<Your Name>

Micro Simulations in ORA

Kenny Joseph
Wei Wei

The CASOS Center
COS Program, School of Computer Science, Carnegie Mellon
Summer Institute 2013

Agenda

- Micro Simulations Background
- Generate Stylized Networks for Micro Simulation Experiments
- Run Micro Simulations from ORA Visualizer
- Run Micro Simulations from ORA Menu
  - Visualization of networks over time
  - Visualization of agent trails
  - Utilized Network
- Questions

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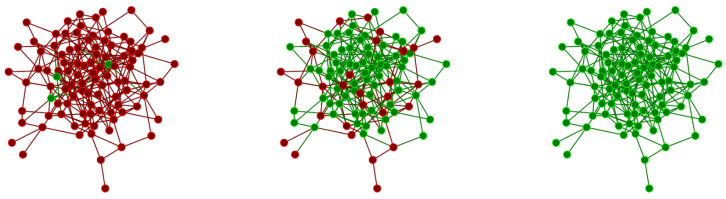
What are Micro Simulations?

- Simulations of something moving through a network over time



- Four Types of Diffusion Models in ORA:
  - "Disease" diffusion
  - "Monetary" diffusion
  - "Idea" diffusion
  - "Technology adoption"

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Input to and Output of Micro Sims. In ORA

- Input to Micro Simulations
  - A square network comprised of one node class (e.g. agent by agent, location by location)
  - A subset of nodes with resources to initialize the diffusion
  - A parameter, transmission resistance
  - Model specific parameters
- Output of Micro Simulations
  - Diffusion networks
  - Dynamic visualizations of the diffusion process over time (only if run via ORA Visualizer)

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General Micro Simulation Process in ORA

- The Diffusion Process
  - On each time step, agents who have resources will try to propagate them to their neighbors.
  - Resources will be diffused if the BOTH of the link activation checks are passed.
- The Link Activation Check
  - A probabilistic process
  - Link weight check:
    - On each link, there is a Link_Weight / Maximum **Link Successful Rate** to pass the check.
  - Transmission resistance check:
    - There is a **1 - Transmission resistance** probability to pass the second test.

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Types of Micro Simulation Models

- 1. Idea Diffusion
  - An agent can give away information it has access to
  - An agent retains information even after giving it away
  - An agent never loses information it gains
  - An agent never stops giving away information
- 2. Money Diffusion
  - An agent can give away money it posses (all or nothing) to only one of its neighbors (pick randomly)
  - Once given, the agent lost the money immediately
  - An agent can re-acquire money previously given away

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Types of Micro Simulation Models (cont.)

- 3. Disease Diffusion
  - An agent can give the disease to other entities while it is infectious.
  - A agent will be "cured" after a user-specified number of time periods.
  - Once the agent is cured, it becomes immune against it and can not become infected again.
  - Additional model parameter: a user-specified parameter indicating the proportion of agents who are immune

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Types of Micro Simulation Models (cont.)

- 4. Technology Adoption
  - An agent may adopt a technology if enough of its neighbors use the technology
  - An agent can stop using a technology, especially if its neighbors are not using the technology
  - For an agent with no incoming links, it will flip a coin to adopt/drop a technology
  - An agent can re-start using a technology

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Overview of Micro Sim. Types

	I can give it to others	I lose it after sharing	I lose it after some time	I can get it back
Ideas	YES	No	No	N/A
Disease	YES	No	YES	No
Money	YES	YES	No	YES
Tech	YES	No	YES	YES

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Micro Simulations Background (9 of 9)

- Things you should know
  - Micros Simulation is a random model
    - The results could be different each time you run the simulation
  - Link weight is important
    - The larger the link weights are, the more likely diffusion is
    - In a network that has equal weights on links (e.g. binary networks), the probability to pass link weight check will always be 1 on each link.
  - Transmission resistance
    - The larger transmission resistant is, the less likely diffusion will happen in the network.
    - If transmission resistance is 0, the diffusion is solely depends on the weights of every link in the network.

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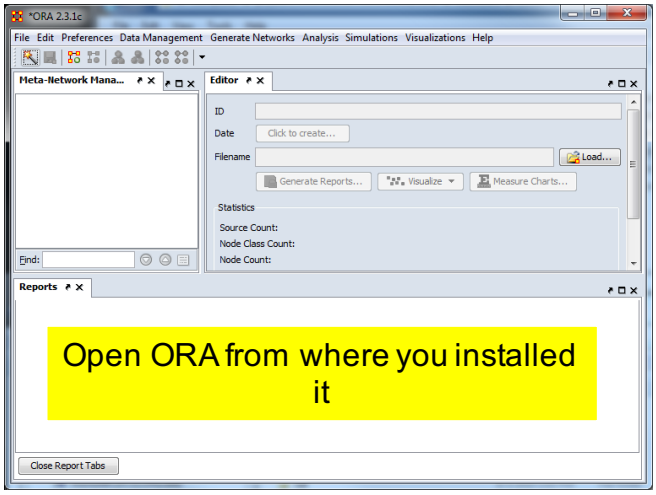
ORA Startup Screen



Open ORA from where you installed it

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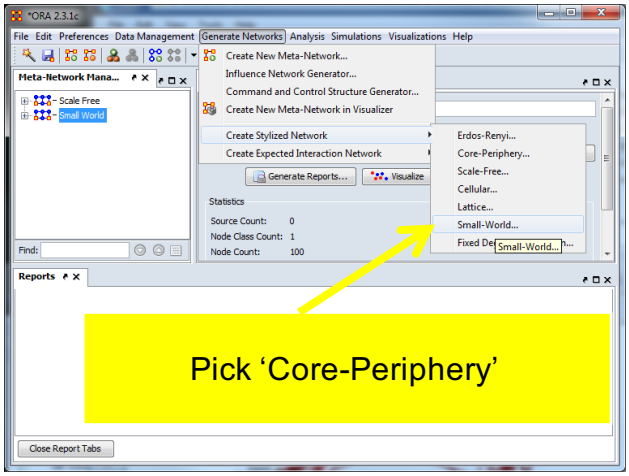
Generate Network



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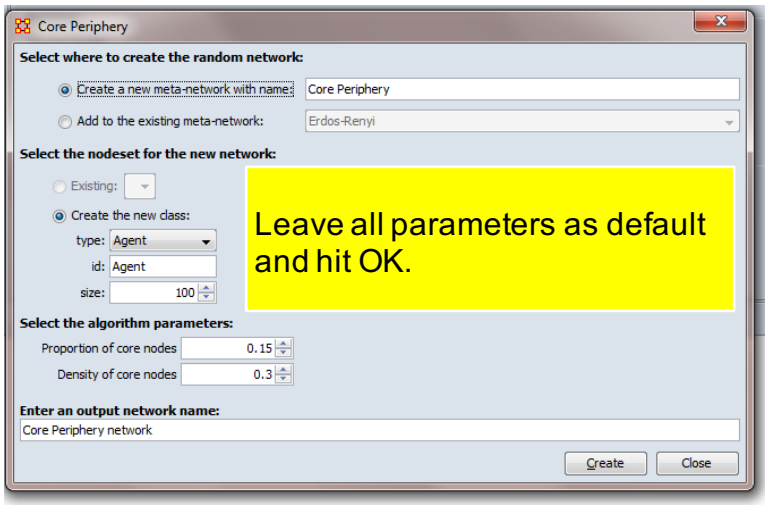
Generate a Core-Periphery Network



Leave all parameters as default and hit OK.

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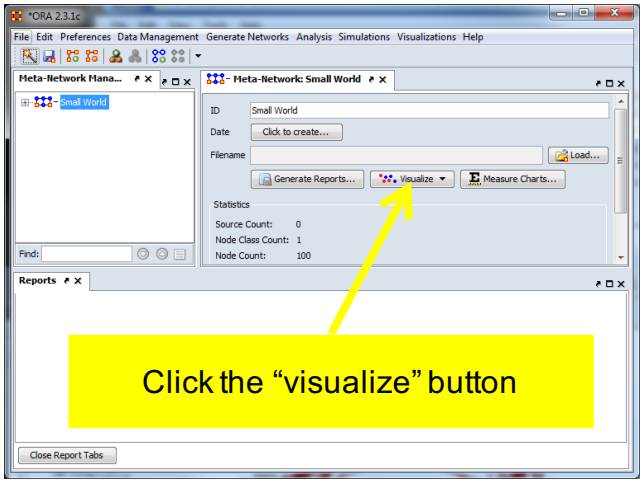
Visualize Network



Click the “visualize” button

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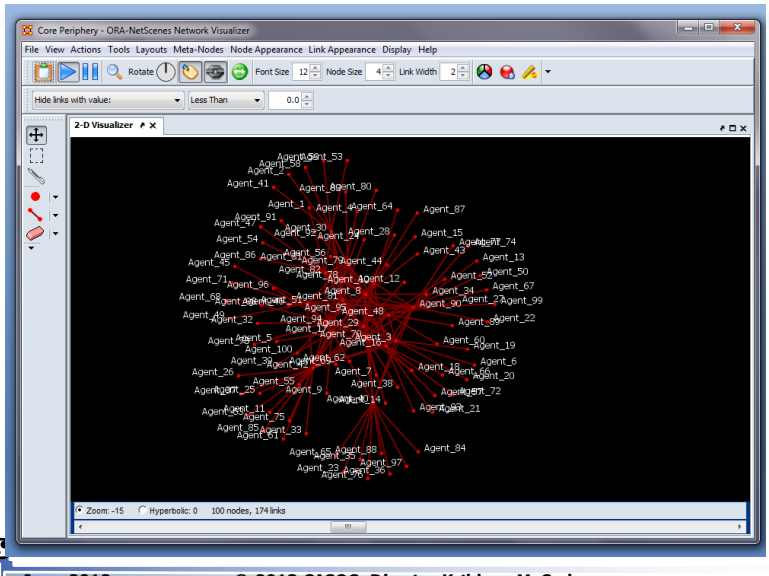
Visualize Network



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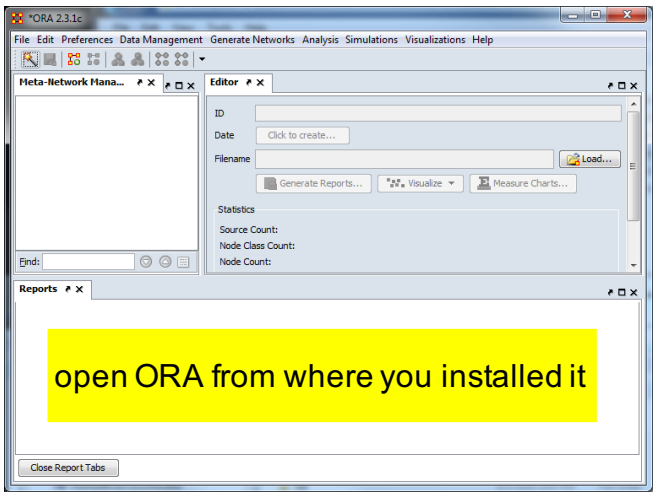
ORA Startup Screen



open ORA from where you installed it

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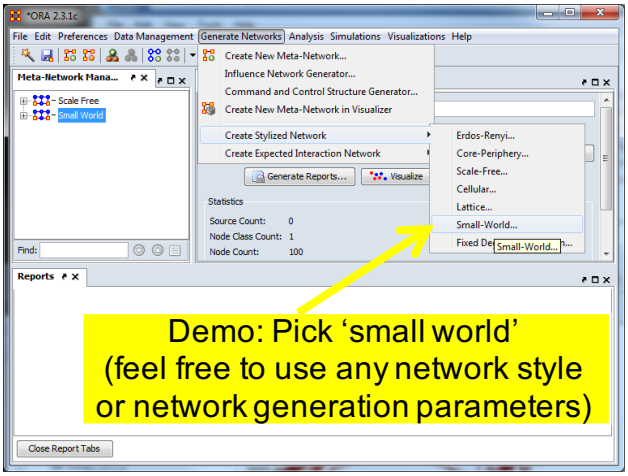
Generate Network



Demo: Pick 'small world'
(feel free to use any network style or network generation parameters)

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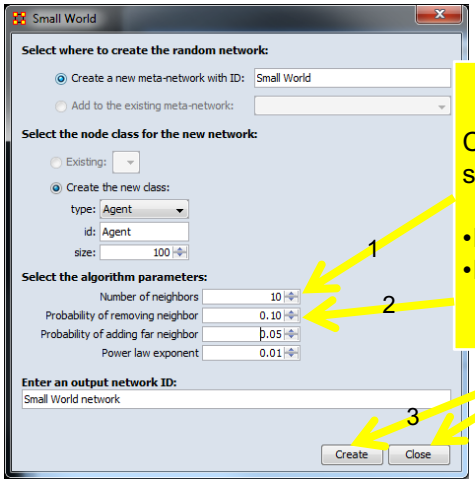
ORA Small World Generation



Change Defaults settings

- Press 'Create' then
- Press 'Close'

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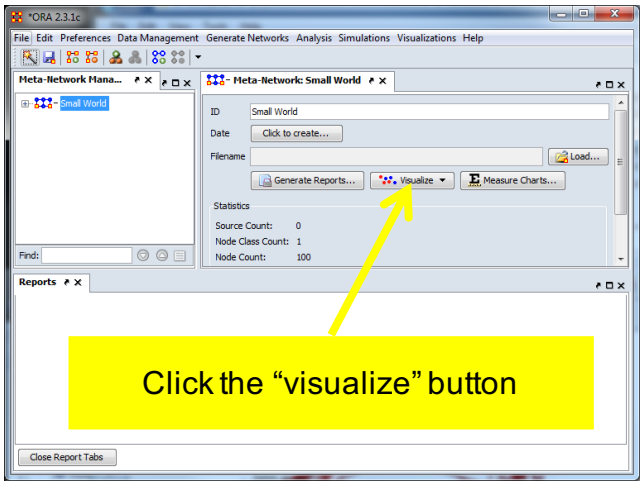
Visualize Network



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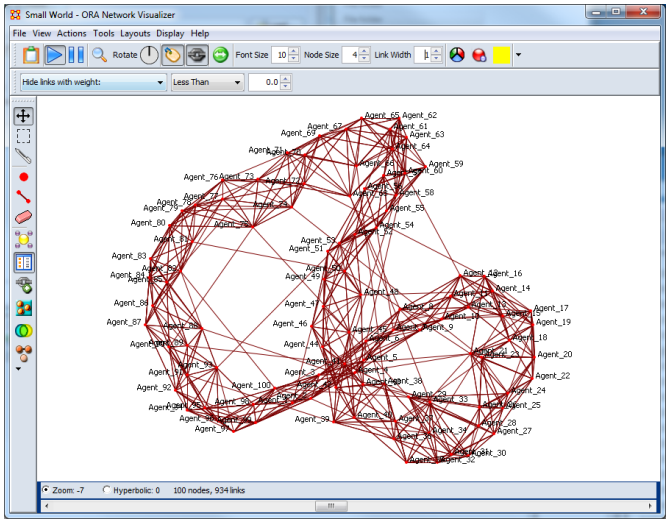
Small World Visualization



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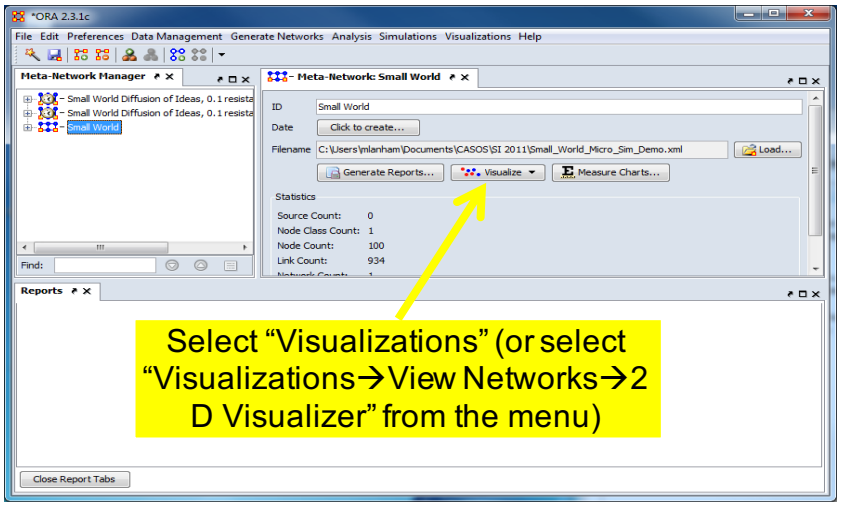

Select "Visualizations" (or select "Visualizations→View Networks→2 D Visualizer" from the menu)

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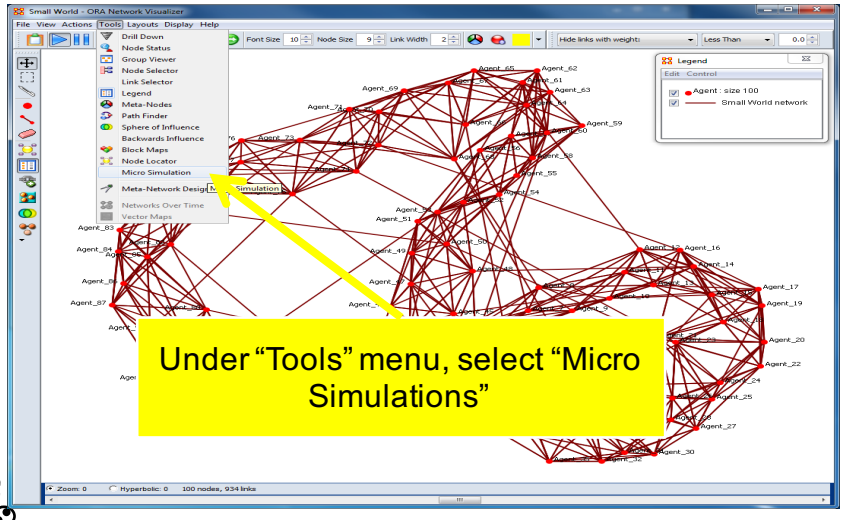
Micro-Simulation in Visualizer



Under "Tools" menu, select "Micro Simulations"

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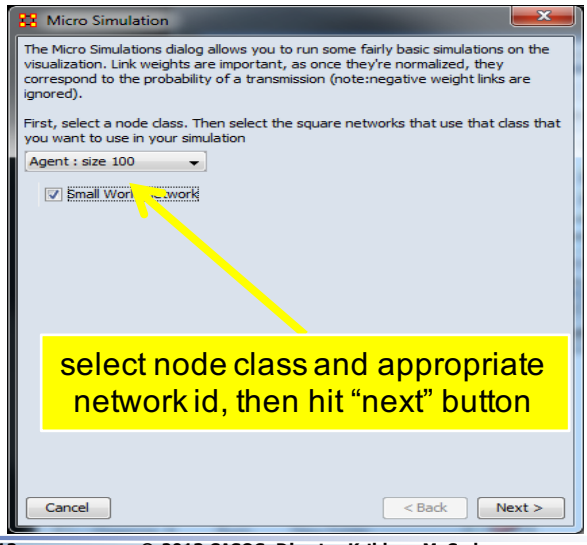
Select Nodeclass and Network for Diffusion



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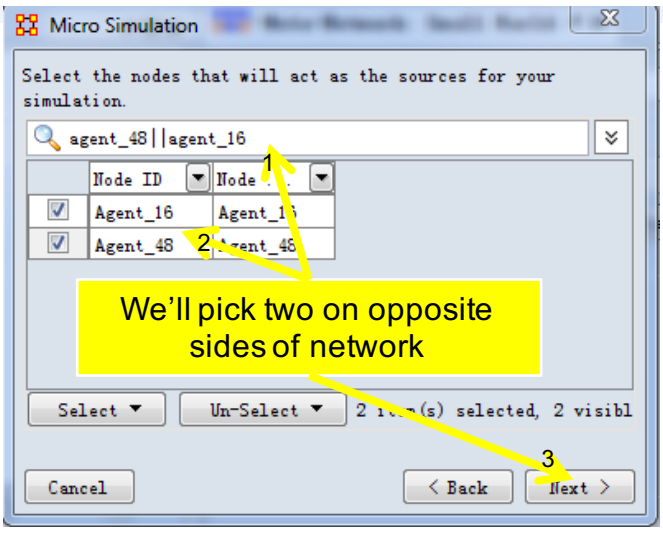
Select Initial Agents



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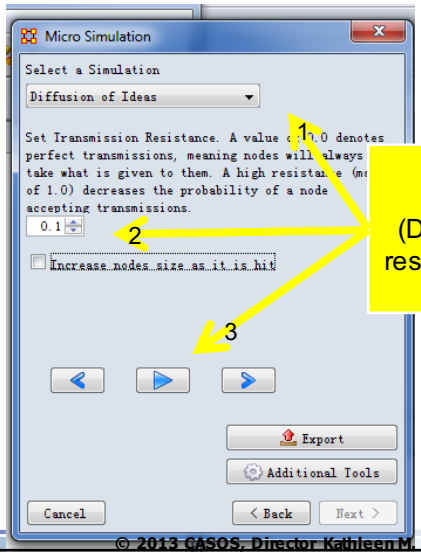
Choose Simulation Parameters



Set Choices in GUI (Diffusion of Ideas, 0.1 resistance) & Run/Pause

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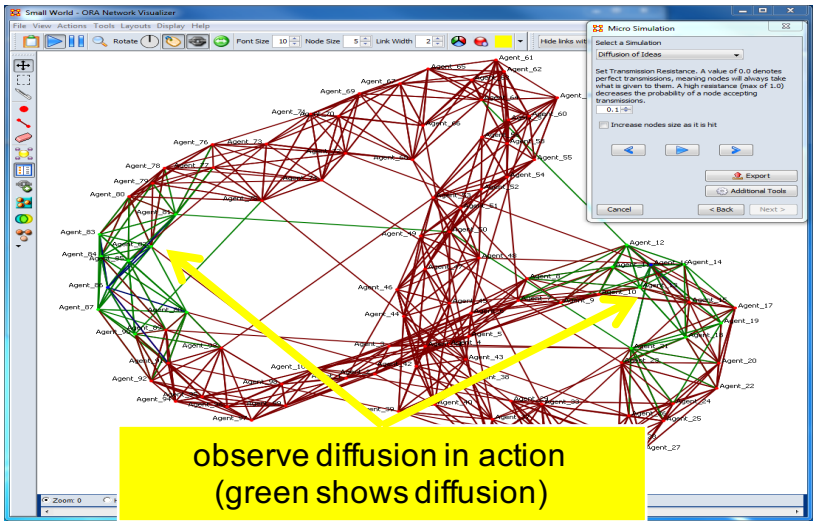
Run Simulation



observe diffusion in action (green shows diffusion)

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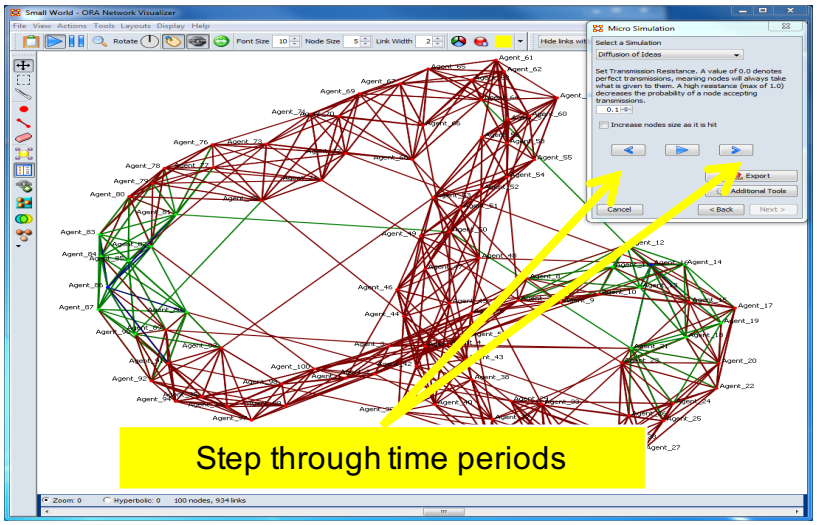
Run Simulation



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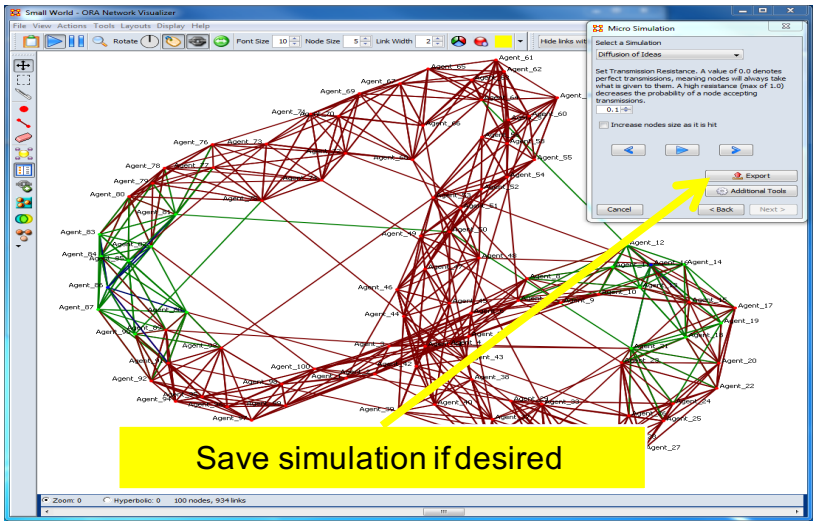
Run Simulation



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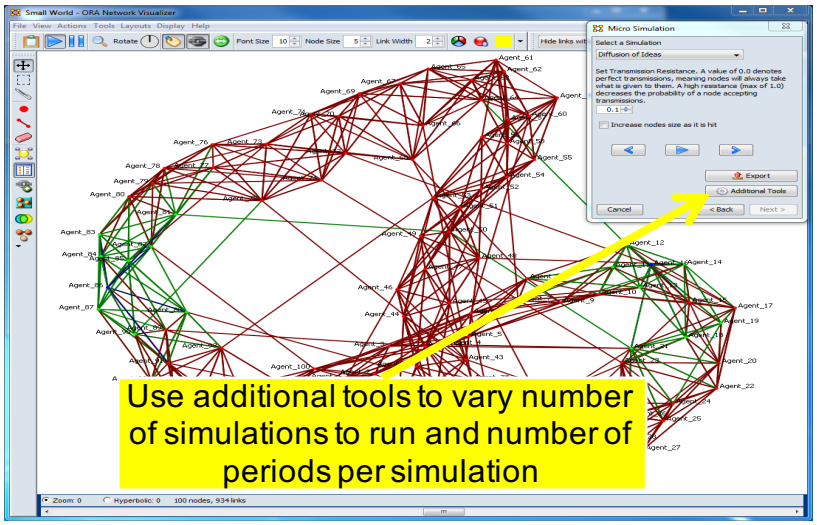

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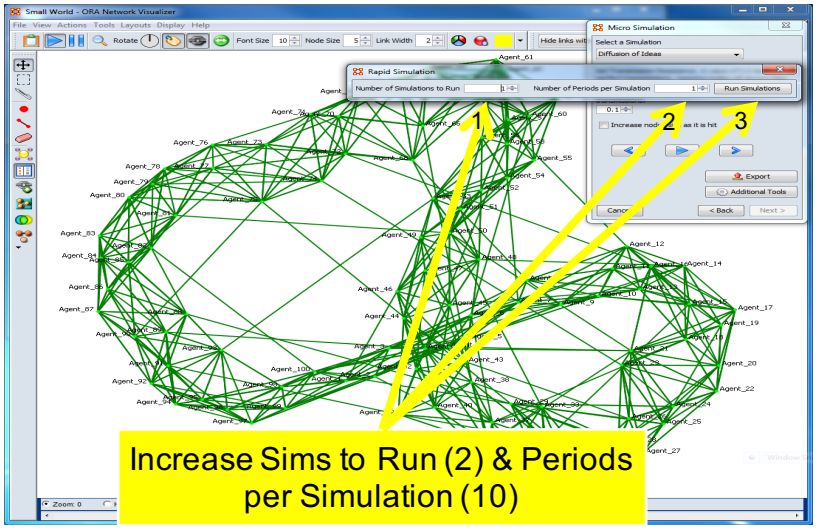
Run Simulation



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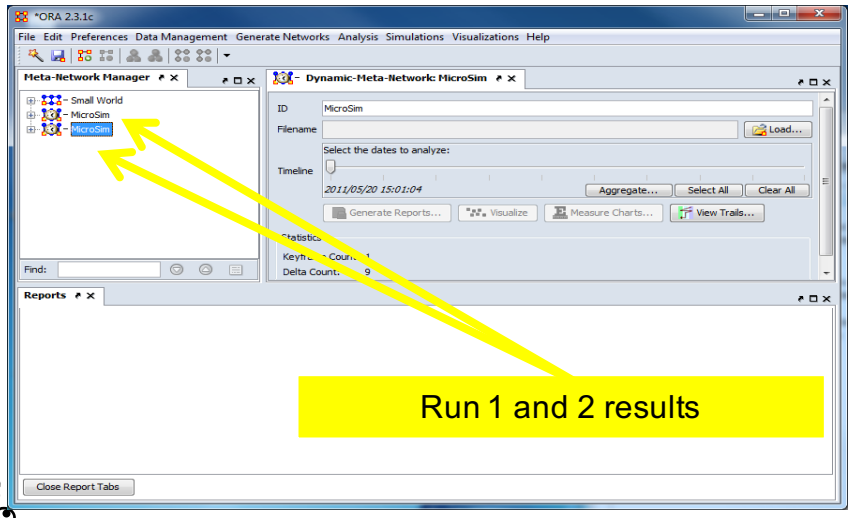
Results of Multiple Runs



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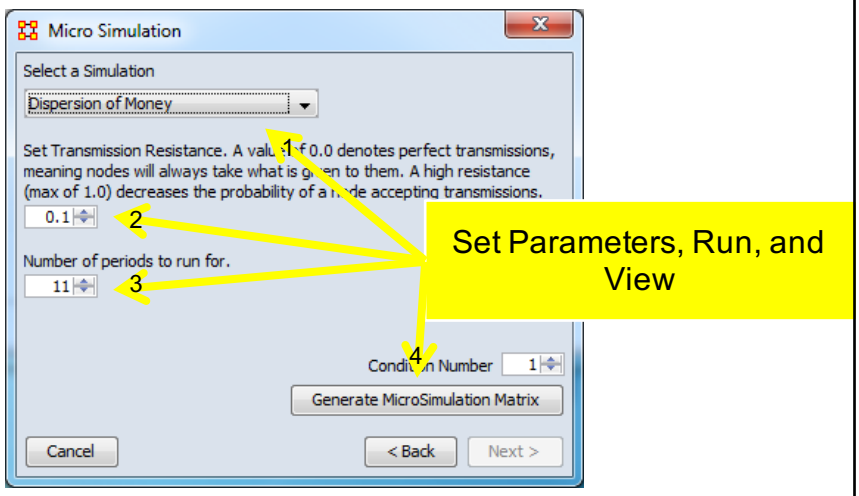
Diffusion of Money



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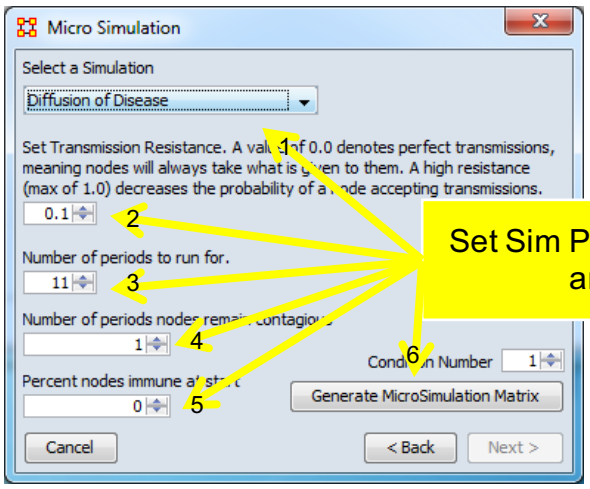
Diffusion of Disease



Set Sim Parameters, Run, and View

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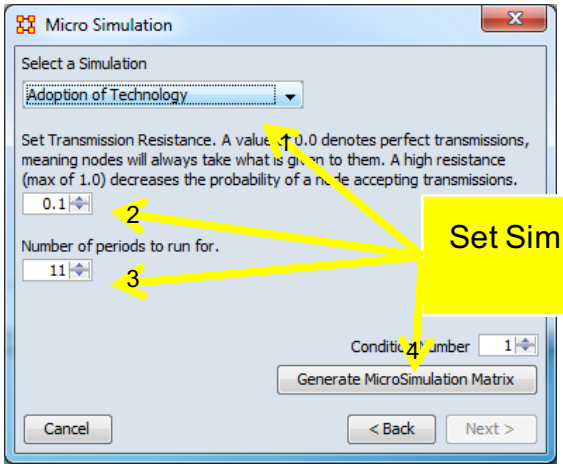
Adoption of Technology



Set Sim Parameters, Run, and View

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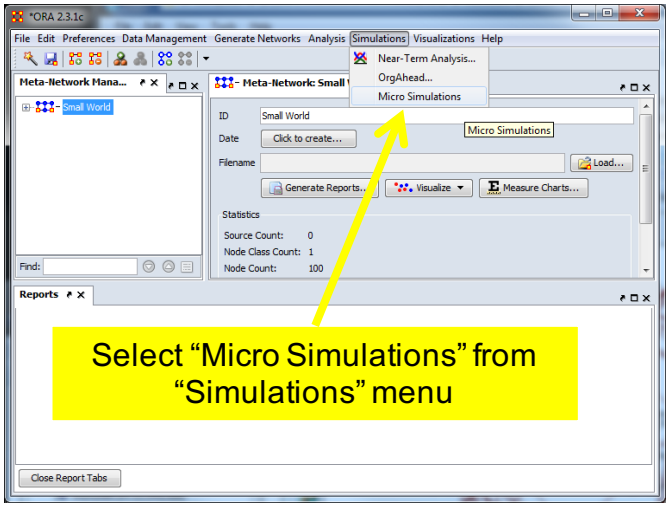
Start the Microsimulation



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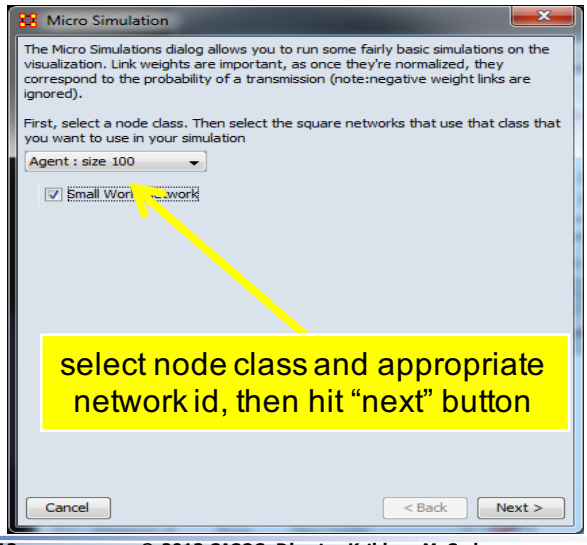
Select Network for Diffusion



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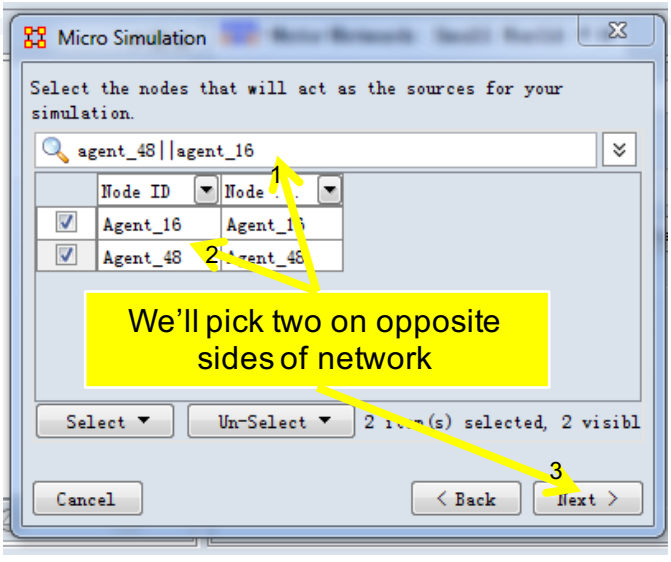
Select Initial Agents



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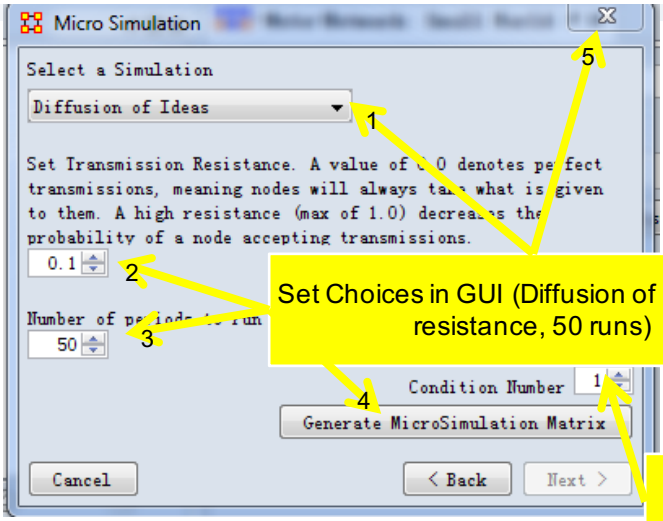
Choose Simulation Parameters



Set Choices in GUI (Diffusion of Ideas, 0.1 resistance, 50 runs)

Deprecated.

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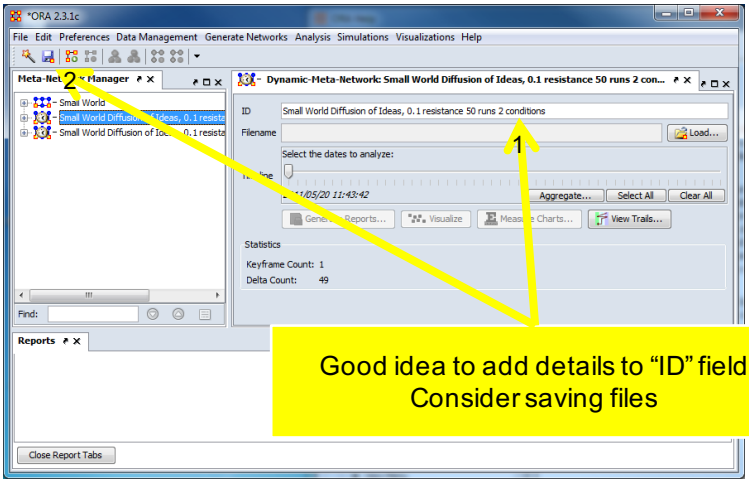
Meta-Network Manager



Good idea to add details to "ID" field
Consider saving files

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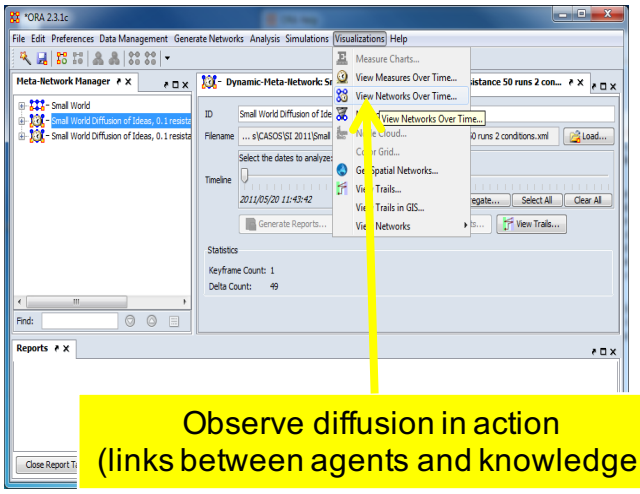
Visualize Simulation Networks over Time



Observe diffusion in action
(links between agents and knowledge)

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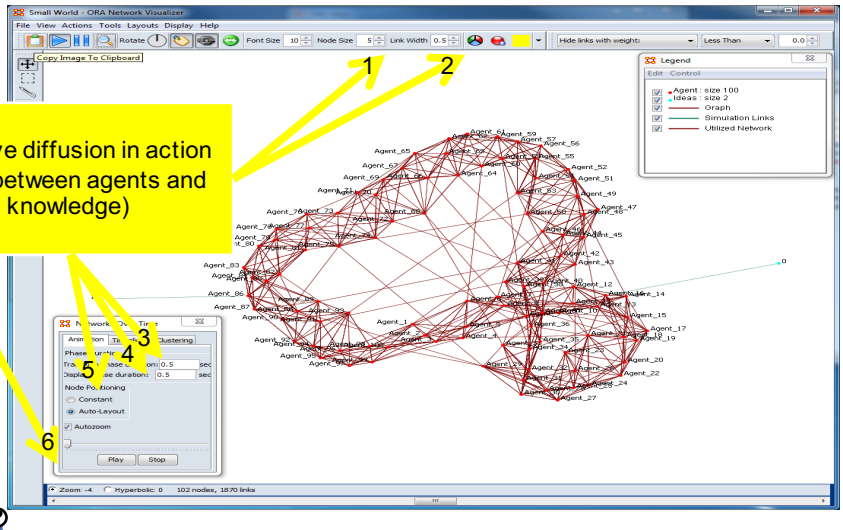
Visualize Simulation Networks over Time



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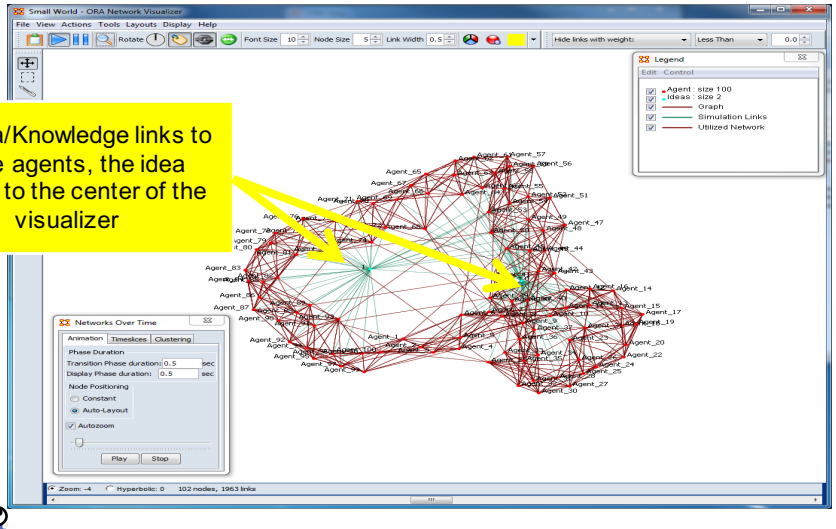
Visualize Simulation Networks over Time



As Idea/Knowledge links to more agents, the idea moves to the center of the visualizer

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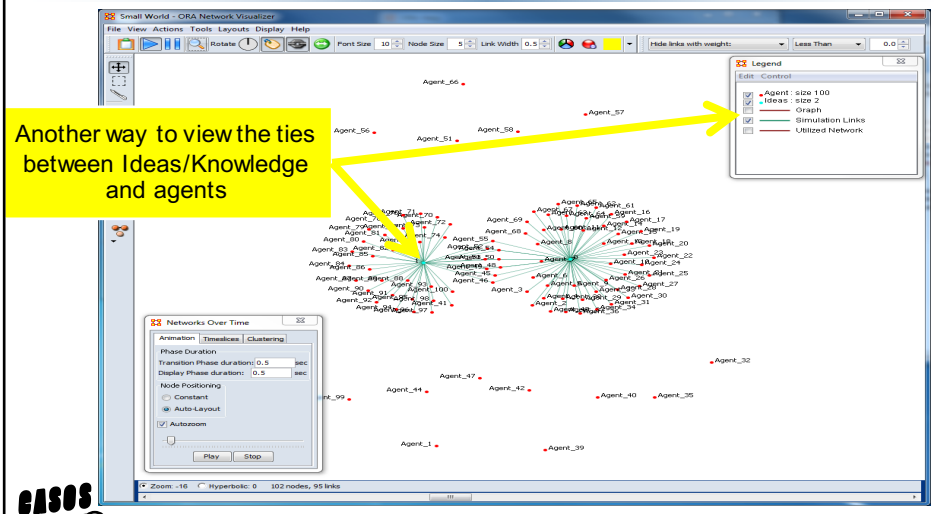
Visualize Simulation Networks over Time



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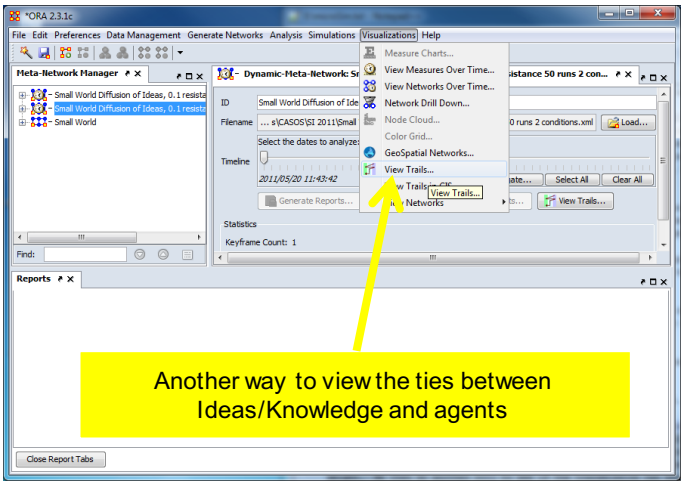
Visualization of Trails



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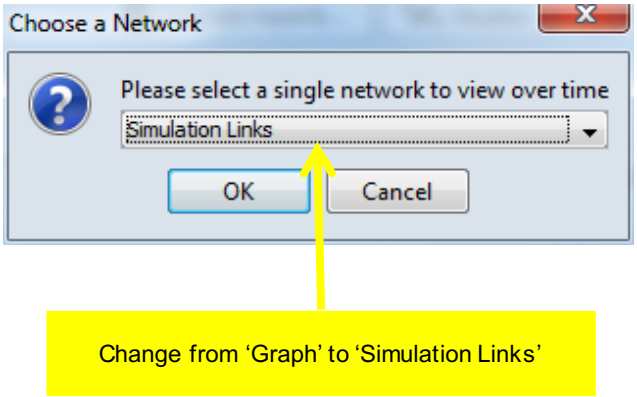
Visualization of Trails



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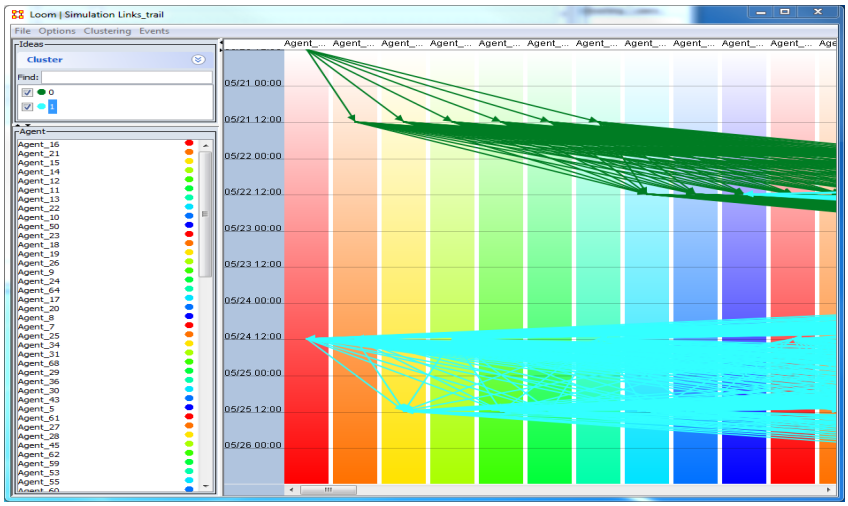
Trails of Information over time



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Agenda

- Micro Simulations Background
- Generate Stylized Networks for Micro Simulation Experiments
- Run Micro Simulations from ORA Visualizer
- Run Micro Simulations from ORA Menu
  - Visualization of networks over time
  - Visualization of agent trails
  - Utilized Network
- Questions

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What is the Utilization Network?

- A end-of-sim view of network links used for transmission
- Link $Weight_{AB}$ = count of times transmission occurred from node A to node B (More useful for money and technology)
- If transmission occurs between Node A and B
  - Link $Weight_{AB}$:= Link $Weight_{AB}$ + 1

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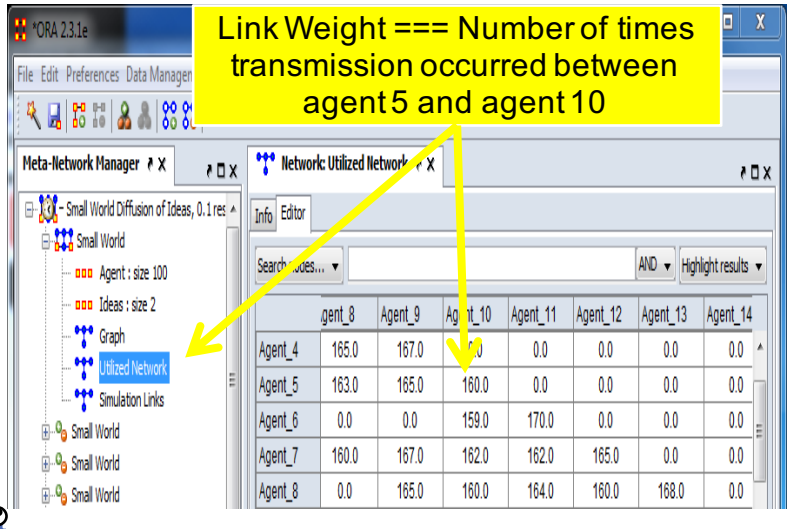
Utilized Network



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Micro-Sims vs Near Term Analysis & Construct

- Micro-sims use fixed probabilities of transmission, Construct's probabilities of interaction vary
- Micro-sims only require one node set and network type to run the simulation, Construct requires many
- Micro-sims used via two ways in ORA GUI, Construct is primarily non-GUI
- Micro-sims treat the examined network as static; none of the other networks (e.g. the knowledge network) will change during the simulation
- Micro-sims do not calculate diffusion metrics

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Questions?

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Backup Slides

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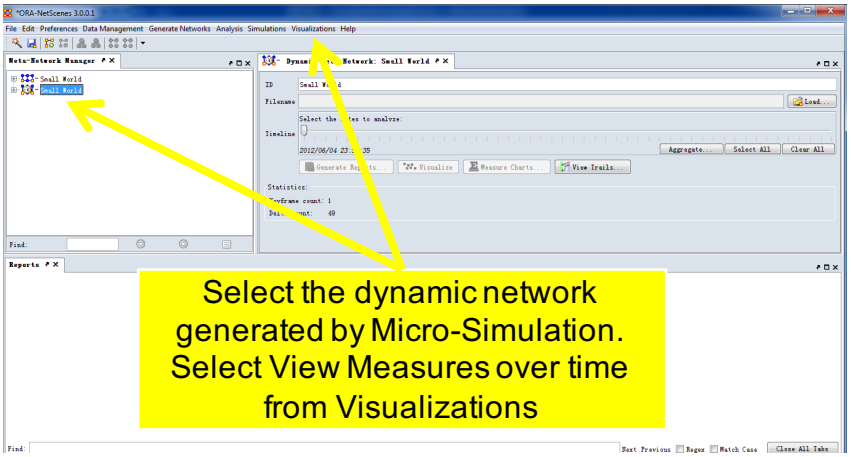
Exclusivity of Disease/Resource Diffusion Overtime



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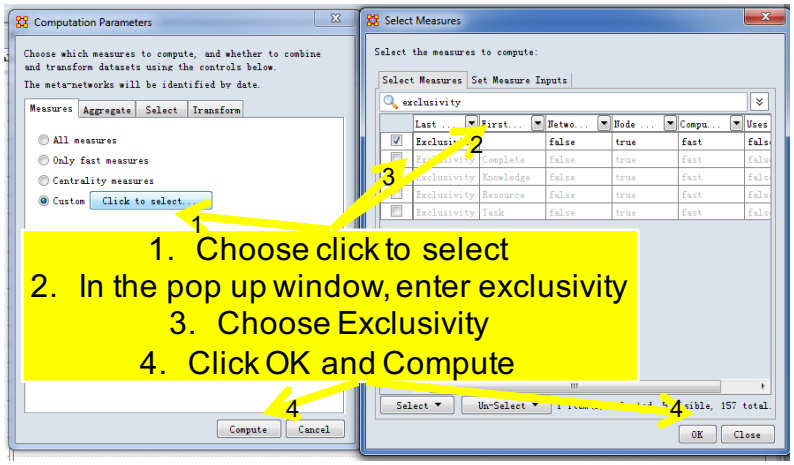
Exclusivity of Disease/Resource Diffusion Overtime



1. Choose click to select
2. In the pop up window, enter exclusivity
3. Choose Exclusivity
4. Click OK and Compute

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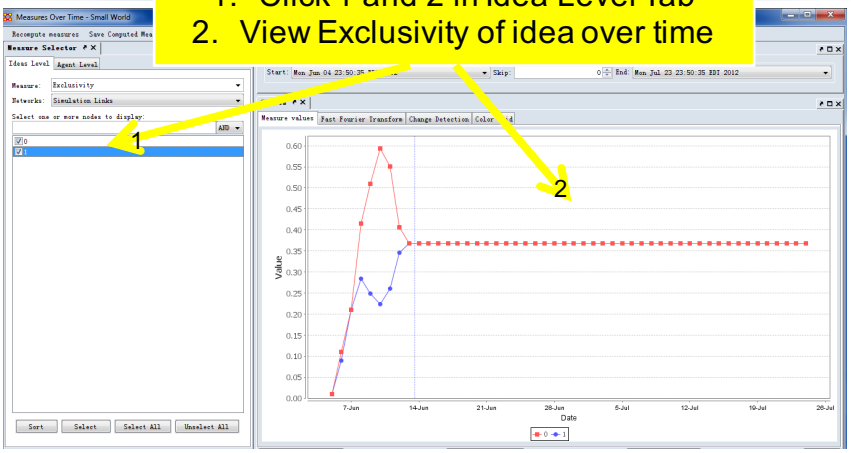
Exclusivity of Disease/Resource Diffusion Overtime

1. Click 1 and 2 in Idea Level Tab
2. View Exclusivity of idea over time



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