



Near Term Analysis

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Kenny Joseph

The CASOS Center
COS Program, School of Computer Science, Carnegie Mellon
Summer Institute 2015



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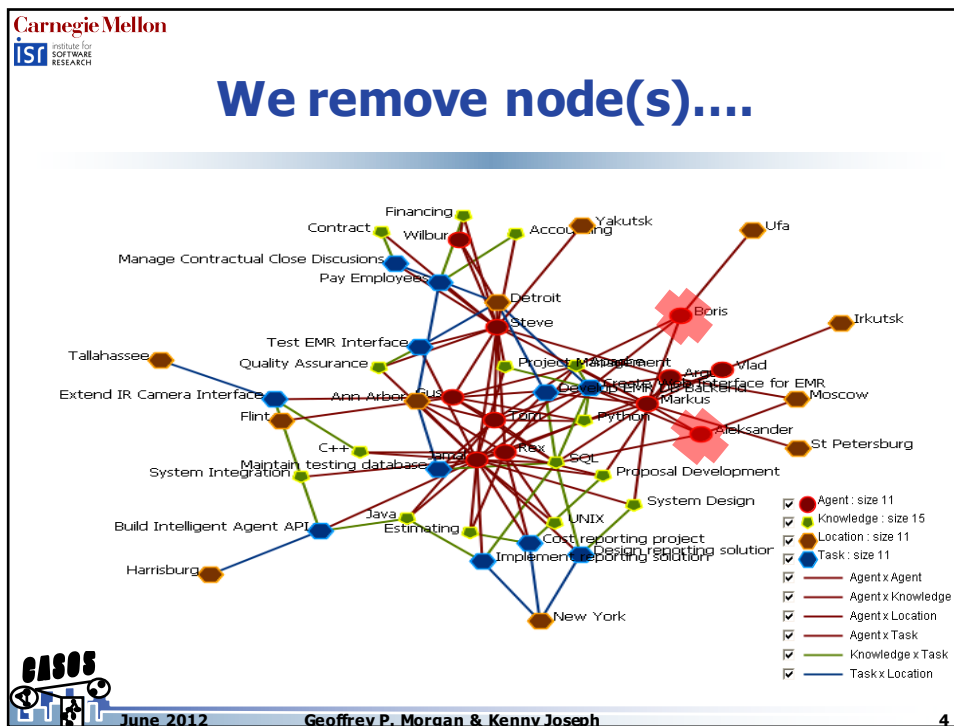
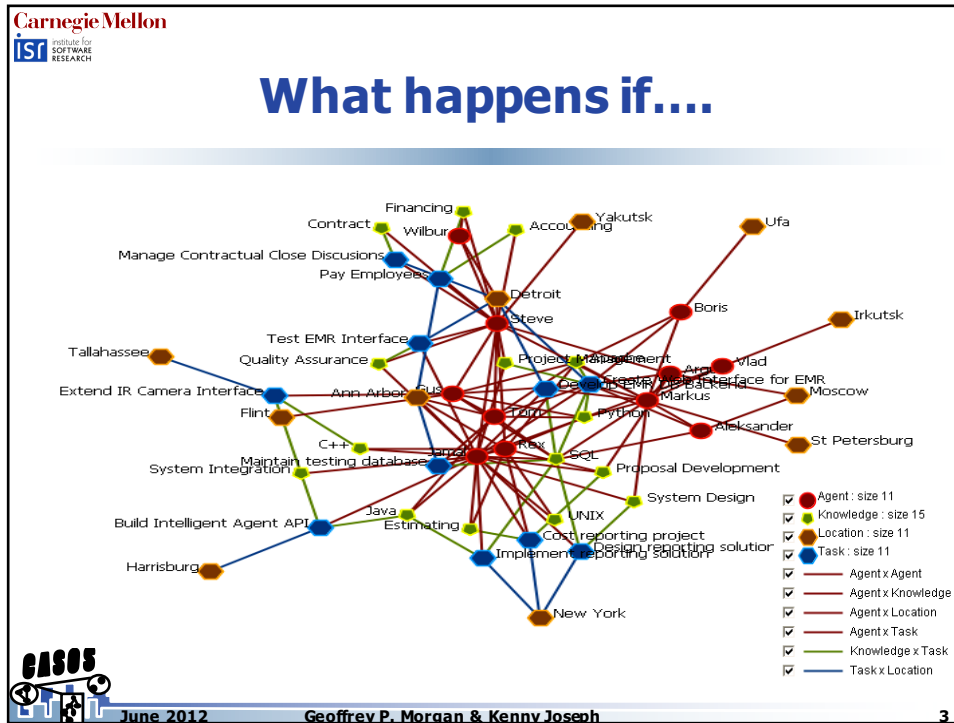
Center for Computational Analysis of
Social and Organizational Systems
<http://www.casos.cs.cmu.edu/>



Agenda

- Load in a network, run a simulation using Near Term Construct
 - Look at the networks in ORA, compare generated to input
 - Initial vs. final knowledge
- Remove the 10 actors that are highest in one of the centralities
 - Examine change in knowledge diffusion
 - Look at generated knowledge networks in ORA
 - Compare to immediate impact report






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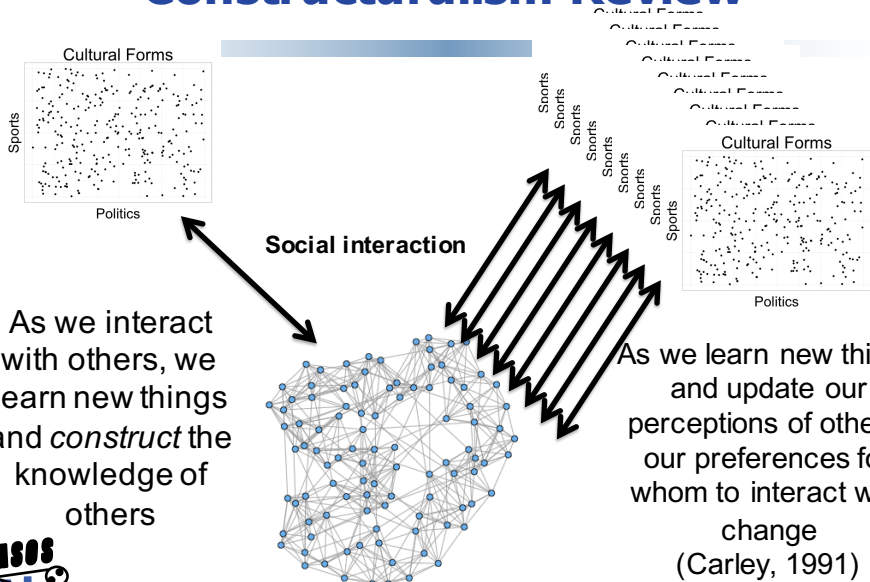
We get...

- Changes to
 - A few to many changes in network measures
 - Node-level measures adjacent to removed node(s)
 - Emergent behavior (e.g. knowledge diffusion)
- **Knowledge Diffusion delta's are the focus of NTA**
- Knowledge Diffusion: a bit of 'knowledge' given to a random node spreads over time to the remainder of the due to agent-to-agent interactions & exchanges of knowledge


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Constructuralism Review



Social interaction

As we interact with others, we learn new things and *construct* the knowledge of others

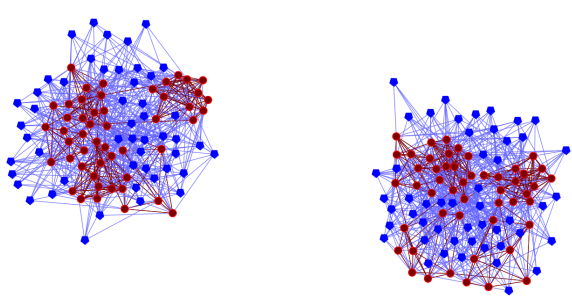
As we learn new things and update our perceptions of others, our preferences for whom to interact with change (Carley, 1991)



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Load in CapuletsAndMontagues

CapuletsAndMontagues

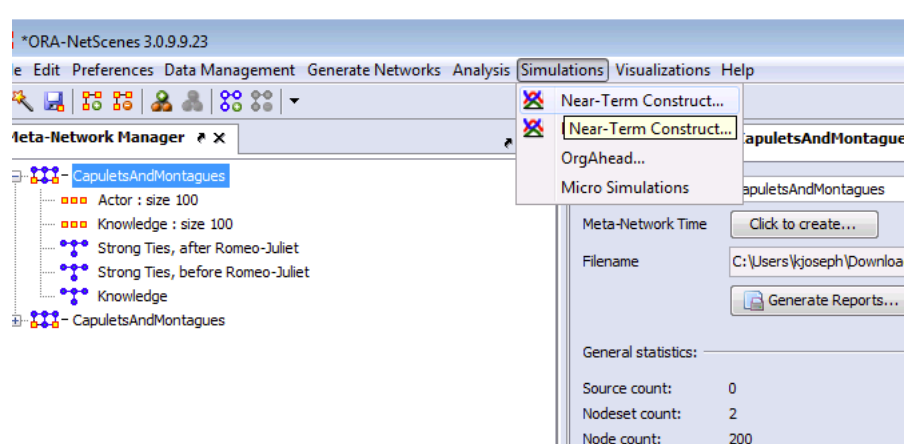


powered by ORA Networks

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Go to Near Term Construct



*ORA-NetScenes 3.0.9.9.23

File Edit Preferences Data Management Generate Networks Analysis Simulations Visualizations Help

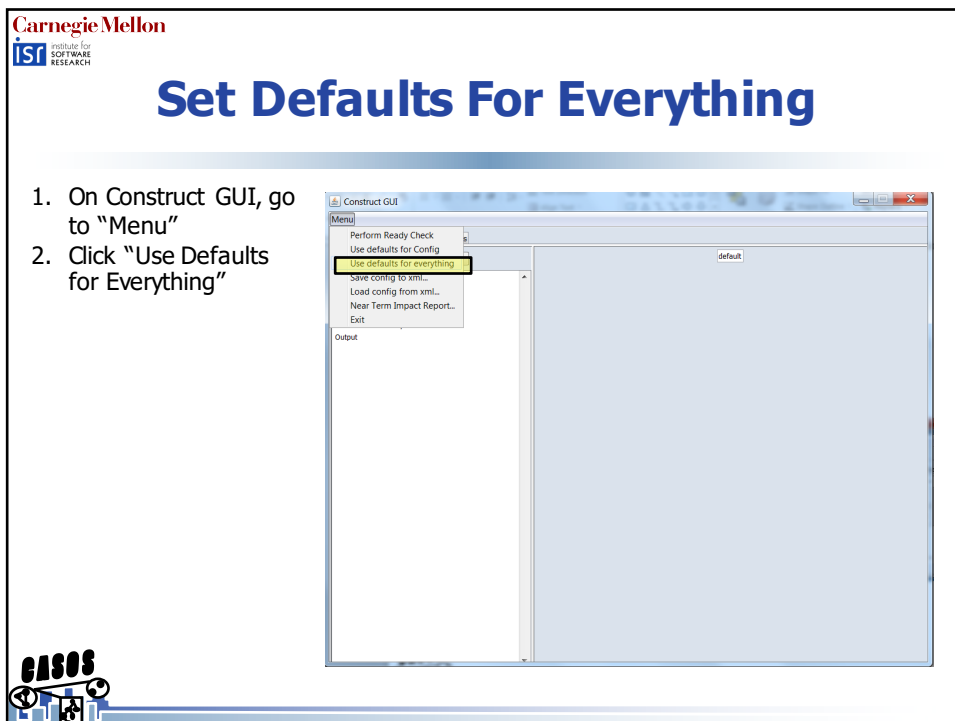
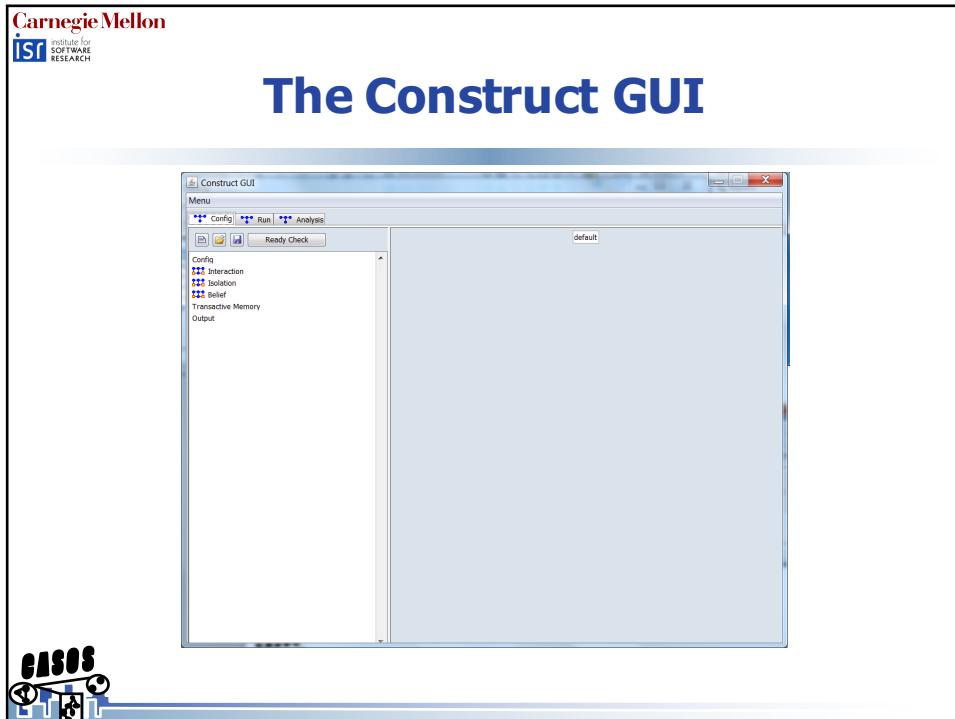
Meta-Network Manager

- CapuletsAndMontagues
 - Actor : size 100
 - Knowledge : size 100
 - Strong Ties, after Romeo-Juliet
 - Strong Ties, before Romeo-Juliet
 - Knowledge
- CapuletsAndMontagues

General statistics:

Source count:	0
Nodeset count:	2
Node count:	200

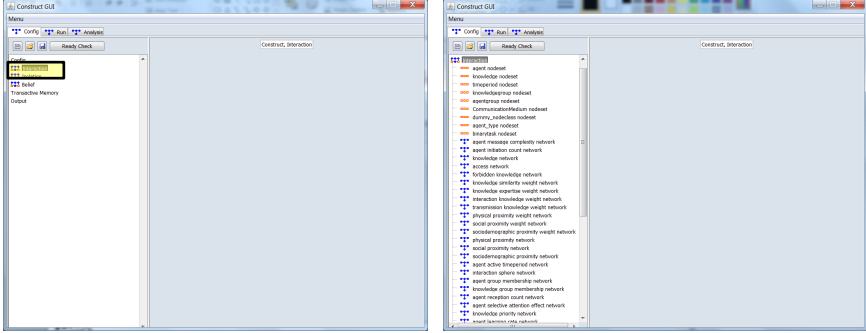
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Open "Interaction" Meta-Network

1. Double-Click "Interaction"



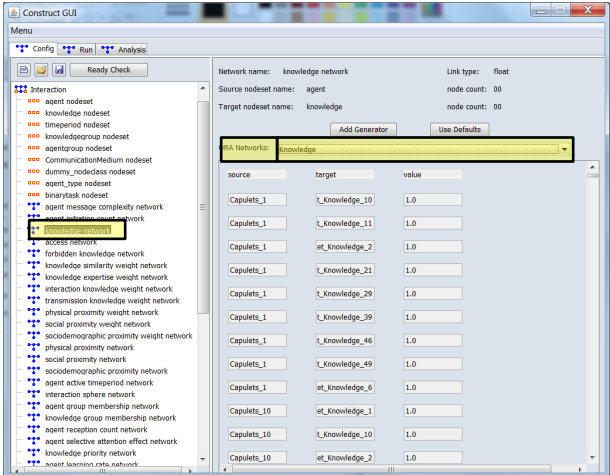
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Set Knowledge Network

When we clicked "Use Defaults", the Construct GUI assumed we every agent to have a chance of knowing everything. This is not what we want, so we use our ORA network to set the network in Construct.

1. Click "knowledge network"
2. Go to ORA Network Combo-Box
3. Select "Knowledge Network"



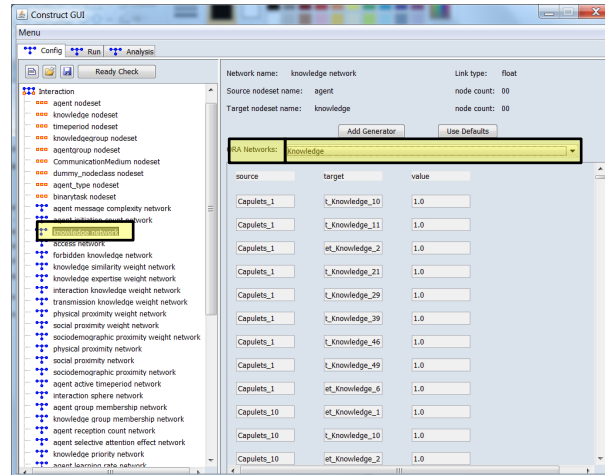
source	target	value
Capulets_1	_knowledge_10	1.0
Capulets_1	_knowledge_11	1.0
Capulets_1	et_knowledge_2	1.0
Capulets_1	_knowledge_21	1.0
Capulets_1	_knowledge_29	1.0
Capulets_1	_knowledge_39	1.0
Capulets_1	_knowledge_46	1.0
Capulets_1	_knowledge_49	1.0
Capulets_1	et_knowledge_6	1.0
Capulets_10	et_knowledge_1	1.0
Capulets_10	_knowledge_10	1.0
Capulets_10	et_knowledge_2	1.0

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Set Knowledge Network

When we clicked "Use Defaults", the Construct GUI assumed we want every agent to have a chance of knowing everything. This is not what we want, so we use our ORA network to set the network in Construct.

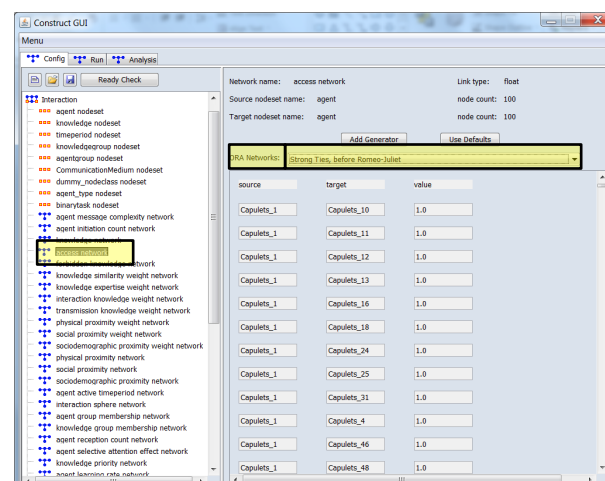
1. Click "knowledge network"
2. Go to the "ORA Networks" Combo-Box
3. Select "Knowledge" (this is the name of the network in ORA)



Set Access Network, Use "Before"

When we clicked "Use Defaults", the Construct GUI assumed we want every agent to be able to interact with everyone. This is not what we want, so we use our ORA network to set the network in Construct.

1. Click "access network"
2. Go to the "ORA Networks" Combo-Box
3. Select "Strong Ties, before Romeo-Juliet" (this is the name of the network in ORA)

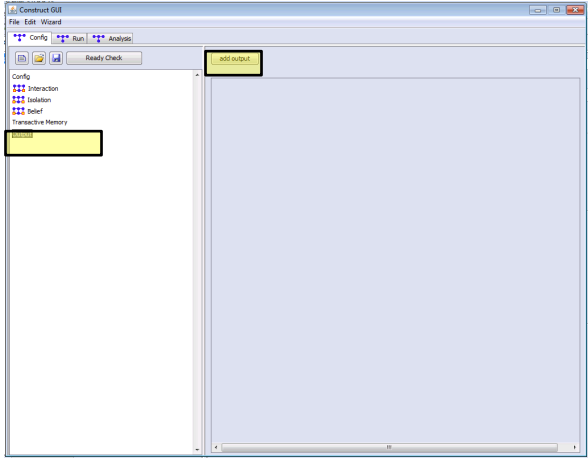


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Configure Output

When we clicked "Use Defaults", the Construct GUI assumed we want every agent to be able to interact with everyone. This is not what we want, so we use our ORA network to set the network in Construct.

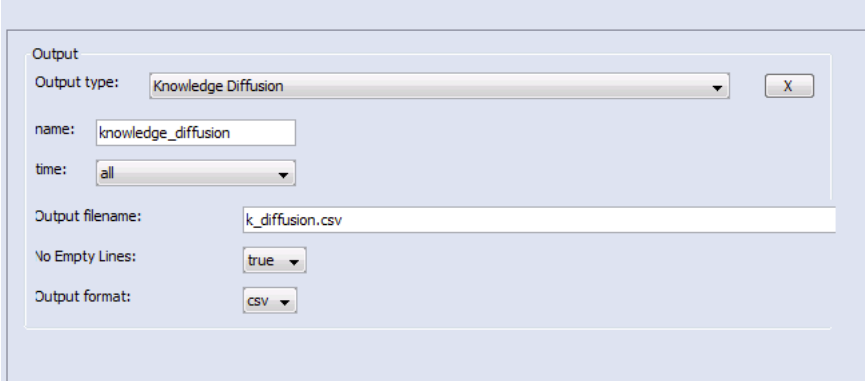
1. Click "access network"
2. Go to the "ORA Networks" Combo-Box
3. Select "Strong Ties, before Romeo-Juliet" (this is the name of the network in ORA)



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Add Knowledge Diffusion



Output

Output type: Knowledge Diffusion

name: knowledge_diffusion

time: all

Output filename: k_diffusion.csv

No Empty Lines: true

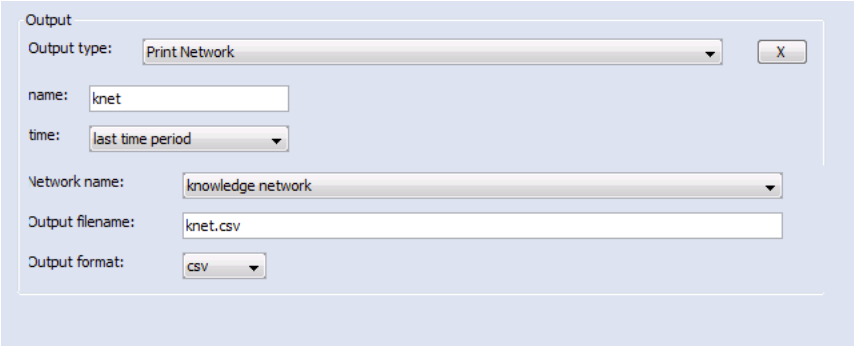
Output format: CSV

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Add Knowledge Network at last time period



Output type: Print Network

name: knet

time: last time period

Network name: knowledge network

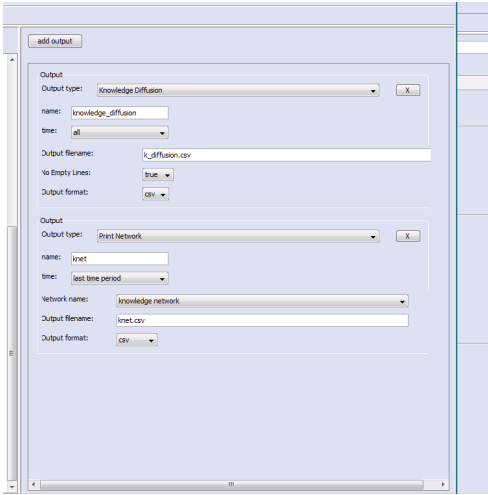
Output filename: knet.csv

Output format: csv

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You should have two outputs



add output

Output type: Knowledge Diffusion

name: knowledge_diffusion

time: all

Output filename: _diffusion.csv

No Empty Lines: true

Output format: csv

Output type: Print Network

name: knet

time: last time period

Network name: knowledge network

Output filename: knet.csv

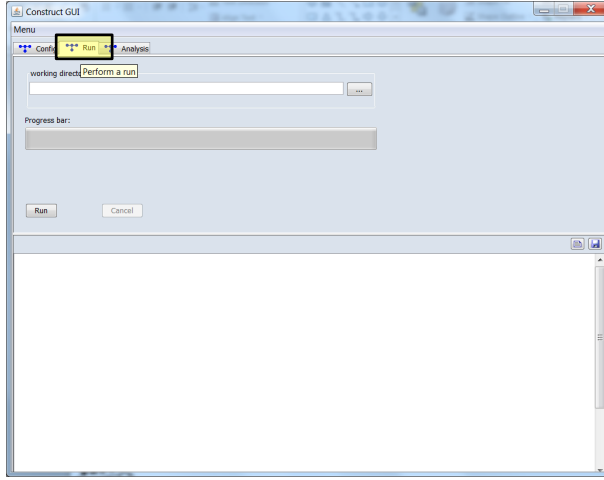
Output format: csv

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Go to the Run Tab

We have to tell Construct where to run to put the output, and then start the run.



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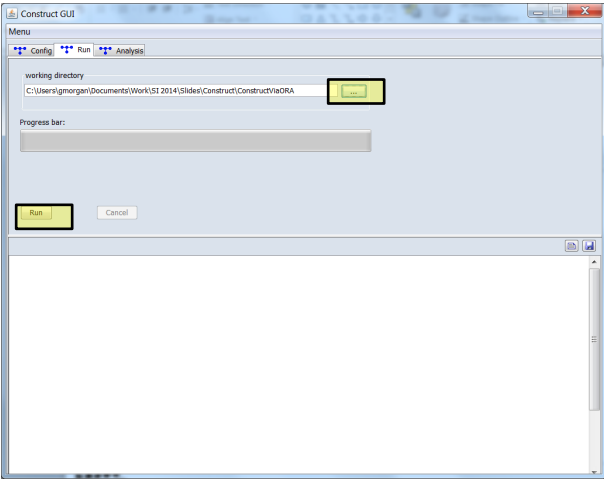
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Configure the working directory, start the sim!

We have to tell Construct where to run to put the output, and then start the run.

1. Set the working directory by clicking "..."
2. Click "Run"

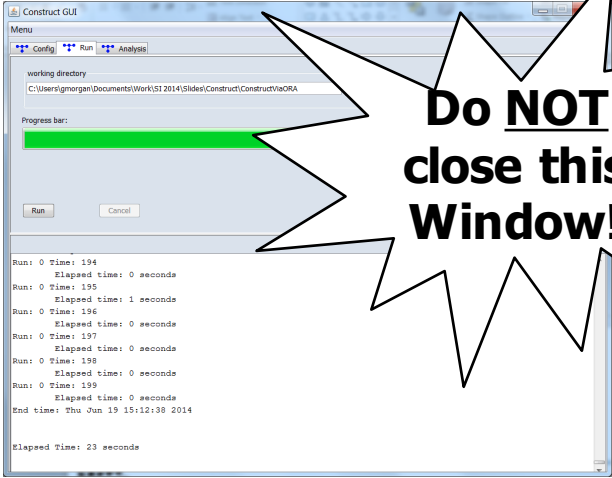
(There will be lots of text. And this will take a few minutes.)



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Voila!



working directory
C:\Users\jmorgan\Documents\Work\SI 2014\Slides\Construct\ConstructViaORA

Progress bar:

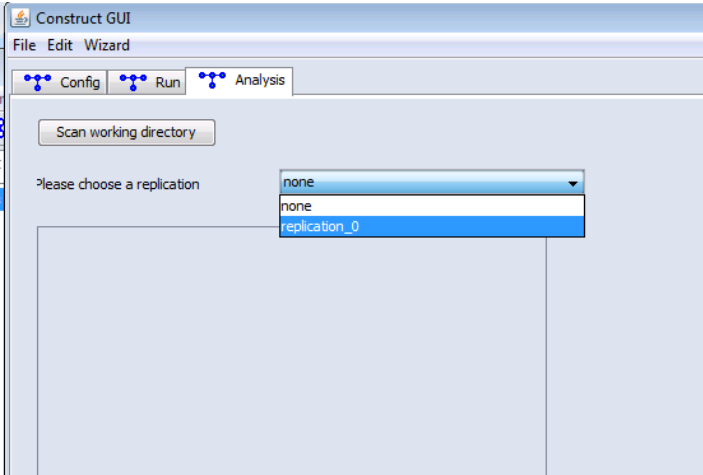
Run: 0 Time: 194 Elapsed time: 0 seconds
Run: 0 Time: 195 Elapsed time: 1 seconds
Run: 0 Time: 196 Elapsed time: 0 seconds
Run: 0 Time: 197 Elapsed time: 0 seconds
Run: 0 Time: 198 Elapsed time: 0 seconds
Run: 0 Time: 199 Elapsed time: 0 seconds
End time: Thu Jun 19 15:12:38 2014
Elapsed Time: 23 seconds

Do NOT close this Window!

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Scan the working directory, select replication_0



Construct GUI
File Edit Wizard

Config Run Analysis

Scan working directory

Please choose a replication

- none
- none
- replication_0

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Lets look at knowledge diffusion

Output

name: knowledge_diffusion

type: ReadKnowledgeDiffusion

Visualize

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What is knowledge diffusion?

Knowledge Diffusion

Diffusion

Time

diffusion

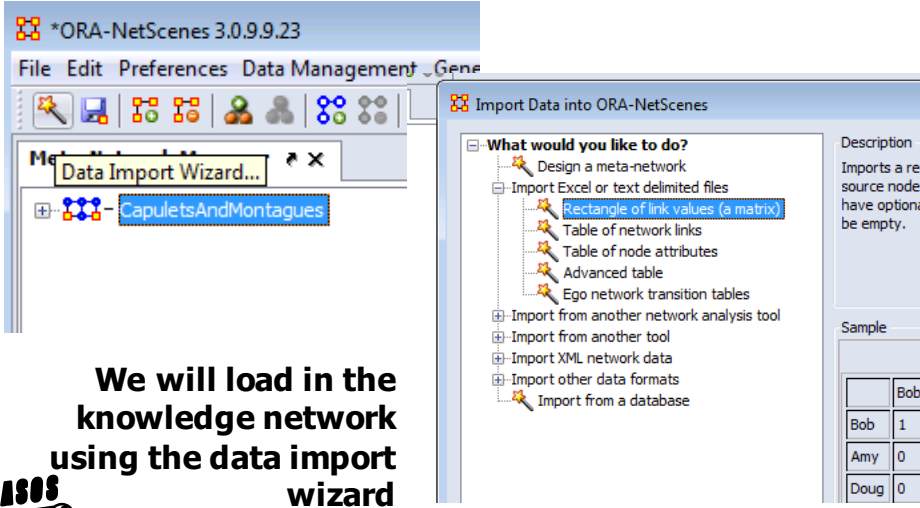
50% appears to be a ceiling, why?

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Looking at the knowledge network



We will load in the knowledge network using the data import wizard

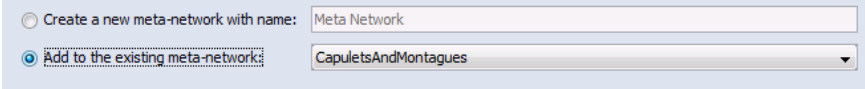
Sample

	Bob
Bob	1
Amy	0
Doug	0

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Importing knot.csv



Create a new meta-network with name: Meta Network

Add to the existing meta-network: CapuletsAndMontagues

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Importing knet.csv

Navigate to what you set the working directory to in the Construct GUI

Data will be in
YOUR_DIR/replication_0/output/knet/knet.csv

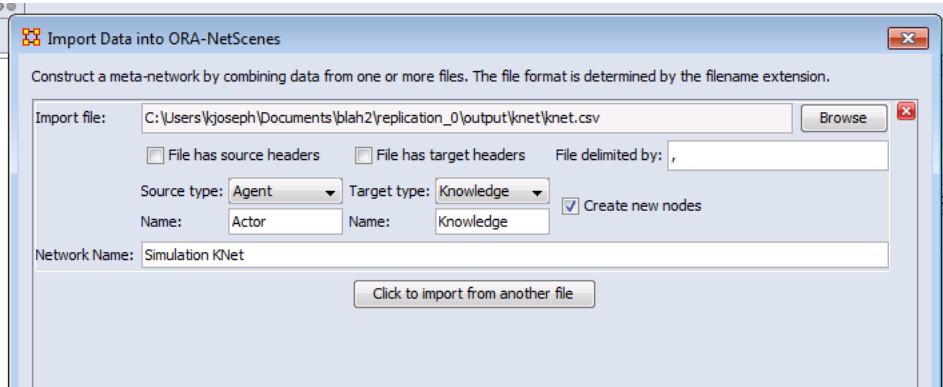
Note, your data does not have headers!

Note, you need to change the name of the node class!

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Importing knet.csv



Import Data into ORA-NetScenes

Construct a meta-network by combining data from one or more files. The file format is determined by the filename extension.

Import file: C:\Users\joseph\Documents\blah2\replication_0\output\knet\knet.csv

File has source headers File has target headers File delimited by: ,

Source type: Agent Target type: Knowledge Create new nodes

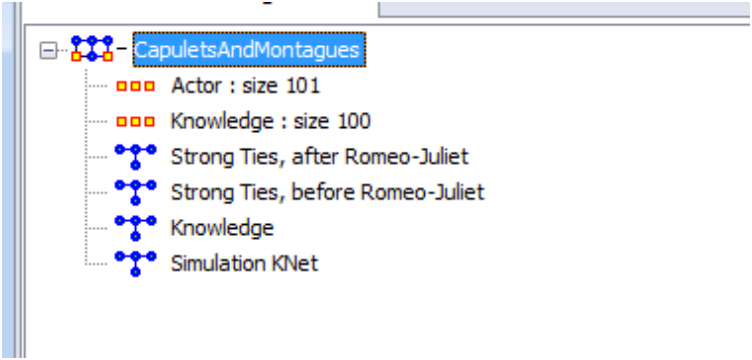
Name: Actor Name: Knowledge

Network Name: Simulation KNet

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If you don't have this now, raise your hand



The screenshot shows a tree view with the following items:

- CapuletsAndMontagues
 - Actor : size 101
 - Knowledge : size 100
 - Strong Ties, after Romeo-Juliet
 - Strong Ties, before Romeo-Juliet
 - Knowledge
 - Simulation KNet

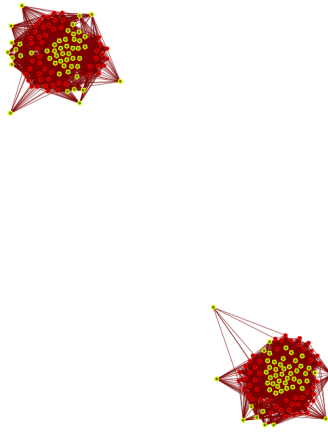
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Look at the networks and their differences

CapuletsAndMontagues



The image displays two network visualizations of the CapuletsAndMontagues dataset. The top visualization shows a dense, highly interconnected network with many red nodes and edges. The bottom visualization shows a sparser network with fewer nodes and edges, representing a different state or configuration of the same dataset.

powered by ORA-NetScapes

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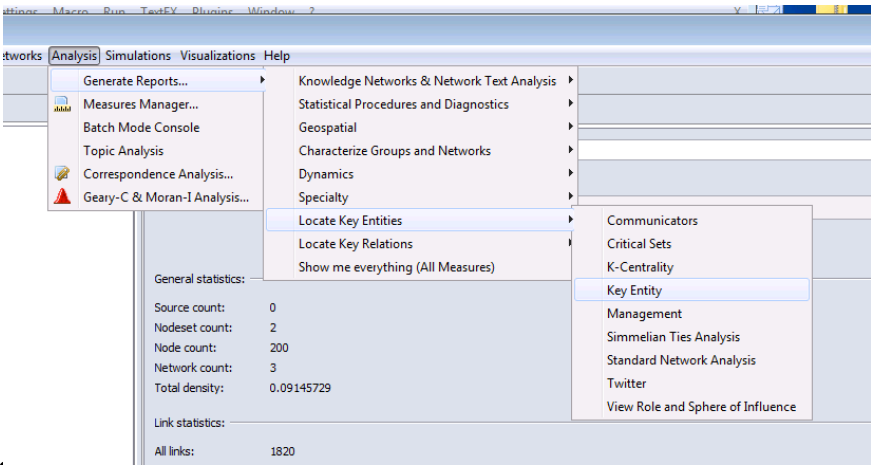
Turning into a Near Term Impact Report

- Now, let's look at what happens to knowledge diffusion when we remove actors
- Pop-quiz ... how do we find the top-K actors in this network?

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Key Entity Report



General statistics:

Source count:	0
Nodeset count:	2
Node count:	200
Network count:	3
Total density:	0.09145729

Link statistics:

All links:	1820
------------	------

Key Entity Report Data:

Communicators
Critical Sets
K-Centrality
Key Entity
Management
Simmelian Ties Analysis
Standard Network Analysis
Twitter
View Role and Sphere of Influence

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Key Entity Report

Generate Reports - Key Entity

Select the parts of the meta-network to analyze.

Nodesets to analyze:

- Actor : size 100
- Knowledge : size 100

Select All | Clear All

Networks to analyze:

- Knowledge
- Strong Ties, after Romeo-Juliet
- Strong Ties, before Romeo-Juliet

Select All | Clear All

< Back Next > Cancel

Only look at before Romeo and Juliet

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Key Entity Report

KEY ENTITY REPORT

Input data: CapuletsAndMontagues
Start time: Thu Jun 25 09:42:51 2015

[Data Description](#)

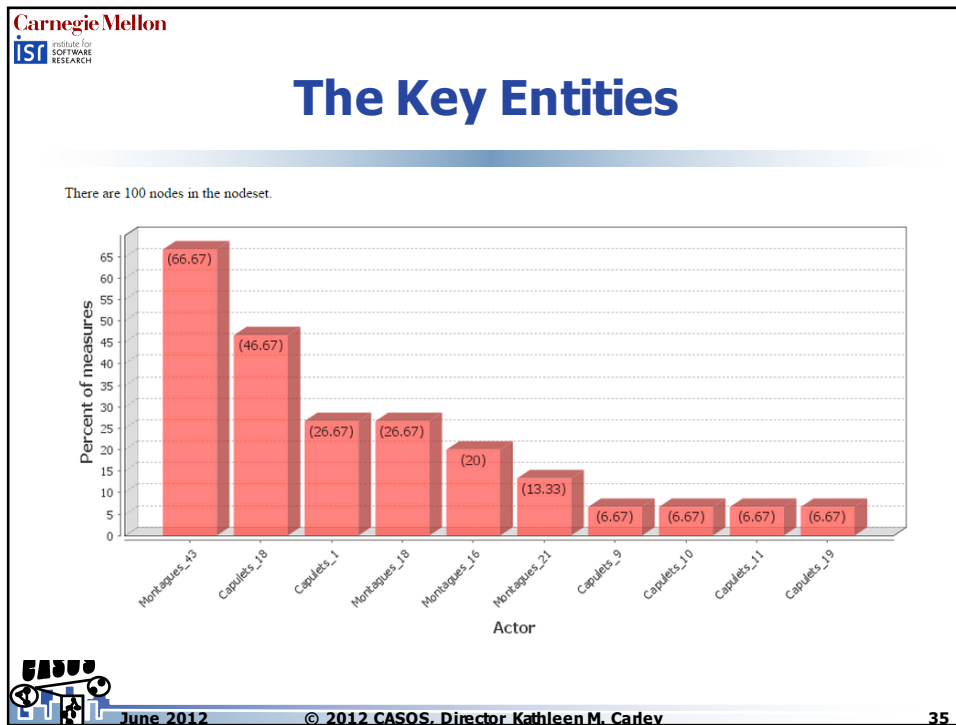
Table of Contents

- [Key Actor - Who Analysis](#)
- [Key Knowledge - How Analysis](#)
- [Performance Indicators - measures performance of the organization\(s\) as a whole](#)
- [Component Analysis](#)

Produced by ORA-NetScenes, a joint product of the CASOS center at Carnegie Mellon University and Netanomics

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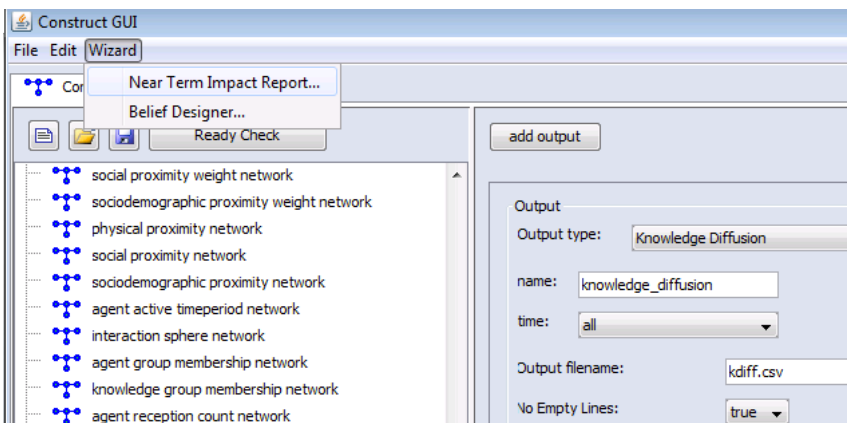
Near Term Impact Assessment

- What happens to knowledge diffusion if we remove these actors?
- Let's go back to the Construct GUI now and check it out
- **Hopefully, you haven't closed the Construct GUI window ... if you have, you'll have to redo...

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Select the Near Term Impact Report from the Wizard menu

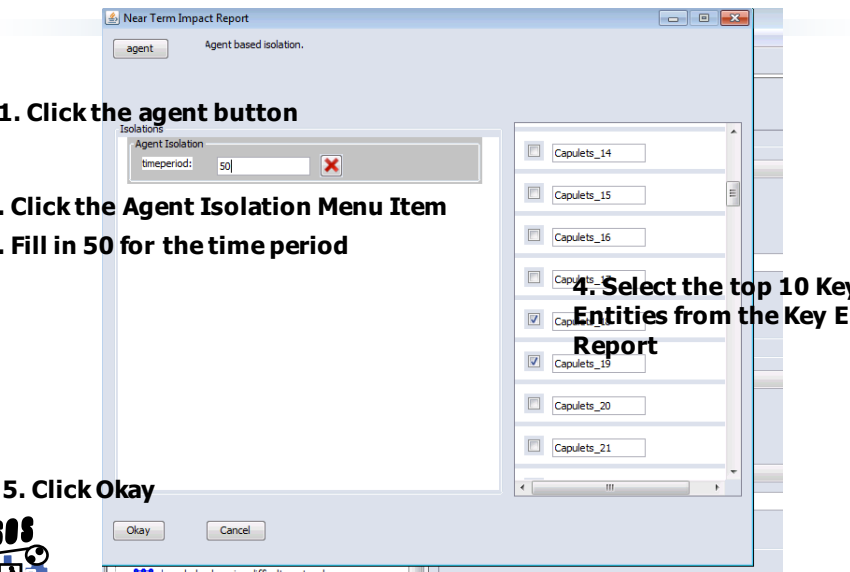


The screenshot shows the Construct GUI interface. The 'Wizard' menu is open, highlighting 'Near Term Impact Report...'. Below the menu, a list of network types is visible, including 'social proximity weight network', 'sociodemographic proximity weight network', 'physical proximity network', 'social proximity network', 'sociodemographic proximity network', 'agent active timeperiod network', 'interaction sphere network', 'agent group membership network', 'knowledge group membership network', and 'agent reception count network'. On the right, the 'Output' configuration panel shows 'Output type: Knowledge Diffusion', 'name: knowledge_diffusion', 'time: all', 'Output filename: kdiff.csv', and 'No Empty Lines: true'.

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Selecting the Isolation event



The screenshot shows the 'Near Term Impact Report' dialog box. The 'agent' button is selected, and the 'Agent based isolation.' option is chosen. The 'Isolation' section has a 'timeperiod:' field set to '50'. A list of 'Capulets' entities is shown on the right, with the top 10 key entities selected. The instructions are as follows:

1. Click the agent button
2. Click the Agent Isolation Menu Item
3. Fill in 50 for the time period
4. Select the top 10 Key Entities from the Key Entity Report
5. Click Okay

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Great, now simply re-run!

- Note: This will overwrite your existing data, but that's okay for now (or change the working directory)
- What happens to knowledge diffusion?

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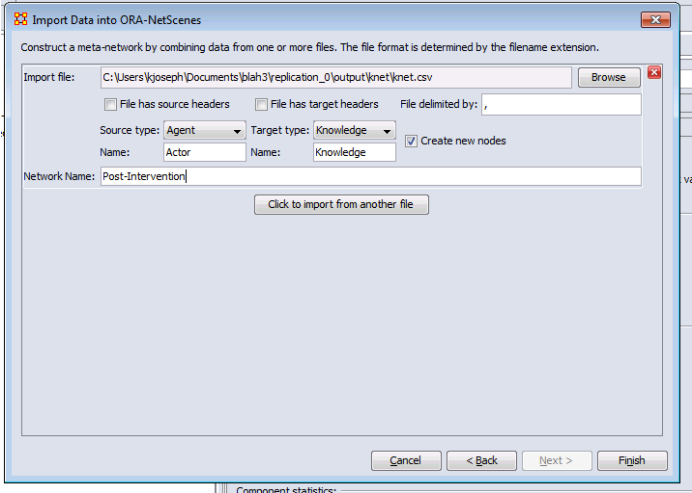
Knowledge Diffusion

Time	Diffusion
0	0.100
25	0.200
50	0.275
50	0.250
75	0.280
100	0.300
125	0.320
150	0.340
175	0.360
200	0.375

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Let's import the new knowledge network and look at it



Construct a meta-network by combining data from one or more files. The file format is determined by the filename extension.

Import file: C:\Users\joseph\Documents\blah2\replication_0\output\knet\knet.csv

File has source headers File has target headers File delimited by: ,

Source type: Agent Target type: Knowledge Create new nodes

Name: Actor Name: Knowledge

Network Name: Post-Intervention

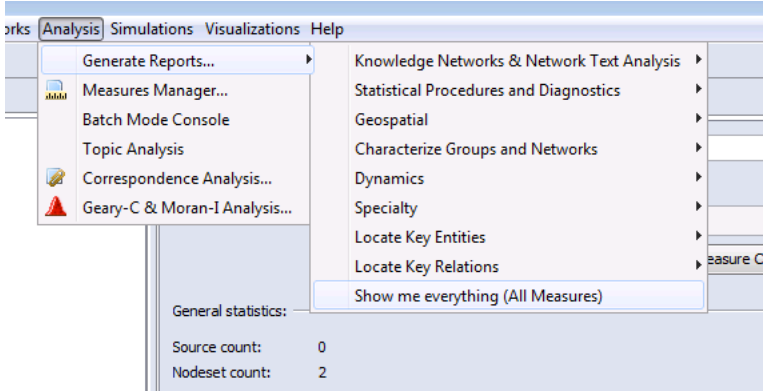
Component statistics:

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Now, lets compare the knowledge networks



Analysis Simulations Visualizations Help

- Generate Reports...
- Measures Manager...
- Batch Mode Console
- Topic Analysis
- Correspondence Analysis...
- Geary-C & Moran-I Analysis...

- Knowledge Networks & Network Text Analysis
 - Statistical Procedures and Diagnostics
 - Geospatial
 - Characterize Groups and Networks
 - Dynamics
 - Specialty
 - Locate Key Entities
 - Locate Key Relations
 - Show me everything (All Measures)

General statistics:

Source count: 0

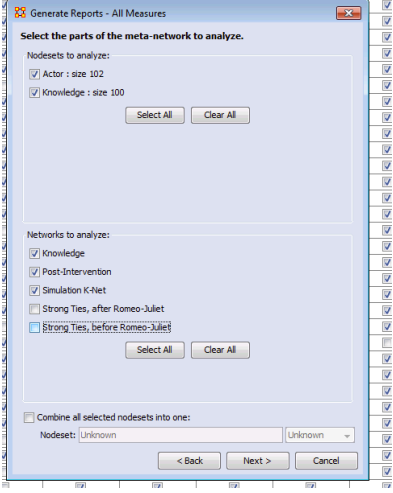
Nodeset count: 2

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Only run with the three knowledge networks



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Take a look at the different metrics

- In particular, look at density

Density	0.100
Density, With-Feed	0.100

Original knowledge network

Density	0.405
---------	-------

No intervention

Density	0.350
---------	-------

With intervention

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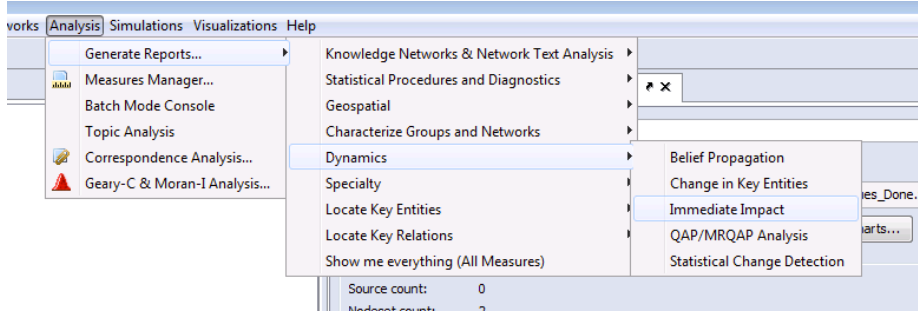
Now

- Is this different interesting/significant?
- What about removing/adding knowledge, or adding new people/connections?
- What about people's beliefs?
- What about if knowledge isn't perfect in the system? E.g. what if we play with transactive memory
- ... later!

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One last thing – Comparing to Immediate Impact Report

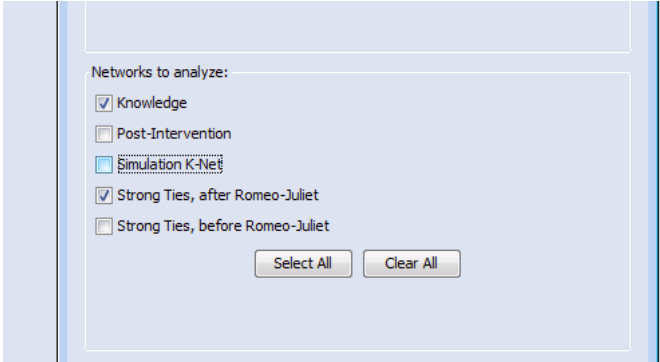


The screenshot shows the CASOS software interface. The 'Analysis' menu is open, displaying a list of analysis options. The 'Dynamics' option is selected, and its sub-menu is also open, showing 'Immediate Impact' as the selected item. Other options in the 'Dynamics' sub-menu include 'Belief Propagation', 'Change in Key Entities', 'QAP/MRQAP Analysis', and 'Statistical Change Detection'. The main window title is 'works' and the menu bar includes 'Analysis', 'Simulations', 'Visualizations', and 'Help'. At the bottom, there are status indicators for 'Source count: 0' and 'Network count: 7'.

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Run on initial network



Networks to analyze:

- Knowledge
- Post-Intervention
- Simulation K-Net
- Strong Ties, after Romeo-Juliet
- Strong Ties, before Romeo-Juliet

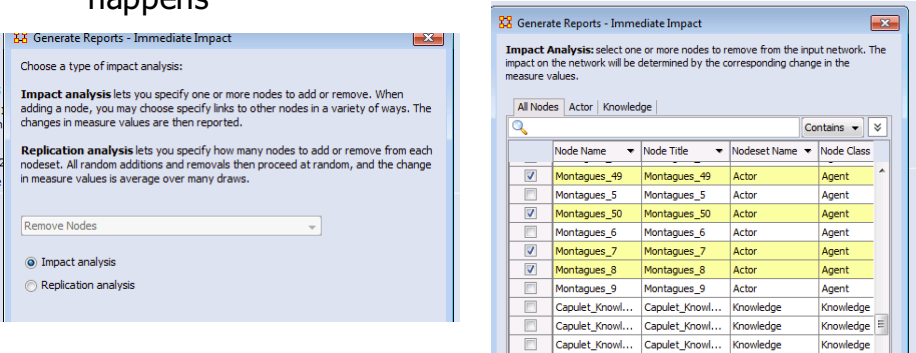
Select All Clear All

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Impact Analysis

- Lets just remove some random people to see what happens



Generate Reports - Immediate Impact

Choose a type of impact analysis:

Impact analysis lets you specify one or more nodes to add or remove. When adding a node, you may choose specify links to other nodes in a variety of ways. The changes in measure values are then reported.

Replication analysis lets you specify how many nodes to add or remove from each nodeset. All random additions and removals then proceed at random, and the change in measure values is average over many draws.

Remove Nodes

Impact analysis
 Replication analysis

Generate Reports - Immediate Impact

Impact Analysis: select one or more nodes to remove from the input network. The impact on the network will be determined by the corresponding change in the measure values.

All Nodes Actor Knowledge

Node Name	Node Title	Nodeset Name	Node Class
<input checked="" type="checkbox"/> Montagues_49	Montagues_49	Actor	Agent
<input type="checkbox"/> Montagues_5	Montagues_5	Actor	Agent
<input checked="" type="checkbox"/> Montagues_50	Montagues_50	Actor	Agent
<input type="checkbox"/> Montagues_6	Montagues_6	Actor	Agent
<input checked="" type="checkbox"/> Montagues_7	Montagues_7	Actor	Agent
<input checked="" type="checkbox"/> Montagues_8	Montagues_8	Actor	Agent
<input type="checkbox"/> Montagues_9	Montagues_9	Actor	Agent
<input type="checkbox"/> Capulet_Knowl...	Capulet_Knowl...	Knowledge	Knowledge
<input type="checkbox"/> Capulet_Knowl...	Capulet_Knowl...	Knowledge	Knowledge
<input type="checkbox"/> Capulet_Knowl...	Capulet_Knowl...	Knowledge	Knowledge

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What's different between NTA and Im. Impact. Report?

Network Level Measures

	Before	After	Percent Change
Overall Complexity	0.093	0.093	-0.01%
Input: entire meta-network considered as a single network			
Diffusion	0.929	0.914	-1.60%
Input network(s): Strong Ties, after Romeo-Juliet			
Clustering Coefficient	0.677	0.677	-0.05%
Input network(s): Strong Ties, after Romeo-Juliet			
Characteristic Path Length	4.560	5.228	+14.65%
Input network(s): Strong Ties, after Romeo-Juliet			
Social Density	0.078	0.075	-3.40%
Input network(s): Strong Ties, after Romeo-Juliet			
Average Communication Speed	0.219	0.191	-12.78%
Input network(s): Strong Ties, after Romeo-Juliet			
Number of Isolated Agents	2	2	+0%
Input network(s): Strong Ties, after Romeo-Juliet			
Fragmentation	0.039	0.043	+10.81%
Input network(s): Strong Ties, after Romeo-Juliet			

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Recap

- Load in a network, run a simulation using Near Term Construct
 - Look at the networks in ORA, compare generated to input
 - Initial vs. final knowledge
- Remove the 10 actors that are highest in one of the centralities
 - Examine change in knowledge diffusion
 - Look at generated knowledge networks in ORA
 - Compare to immediate impact report
- This was just an introduction to the process, we'll get more into what you can do with these tools soon!

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