	Node Level

Measure Name	Uses link weights	Input Mode	Output values
Characteristic Path Length	Yes	One Mode	Network Level
Clique Count	No	One Mode	Network Level, Node Level
Clustering Coefficient Density	No	One Mode	Network Level, Node Level
Cognitive Demand	Yes	Two Mode	Node Level
Communication	No	Multi Mode	Node Level
Communication Congruence	No	Multi Mode	Network Level
Connectedness	No	One Mode	Network Level
Constraint Structural Holes	Yes	One Mode	Node Level
Contribution Centrality	Yes	One Mode	Node Level
Cosine Similarity Correlation	No	One or Two Mode	Node Level, Dyad Level
Diameter	Yes	One Mode	Network Level
Distinctiveness Correlation	No	One or Two Mode	Node Level, Dyad Level
Eccentricity Centrality	Yes	One Mode	Node Level
Echo Chamberness	No	Two Mode	Network Level
Effective Network Size Structural Holes	Yes	One Mode	Node Level
Efficiency	No	One Mode	Network Level
Efficiency Structural Holes	Yes	One Mode	Node Level
Eigenvector Centrality	Yes	One Mode	Node Level
Expertise Correlation	No	One or Two Mode	Node Level, Dyad Level
Fragmentation	No	One Mode	Network Level
Geodesic Distance	Yes	One Mode	Dyad Level
Hub Centrality	Yes	One or Two Mode	Node Level
Hub Modularity Vitality	No	One Mode	Node Level
Individual Congruence	No	Multi Mode	Node Level
Jaccard Similarity Correlation	No	One or Two Mode	Node Level, Dyad Level
K-core	No	One Mode	Node Level
Katz Centrality	Yes	One Mode	Node Level
Knowledge Actual Workload	No	Multi Mode	Node Level
Knowledge Based Task Completion	No	Multi Mode	Network Level
Knowledge Negotiation	No	Multi Mode	Network Level
Knowledge Potential Workload	No	Multi Mode	Node Level
Knowledge Under Supply	No	Multi Mode	Network Level
Minimum Speed	Yes	One Mode	Network Level
Organization Agent Knowledge Needs Congruence	No	Multi Mode	Network Level
Organization Agent Knowledge Waste Congruence	No	Multi Mode	Network Level
Organization Agent Resource Needs Congruence	No	Multi Mode	Network Level
Organization Agent Resource Waste Congruence	No	Multi Mode	Network Level
Organization Task Knowledge Needs Congruence	No	Multi Mode	Network Level
Organization Task Knowledge Waste Congruence	No	Multi Mode	Network Level
Organization Task Resource Needs Congruence	No	Multi Mode	Network Level
Organization Task Resource Waste Congruence	No	Multi Mode	Network Level
Overall Task Completion	No	Multi Mode	Network Level
PageRank Centrality	Yes	One Mode	Node Level
Performance As Accuracy	No	Multi Mode	Network Level

Measure Name	Uses link weights	Input Mode	Output values
Potential Workload	No	Multi Mode	Node Level
Radiality Centrality	Yes	One Mode	Node Level
Reachable Diameter	Yes	One Mode	Network Level
Reciprocity	No	One Mode	Network Level
Resemblance Correlation	No	One or Two Mode	Node Level, Dyad Level
Resource Actual Workload	No	Multi Mode	Node Level
Resource Based Task Completion	No	Multi Mode	Network Level
Resource Negotiation	No	Multi Mode	Network Level
Resource Potential Workload	No	Multi Mode	Node Level
Resource Under Supply	No	Multi Mode	Network Level
Shared Situation Awareness	No	Two Mode	Node Level, Network Level, Dyad Level
Simmelian Ties	No	One Mode	Node Level
Skip Link Count	No	One Mode	Network Level
Social Technical Congruence	No	Multi Mode	Network Level, Dyad Level
Strict Knowledge Congruence	No	Multi Mode	Network Level
Strict Resource Congruence	No	Multi Mode	Network Level
Strong Component Count	No	One Mode	Network Level, Node Level
Task Knowledge Needs Congruence	No	Multi Mode	Node Level
Task Knowledge Waste Congruence	No	Multi Mode	Node Level
Task Resource Needs Congruence	No	Multi Mode	Node Level
Task Resource Waste Congruence	No	Multi Mode	Node Level
Transitivity	No	One Mode	Network Level
Triad Count	No	One Mode	Node Level
Twitter, Actual Influencer	Yes	Multi Mode	Node Level
Twitter, Most Mentioned	Yes	Two Mode	Node Level
Twitter, Potential Connectors	Yes	Multi Mode	Node Level
Twitter, Potential Consensus Leaders	Yes	Two Mode	Node Level
Twitter, Reciprocal Mentions Clique Count	Yes	Two Mode	Node Level
Twitter, Topic Local Connectors	Yes	Two Mode	Node Level
Twitter, Total Mentions K-Core	Yes	Multi Mode	Node Level
Twitter, Total Mentions Page Rank	Yes	Multi Mode	Node Level
Weak Component Count	No	One Mode	Network Level
Weak Component Members	No	One Mode	Node Level
Weak Component Size	No	One Mode	Node Level
Weighted Individual Congruence	No	Multi Mode	Node Level

Slow Measures

These measures are slow to compute and usually involve shortest path computations and/or matrix multiplications.

Measure Name	Uses link weights	Input Mode	Output values
Actual Workload	No	Multi Mode	Node Level
Agent Knowledge Needs Congruence	No	Multi Mode	Node Level
Agent Knowledge Waste Congruence	No	Multi Mode	Node Level
Agent Resource Needs Congruence	No	Multi Mode	Node Level
Agent Resource Waste Congruence	No	Multi Mode	Node Level
Authority Centrality	Yes	One or Two Mode	Node Level
Average Speed	Yes	One Mode	Network Level

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Measure Name	Uses link weights	Input Mode	Output values
Bi-directional Link Count	No	One Mode	Network Level
Bonacich Power Centrality	Yes	One Mode	Node Level
Boundary Spanner	No	One Mode	Node Level
Brokerage	No	One Mode	Node Level
Characteristic Path Length	Yes	One Mode	Network Level
Clique Count	No	One Mode	Network Level, Node Level
Clustering Coefficient Density	No	One Mode	Network Level, Node Level
Cognitive Demand	Yes	Two Mode	Node Level
Communication	No	Multi Mode	Node Level
Communication Congruence	No	Multi Mode	Network Level
Connectedness	No	One Mode	Network Level
Constraint Structural Holes	Yes	One Mode	Node Level
Contribution Centrality	Yes	One Mode	Node Level
Cosine Similarity Correlation	No	One or Two Mode	Node Level, Dyad Level
Diameter	Yes	One Mode	Network Level
Distinctiveness Correlation	No	One or Two Mode	Node Level, Dyad Level
Eccentricity Centrality	Yes	One Mode	Node Level
Echo Chamberness	No	Two Mode	Network Level
Effective Network Size Structural Holes	Yes	One Mode	Node Level
Efficiency	No	One Mode	Network Level
Efficiency Structural Holes	Yes	One Mode	Node Level
Eigenvector Centrality	Yes	One Mode	Node Level
Expertise Correlation	No	One or Two Mode	Node Level, Dyad Level
Fragmentation	No	One Mode	Network Level
Geodesic Distance	Yes	One Mode	Dyad Level
Hub Centrality	Yes	One or Two Mode	Node Level
Individual Congruence	No	Multi Mode	Node Level
Jaccard Similarity Correlation	No	One or Two Mode	Node Level, Dyad Level
K-core	No	One Mode	Node Level
Katz Centrality	Yes	One Mode	Node Level
Knowledge Actual Workload	No	Multi Mode	Node Level
Knowledge Based Task Completion	No	Multi Mode	Network Level
Knowledge Negotiation	No	Multi Mode	Network Level
Knowledge Potential Workload	No	Multi Mode	Node Level
Knowledge Under Supply	No	Multi Mode	Network Level
Minimum Speed	Yes	One Mode	Network Level
Organization Agent Knowledge Needs Congruence	No	Multi Mode	Network Level
Organization Agent Knowledge Waste Congruence	No	Multi Mode	Network Level
Organization Agent Resource Needs Congruence	No	Multi Mode	Network Level
Organization Agent Resource Waste Congruence	No	Multi Mode	Network Level
Organization Task Knowledge Needs Congruence	No	Multi Mode	Network Level
Organization Task Knowledge Waste Congruence	No	Multi Mode	Network Level
Organization Task Resource Needs Congruence	No	Multi Mode	Network Level
Organization Task Resource Waste Congruence	No	Multi Mode	Network Level

Measure Name	Uses link weights	Input Mode	Output values
Overall Task Completion	No	Multi Mode	Network Level
PageRank Centrality	Yes	One Mode	Node Level
Performance As Accuracy	No	Multi Mode	Network Level
Potential Workload	No	Multi Mode	Node Level
Radiality Centrality	Yes	One Mode	Node Level
Reachable Diameter	Yes	One Mode	Network Level
Reciprocity	No	One Mode	Network Level
Resemblance Correlation	No	One or Two Mode	Node Level, Dyad Level
Resource Actual Workload	No	Multi Mode	Node Level
Resource Based Task Completion	No	Multi Mode	Network Level
Resource Negotiation	No	Multi Mode	Network Level
Resource Potential Workload	No	Multi Mode	Node Level
Resource Under Supply	No	Multi Mode	Network Level
Shared Situation Awareness	No	Two Mode	Node Level, Network Level, Dyad Level
Simmelian Ties	No	One Mode	Node Level
Skip Link Count	No	One Mode	Network Level
Social Technical Congruence	No	Multi Mode	Network Level, Dyad Level
Strict Knowledge Congruence	No	Multi Mode	Network Level
Strict Resource Congruence	No	Multi Mode	Network Level
Strong Component Count	No	One Mode	Network Level, Node Level
Task Knowledge Needs Congruence	No	Multi Mode	Node Level
Task Knowledge Waste Congruence	No	Multi Mode	Node Level
Task Resource Needs Congruence	No	Multi Mode	Node Level
Task Resource Waste Congruence	No	Multi Mode	Node Level
Transitivity	No	One Mode	Network Level
Triad Count	No	One Mode	Node Level
Twitter, Actual Influencer	Yes	Multi Mode	Node Level
Twitter, Most Mentioned	Yes	Two Mode	Node Level
Twitter, Potential Connectors	Yes	Multi Mode	Node Level
Twitter, Potential Consensus Leaders	Yes	Two Mode	Node Level
Twitter, Reciprocal Mentions Clique Count	Yes	Two Mode	Node Level
Twitter, Topic Local Connectors	Yes	Two Mode	Node Level
Twitter, Total Mentions K-Core	Yes	Multi Mode	Node Level
Twitter, Total Mentions Page Rank	Yes	Multi Mode	Node Level
Weak Component Count	No	One Mode	Network Level
Weak Component Members	No	One Mode	Node Level
Weak Component Size	No	One Mode	Node Level
Weighted Individual Congruence	No	Multi Mode	Node Level

Analyses

Analyses are listed under the Analysis menu, and include:

- **Correspondence Analysis** : Runs a correspondence analysis on the selected network to find patterns in the row and column entries.
- **Socio-cultural Cognitive Maps (SCMs)** : Creates the best-fit network model for the set of underlying node to variable data.

- **Geary-C & Moran-I Analysis...** : Performs Moran's I test using phylogenetic and spatial link matrix (binary or general). It uses neighboring weights so Moran's I and Geary's C randomization tests are equivalent.

Individual analyses are documented in the **Analysis** *section of the ORA help.*

Reports

In ORA, a report is a collection of analyses run to answer a particular research question. Most of the analyses are the measures available in ORA. Measure values are typically displayed as ranked tables of values to show which nodes score highest. A report typically also contains bar charts, spider charts, and network pictures that all serve to answer the research question.

Reports range from general purpose applicable to all networks (e.g. Shortest Path, All Measures by Category) to numerous reports intended for structured inputs derived for specific types of data (e.g., Geospatial Assessment, Key Entities Ranking) to reports coupled to information derived from specific sources (e.g. Twitter, YouTube). The user can also create custom reports by selecting desired measures under a specified name.

A report usually outputs multiple files, and the following file formats are available:

- **Text** - human readable report in plain text (no images or charts). The "pages" of the report are separate files with appropriate names.
- **HTML** - which can be viewed in any browser. This is the most interactive of the human readable formats and is often used for data exploration and analysis
- **CSV** - comma-separated-value files for importing into spreadsheets.
- **JSON** - data values in JavaScript Object Notation (JSON) format. This format supports access to the computed measures for further analysis.
- **PowerPoint** - a Microsoft PowerPoint slide deck. Two types of PowerPoint reports are available:
  - **All slides** - full human readable report, including text, tables, images and charts.
  - **Only slides with charts and pictures** - contains only slides containing tables, images and charts (with standard label text).
- **PDF** - human readable report which is saved in a single file.

In some instances, a report will also return information to the input meta-network(s) in the form of additional nodesets or networks.

HTML Format Report Output

HTML Reports are structured for both user readability and interactivity. The other human readable reports are derived from the HTML format report and lack some or all interactive features. The derived versions are provided, in large part, as a source of material for report, presentations, etc.

Features available in the HTML report output include:

- A navigable hierarchy of pages.
- Content labeling (e.g., "*This page has summary information on all documents and a more detailed analysis for the selected documents of interest.*")
- Data and measures tables which can be:
  - Scrolled, resized, and sorted by column.

- o   Printed or copied with a single operation (in many instances).
- Ranked values are color coded to indicate if a value is greater than 1 standard deviation(s) above the mean (red), within 1 standard deviation of the mean (green) or less than one standard deviation(s) below the mean (blue).
- For Twitter reports, verified actors have a plus (+) appended to their name and news sources have an asterisk (*) appended to their name.

Available Reports
This table lists each report and gives a description of what it does and how it might be used.

The reports listed below are documented in the **Reports** *section of the ORA help.*

Report	Usage
All Measures by Category	Computes all measures in a given category for each input network and creates ranked tables and lists of values.
Belief Propagation	This report runs a simulation of belief (or attitude) propagation based on the Friedkin model from social influence theory.
BEND & Community Assessment	Identifies topic groups based on social interactions, agent shared knowledge connections, and agent topic connections.
Bibliography and Citation	Analyzes network data extracted from a list of citations in various formats including BibTex, RIS and Scopus.
Blog	Analyzes data extracted from blogs by the Blogtrackers tool.
Change in Key Entities	Provides information on the overall structure of a complex network and identifies, for each type of node, which nodes stand out.
Communications Network Assessment	Evaluates the effectiveness of a computer network, with the computer nodes being represented as resources. The computer network represents the physical layer of connections between machines. Effectiveness takes into account the placement of nodes in the network
Communicators	Analyzes the communication network (agent by agent) and gives high level statistics on its structure.
Context	Compares measured values against various stylized forms of networks in an effort to characterize network topology.
Core Network	Computes the core network and reports general statistics. The **core network** is the largest component (sub-graph) in the graph.
Critical Sets	Finds critical sets of nodes in a network that best reach all other nodes or whose removal maximally disrupts a network.
Custom	The custom report allows a user to be able to design a report to meet a specific need by identifying the metrics that should be calculated on an input network. The custom report can be used when a specific set of metrics or measures are needed routinely as opposed to simply producing the metrics directly each time.
Detect Spatial Patterns	Examines whether nodes with the same attribute values are in the same locations.
Ego Net	Analyzes the ego networks for a collection of nodes. Ego networks consist of a focal node ("ego") and the nodes to whom ego is connected by a path of a specified maximum length (the radius, most frequently set to 1). This report allows the user to specify ego nodes, radius, and the type of links used to define connections.
Geospatial Assessment	Finds nodes that are co-located based and counts the number of nodes that appear in location pairs.
Group Talk	Analyzes the relationship between agents and knowledge.
Hot Topics (Content Analysis)	This report will identify the most and least frequently mentioned concepts in a text set. The networks are typically formed from AutoMap with a frequency attribute on each

Report	Usage
	concept node. It can operate on any network (meta-network, semantic network, or concept network) as it makes use of only the nodes of the network.
Immediate Impact	This report allows you to perform one of two types of evaluation against the base network : Impact analysis and Replication analysis. • Isolation Analysis : One or more of the nodes identified in the Key Entities Ranking report are deleted as part of an assessment of the degradation in the network if those nodes were no longer in the network. The report then shows the differences in values between the original and modified networks' at both the node and network measure levels. • Remove Nodes Replication Analysis : Set a random number of nodes to delete, then the report will show the differences in values between the original and modified network's. Unlike Isolation Analysis, the nodes are selected at random. The user also selects the number of iterations to execute, allowing a researcher to assess the vulnerability of a network to random node deletions.
Influence Net	Displays the influence network and gives high level statistics on its structure.
K-Centrality	Calculates the geodesic centrality measures for various radius values k, which approximates the geodesic computation by only considering neighbors within the radius distance.
Key Entities Ranking	Identifies key entities and groups who by virtue of their position in the network are critical to its operation.
Locate Groups	Identifies groups present in a network by applying one or more grouping algorithms.
Management	Use this report to locate strongest and weakness parts of a meta-network and also the most well connected nodes.
Missing Links	Compute possible missing links in a network.
Network Comparison	Compares the node and link distributions of a collection of meta-networks.
Node of Interest Characterization	For each individual, finds some important measures and facts about the actor in relation to their network.
Optimizer	Adapt the link structure of a meta-network to maximize or minimize selected measure values. This should only be used for small networks of several hundred nodes as it is computationally intensive.
Part of Speech	Identifies the part of speech from the concepts in a text set. The networks are typically formed from AutoMap with a part of speech (pos) attribute on each concept node. It can operate on any network (meta-network, semantic network, or concept network) as it makes use of only the nodes of the network.
Potential Errors	Detects potential errors in agent to agent interactions based on the expected interactions from cognitive similarity and expertise.
QAP/MRQAP Analysis	Compares multiple networks to understand how two different networks relate using one network as dependent and the other as an independent network. Also useful for predicting the future of a network if there are multiple snapshots of the same network.
Reddit	Analyzes data extracted from Reddit.
Semantic Network	This report analyzes one or more semantic networks, computing central networks and key concepts and links. Performing map comparison can help to answer questions such as: • Do different people use the same words and themes in the same way? • Do different people link concepts and themes in the same way? • Do different people share the same knowledge? • How similar or different are the analyzed texts?
Shortest Path	Computes the shortest path between two entities and general statistics on the paths. The sphere of influence of each entity is also computed.

Report	Usage
Simmelian Ties Analysis	Calculates the number of Asymmetric, Sole-Symmetric and Simmelian ties in unimodal networks computes standard measures on them.
Socio-cultural Cognitive Mapping	Analyzes social-cultural mappings. Socio-cultural Cognitive Mapping (SCM) is a best-fit network model to the set of underlying node to variable data. SCM permits objective visualization of the network, inference about the impact of changes in the underlying conditions influencing the nodes and comparison of disparate data.
Stance Detection	Using an author's concepts and words in documents and interactions, determines from user-provided seed concept stances the stance of users across the dataset.
Statistical Change Detection	Analyzes the changes in network-level measures over time using a Statistical Process Monitoring (SPM) control chart. Control limits are determined based on a user defined level of risk.
Statistical Distribution	Fits statistical distributions to a network based on measure values.
Story Detection	Detects and analyzes stories within social media data.
Tactical Insight	Analyzes the top agent nodes across time periods, tracking locations and measure values.
Topic Analysis	Finds topic clusters in a collection of text meta-networks using the latent Dirichlet allocation (LDA) and latent semantic analysis (LSA) algorithms.
Trails	Analyzes the trails that an entity class makes through another entity class, for example, how vessels pass through ports.
Triad Census	Computes and classifies the triads in a network.
Twitter	Identifies key tweeters and tweets and in a meta-network derived from twitter data. Characterizes tweets and tweeters.
YouTube	Analyzes data extracted from YouTube.

References

Barnes, J. A. (1954). Class and committees in a Norwegian island parish. *Human relations*, 7(1), 39-58. https://doi.org/10.1177/001872675400700102