

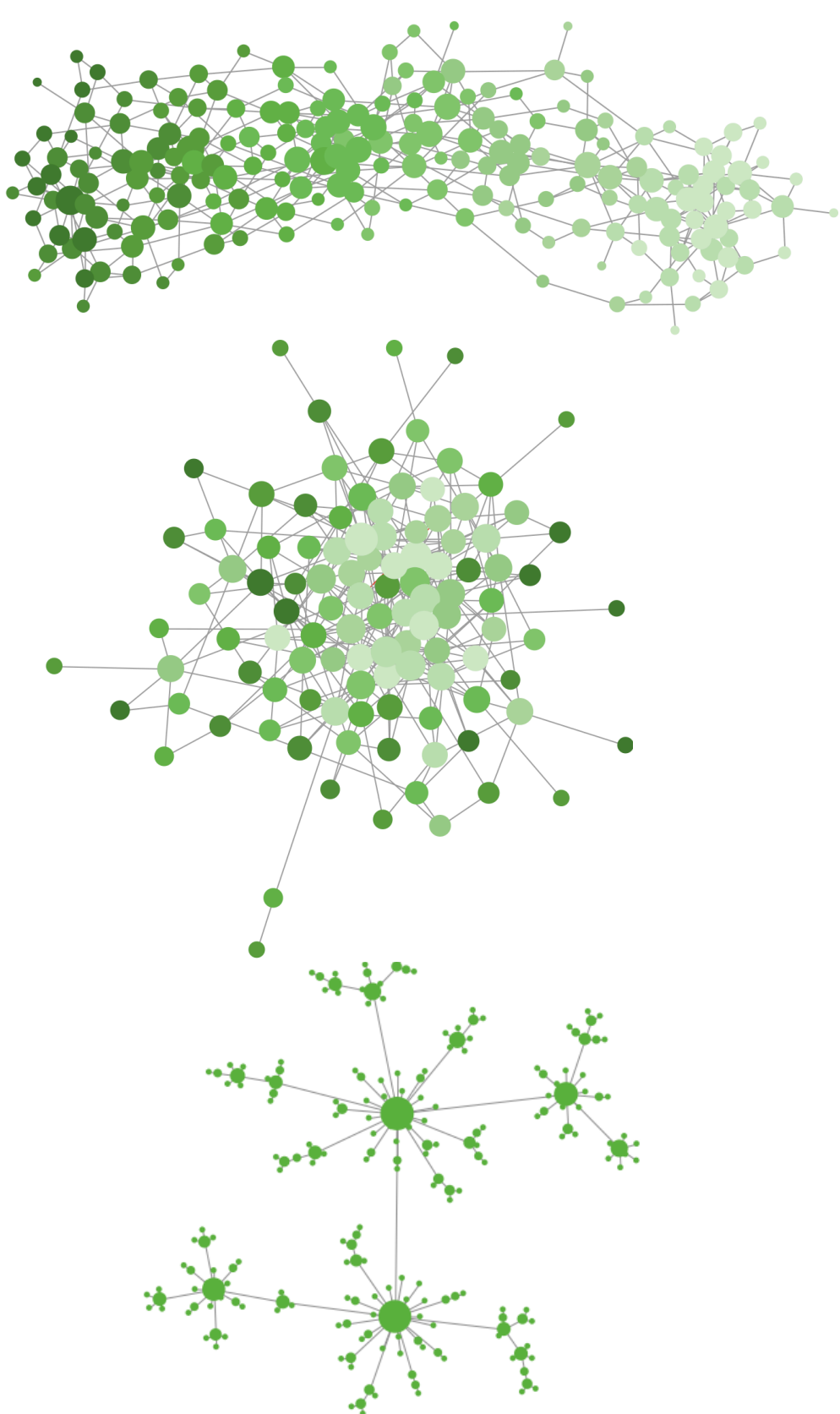
# The Influence of Three Additive Mechanisms for Interorganizational Hyperlink Networks: Homophily, Resource Dependence, and Preferential Attachment

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Agent Based Modeling

## Introduction

Hyperlink networks describe the sum of hyperlinks among a set of organizational actors. Previous scholarship finds three network mechanism shape the configuration of hyperlink networks.

- **Homophily:** Tendency to select actors similar to oneself, e.g., same geography
- **Resource Dependence:** Tendency for actors rich in resources to attract more connections, e.g., media visibility, revenue
- **Preferential Attachment:** Tendency for popular actors that already have a large number of links to attract connections



## Objectives

To examine the influence of homophily, resource dependence, and preferential attachment on interorganizational hyperlink networks, two research questions are proposed:

- **Research Question 1:** Are these three network mechanisms additive or competitive to each other?
- **Research Question 2:** How does the three network mechanisms interact with each other to impact the global network structures?

## Methods

### Agent-based modeling:

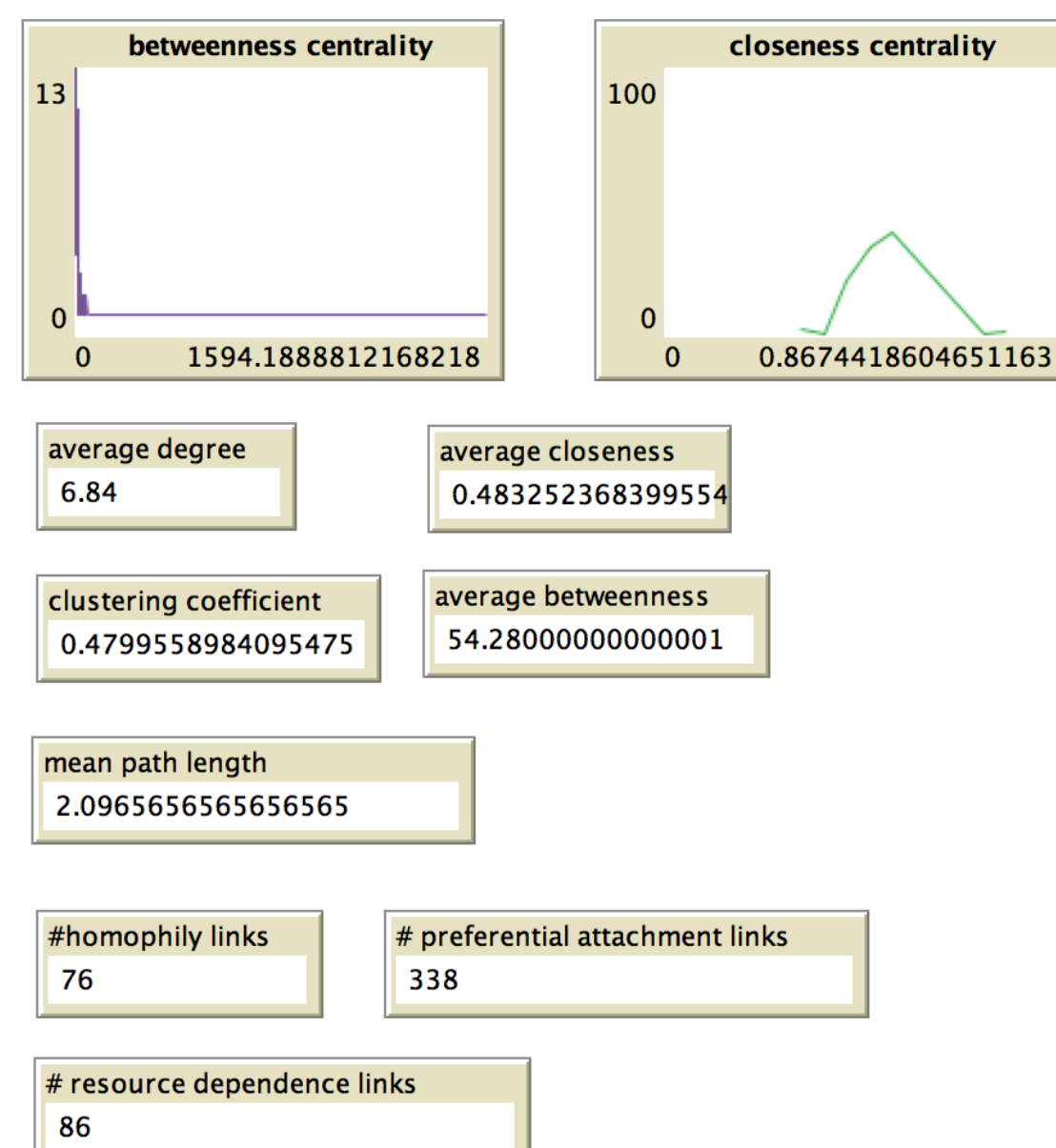
Each agent is randomly assigned some level of wealth. A user determines the probability for each of the three network mechanisms.

- **Homophily:** Agent links to another agent with similar level of wealth;
- **Resource Dependence:** Agent links to another agent that has larger wealth than the agent's;
- **Preferential Attachment:** Agent links to one of the agents with the highest degree centrality.

### Parameters that users can adjust:

- Number of nodes and links
- Probability of homophily effect and resource dependence effect
- Number of agents with the highest degree

### Output:



### Simulations in BehaviorSpace:

- Vary the probability of resource dependence effect and keep homophily effect constant
- Vary the probability of homophily and keep resource dependence effect constant
- Observations collected for regression analyses (N = 120)

## Descriptive

Distribution of betweenness centrality highly skewed and distribution of closeness centrality similar to a normal curve. If preferential attachment has the highest probability, the distribution of betweenness centrality is more extremely skewed.

## Tables

Table 1b

Regression results of the effect of homophily links and preferential attachment links on network structures

	Path Length	Clustering Coefficient	Degree Centrality	Closeness Centrality	Betweenness Centrality
#H links	.00027**	.00049**	-.003**	-.00004**	.0133**
#PA links	-.001**	.00168**	-.008**	.00023**	-.0529**
Constant	2.388**	-0.086**	9.899**	.418**	68.567**
R <sup>2</sup>	.914	.924	.879	.925	.907
N	108	120	120	120	120

Note. \*\*  $p < .001$ . Some coefficients have more decimals for the purpose of comparison.

Table 1c

Regression results of the effect of of preferential attachment and resource dependence links on network structures

	Path Length	Clustering Coefficient	Degree Centrality	Closeness Centrality	Betweenness Centrality
#PA links	-.0013**	.0012**	-.0048**	.00028**	-.066**
#RD links	-0.0003**	-.0005**	.0033**	.00004**	-.013**
Constant	2.521**	.161**	8.253**	.396**	75.239**
R <sup>2</sup>	.914	.924	.879	.925	.907
N	108	120	120	120	120

Note. \*\*  $p < .001$ . Some coefficients have more decimals for the purpose of comparison.

## Results

- Parameter estimates for homophily, resource dependence, and preferential attachment in the regression models are all highly significant.
- However, their signs and magnitude vary substantially.
- The magnitude for preferential attachment is the largest.

## Conclusion

- Homophily, resource dependence, and preferential attachment are additive to each other to impact the structure of interorganizational hyperlink networks.
- Each network mechanism has its unique effects on global structure
- However, the effect of preferential attachment is significantly larger than either homophily effect or resource dependence effect.