

# Social Network Analysis: Overview Part 2

EPIC - SNA, Columbia University

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University of Minnesota

Network Vizualization: Theory and Methods

Network Vizualization: R

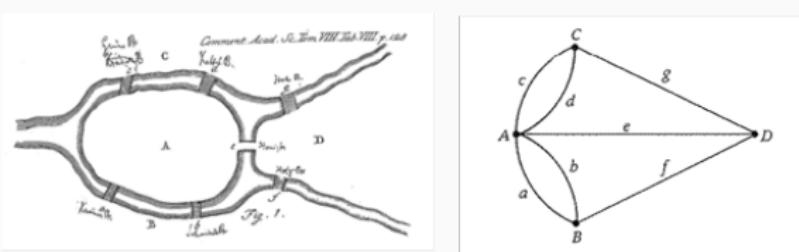
References and Places for More Information

# **Network Vizualization: Theory and Methods**

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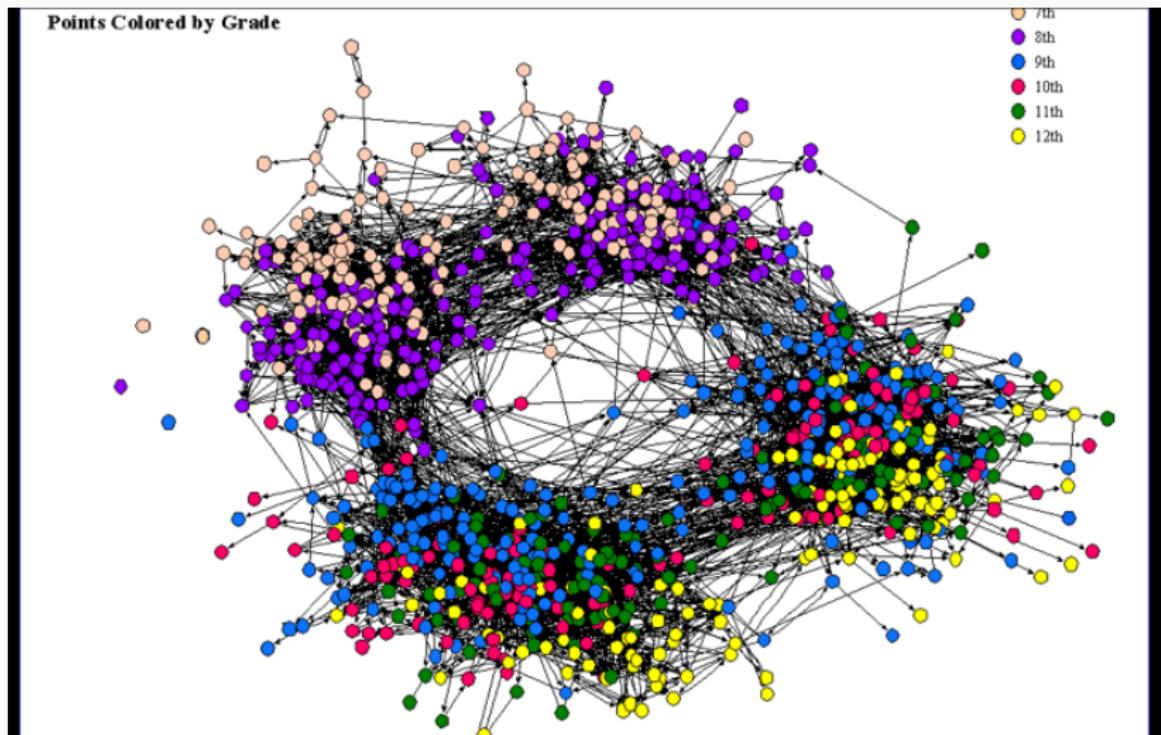
# Visualization

- “The success of a visualization is based on deep knowledge and care about the substance, and the quality, relevance and integrity of the content.” (Tufte, 1983)
- Thus a network graph’s aim is to clearly communicate something (about patterns of social relationships) that we would have difficulty knowing any other way.

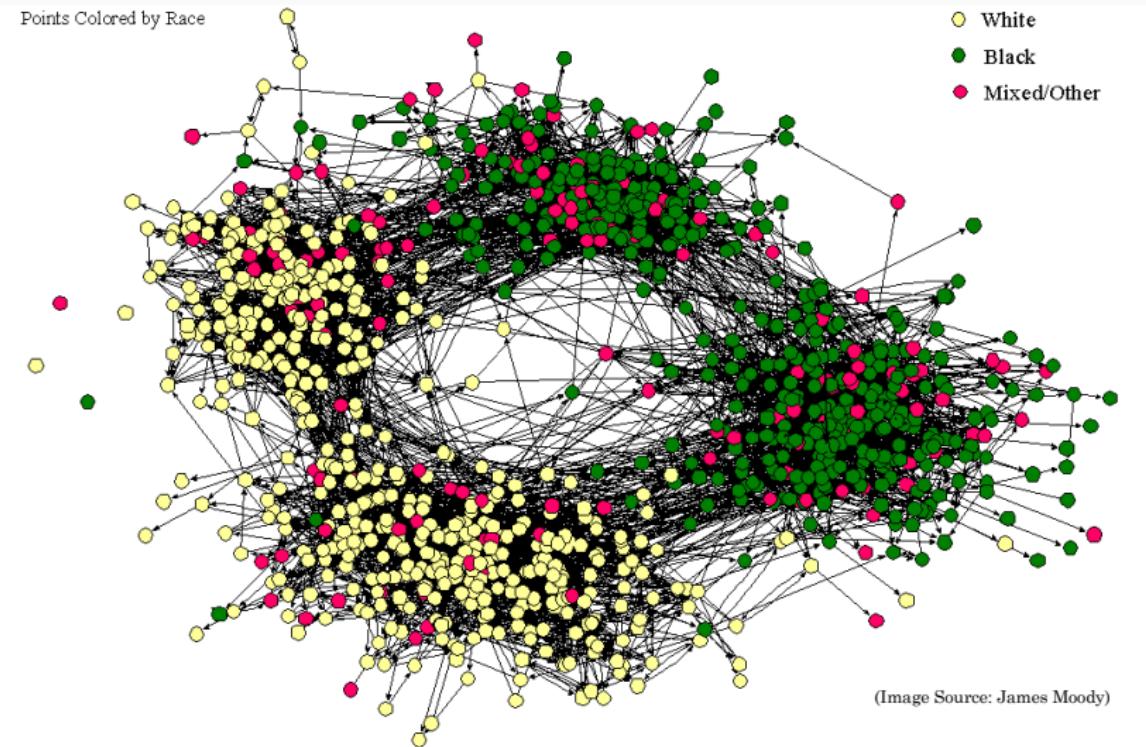


Euler 1741, as reproduced in Freeman LC. Visualizing Social. Journal of Social Structure 2000;1(1).

# Visualization: Gaining Some Intuition

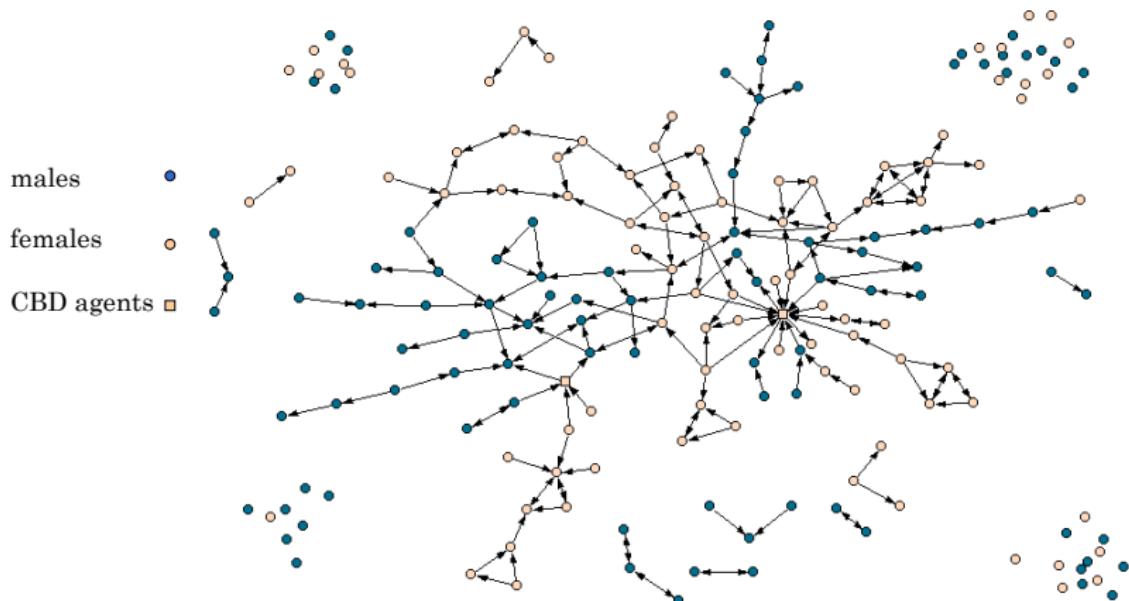


# Visualization: Gaining Some Intuition



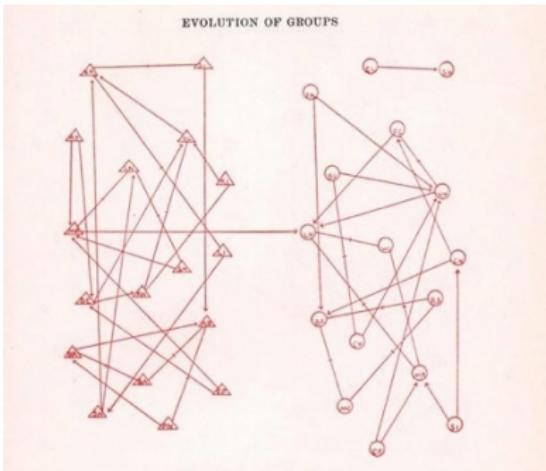
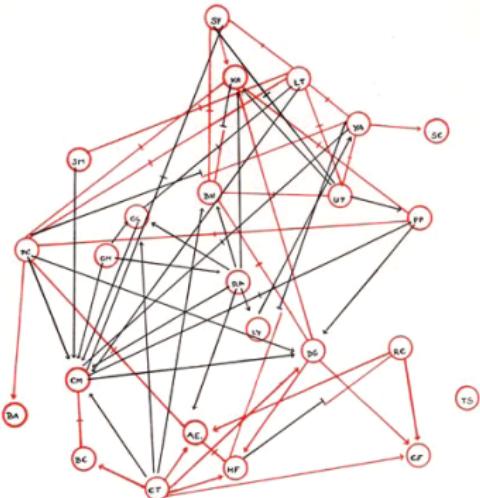
# Visualization: Gaining Some Intuition

Figure 1: The general advice network of the village of *Mandrosohasina*, 1999



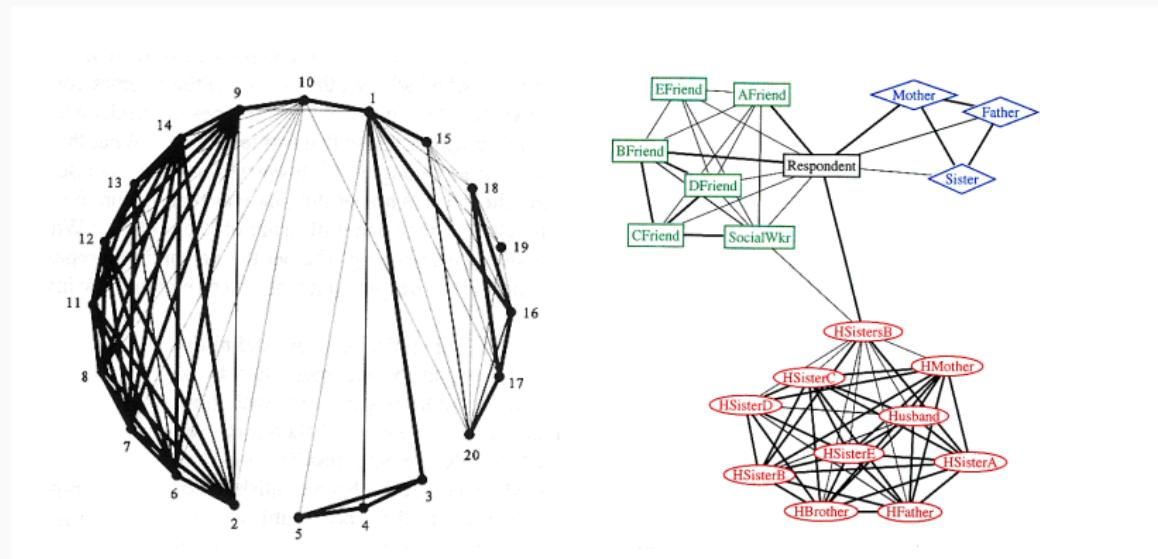
(Image Source: Tom Valente)

# Visualization: Gaining Some Intuition



jimi adama. EPIC - SNA 2017. Columbia, University. Origin: Moreno 1934, as reproduced in Freeman LC. 2000. Visualizing Social Networks. Journal of Social Structure 1(1).

# Visualization: Gaining Some Intuition



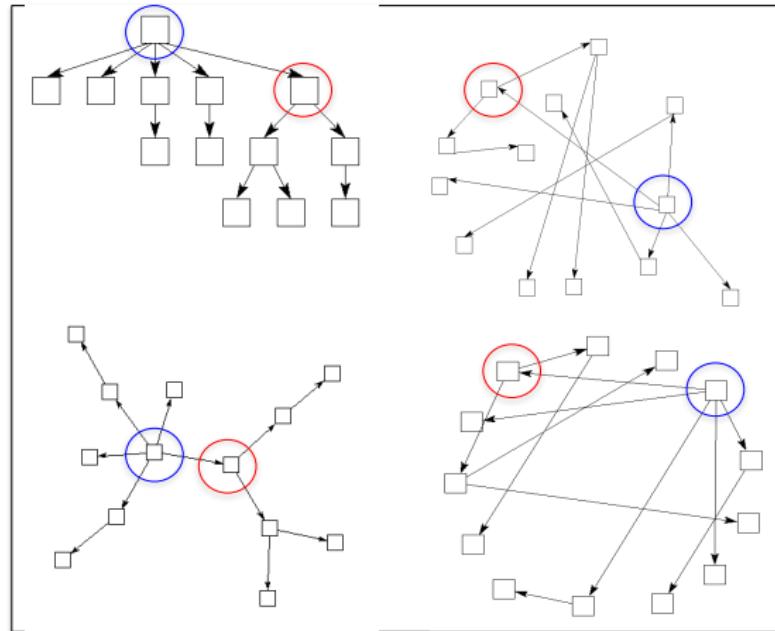
jimi adama. EPIC - SNA 2017. Columbia, University. Origin: Mitchell 1994, as reproduced in Freeman LC. 2000. Visualizing Social Networks. Journal of Social Structure 1(1).

# Visualization: Gaining Some Intuition

Consider these  
4 graphs.

What intuition do  
you gain from each?

They're the exact  
same network, laid  
out differently.



# Visualization: Gaining Some Intuition

## Information

- Build intuition about the social process generating the network
- Succinctly capture high-dimensional properties of the network
- Maximize Ink to Information ratio
- There is value in beauty (e.g., memory)

## Scientifically

- Ability to *replicate* results – same data should produce same picture
- Maximize translation of graph's features to quantifiable measurement of the graph
- Theory-relevant

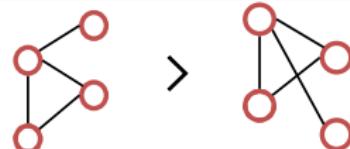


jimi adama. EPIC - SNA 2017. Columbia, University. Origin: Moody J, McFarland DA, Bender-DeMoll S. network visualization. American Journal of Sociology 110(4):1206-1241.

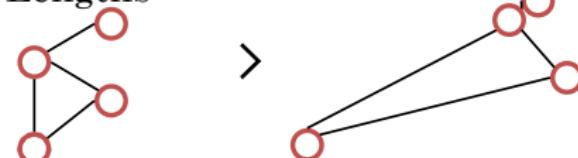
# Visualization: Gaining Some Intuition

## Visualizations

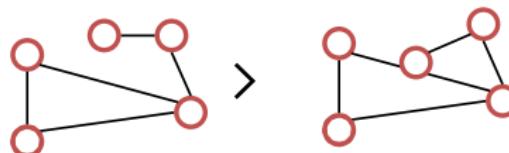
- Minimize edge crossings



- Uniform Edge Lengths

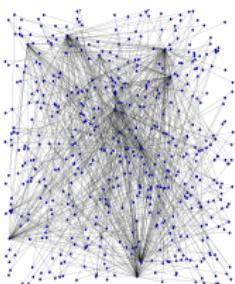


- Nodes don't overlap edges not incident on them

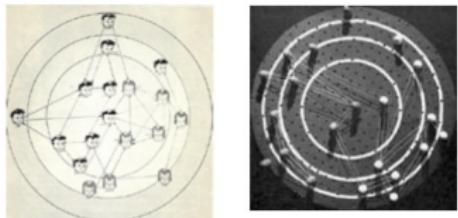


# Visualization: Gaining Some Intuition

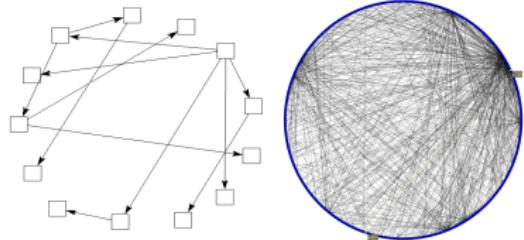
Random



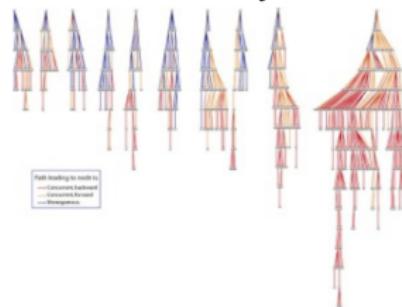
“Spring Embedder”



Circle



Hierarchy

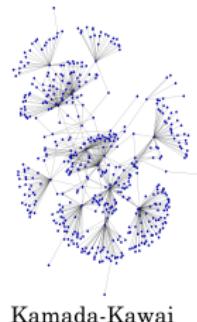


# Visualization: Gaining Some Intuition



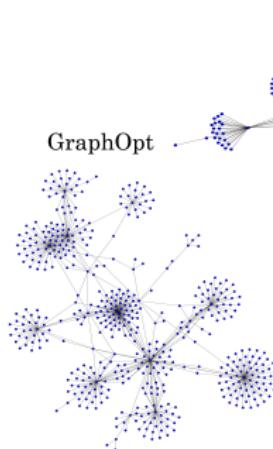
- Connected nodes' springs pull them together
- Disconnected nodes' springs repel one another.
- When balancing these, visualized network's physical space corresponds roughly to social space via network distance/clustering.

Fruchterman-Reingold



Kamada-Kawai

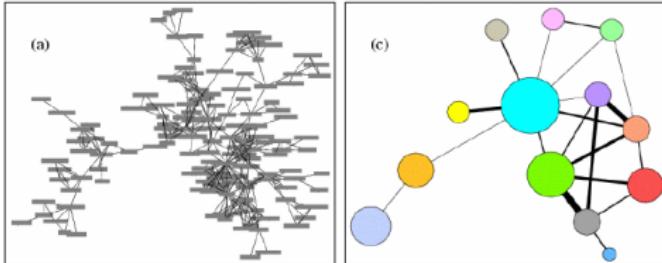
GraphOpt



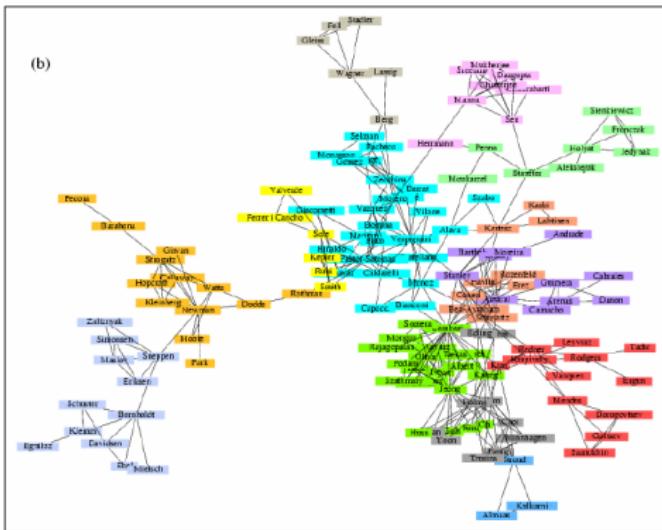
GEM



# Visualization: Gaining Some Intuition



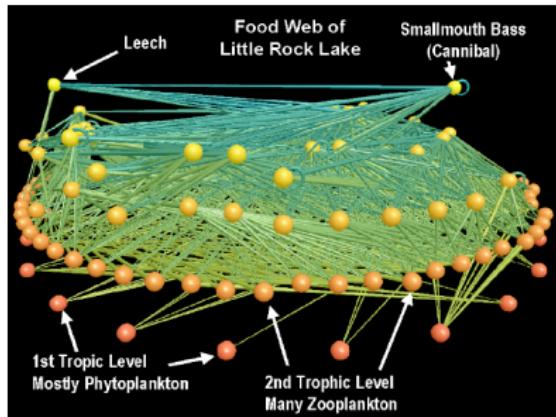
**Example of coarsening network structure**



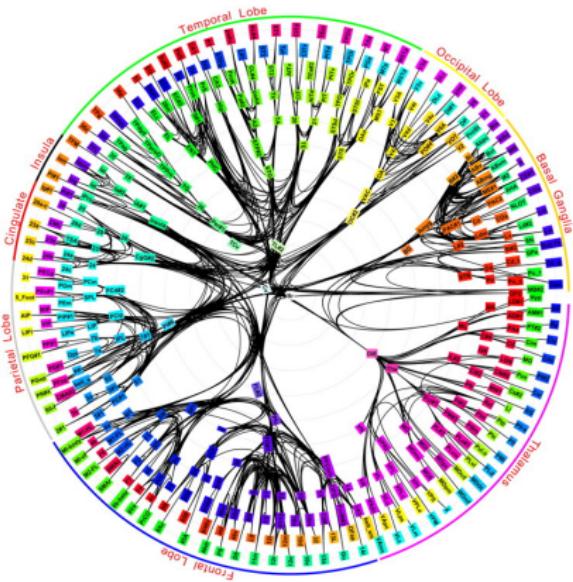
- Newman & Girvan 2004
- co-authorship network of physicists writing papers on networks
- clustering algorithm identifies different subcommunities
- each node is a community – size represents number of authors
- each edge thickness represents the number of co-author pairs between communities

(Image Sources: Lada Adamic)

# Visualization: Gaining Some Intuition



<http://news.bbc.co.uk/2/hi/science/nature/2288621.stm>



PNAS;107(30):13485-13490.

## Visualization: Gaining Some Intuition

- More (circular) Senki Diagrams from Guy Able on Migration
- international migration 1960-2015
- Global Migration by Gender
- Chinese Migration

# Visualization: Gaining Some Intuition

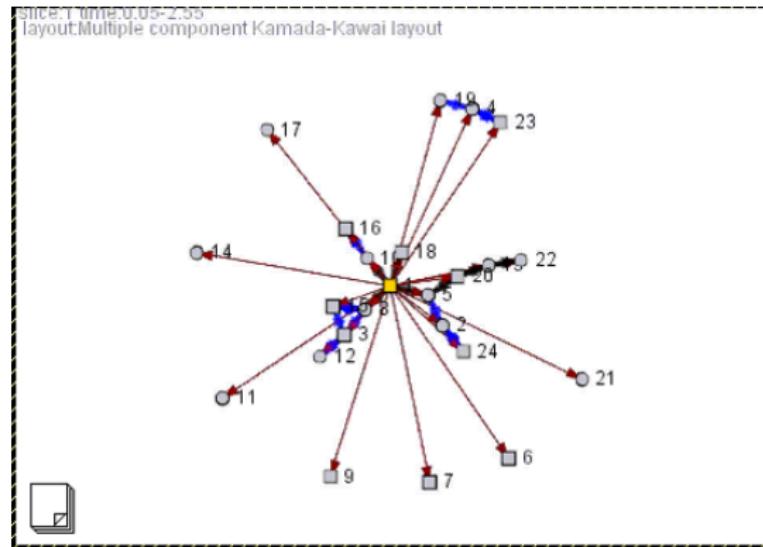
**Arcs:**

- Task
- Social
- Praise
- Sanction

— Direct  
— Broadcast

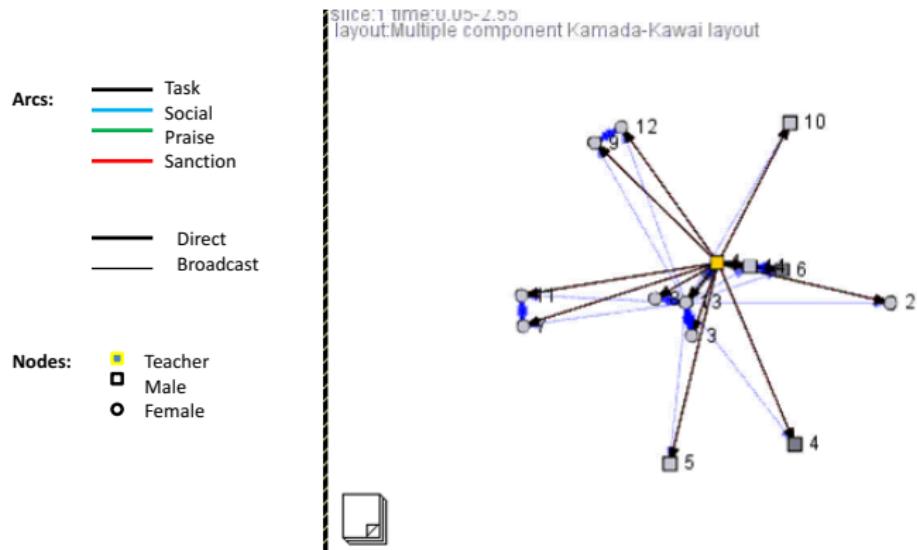
**Nodes:**

- Teacher
- Male
- Female



jimi adama. EPIC - SNA 2017. Columbia, University. Origin: Moody J, McFarland DA, Bender-DeMoll S. 2005. network visualization. American Journal of Sociology 110(4):1206-1241.

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# Visualization: Gaining Some Intuition

Additional considerations:

- timescale, pace, sampling & representations
  - events vs. relationships
  - discrete vs. continuous time
  - binning (min, max, sum, mean, etc.)
- tie weighting/valuation/direction
- isolates, disconnected components
- initial position
  - random w/ repetition
  - data derived / provided (e.g., chaining)

## **Network Vizualization: R**

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## Why R?

- Open Source
- Large community of developers for SNA
  - STATNET, igraph, ...
- Extensible

## **References and Places for More Information**

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## References and Places for More Information i



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