Thomas W. Valente, PhD
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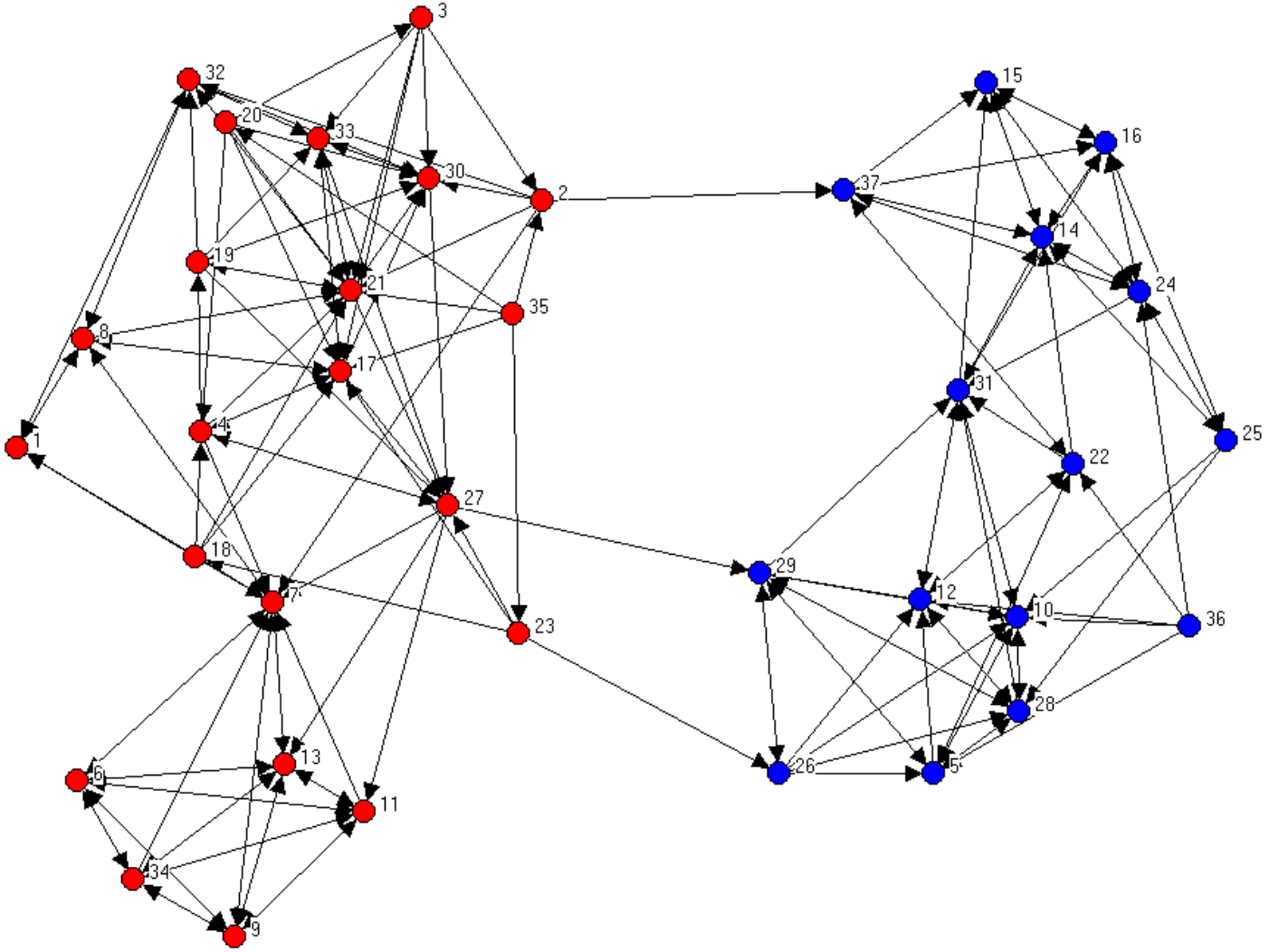
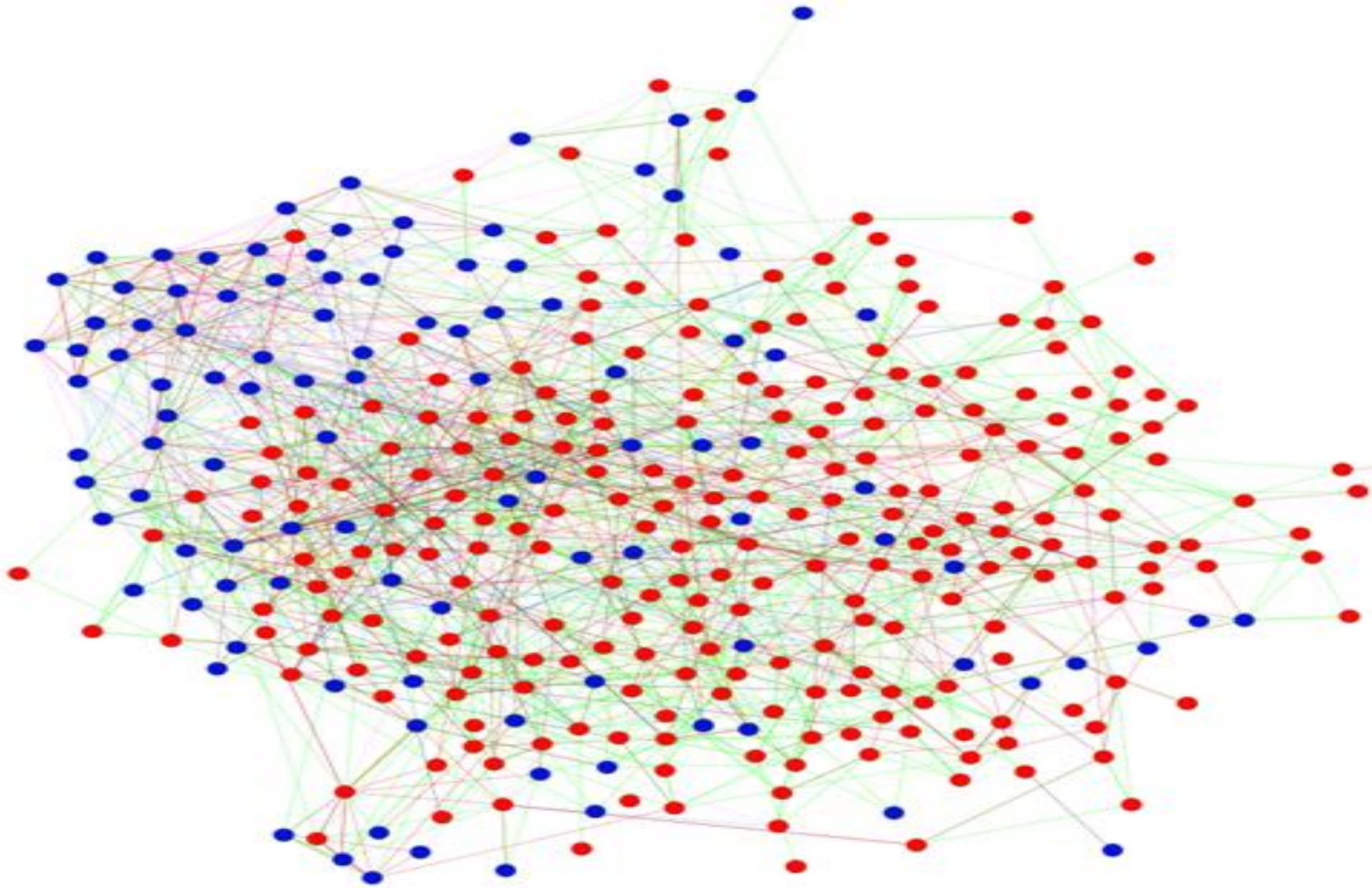
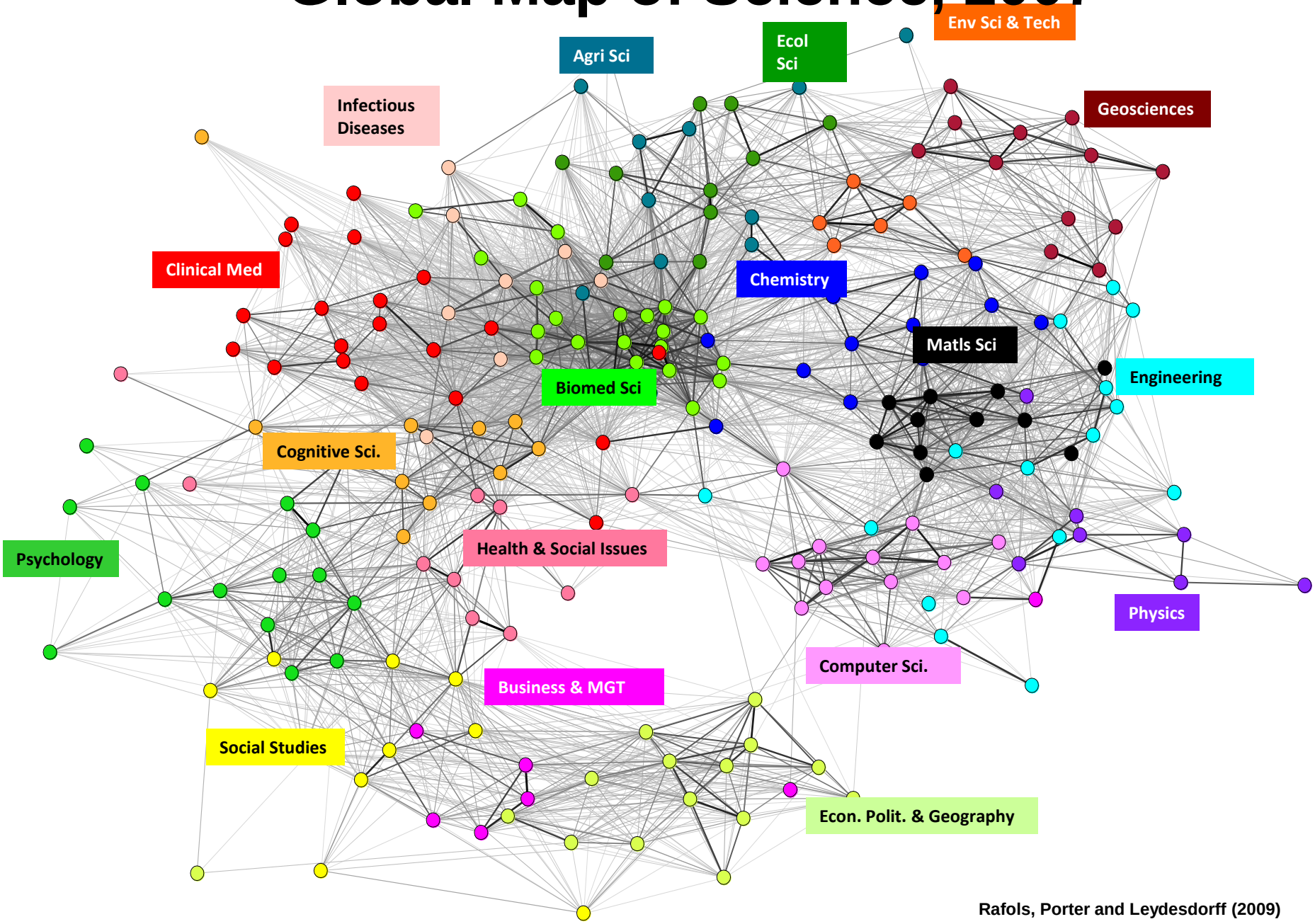
Friendships Among Students in One Classroom (12 year olds)



Relationships of 10th graders



Global Map of Science, 2007

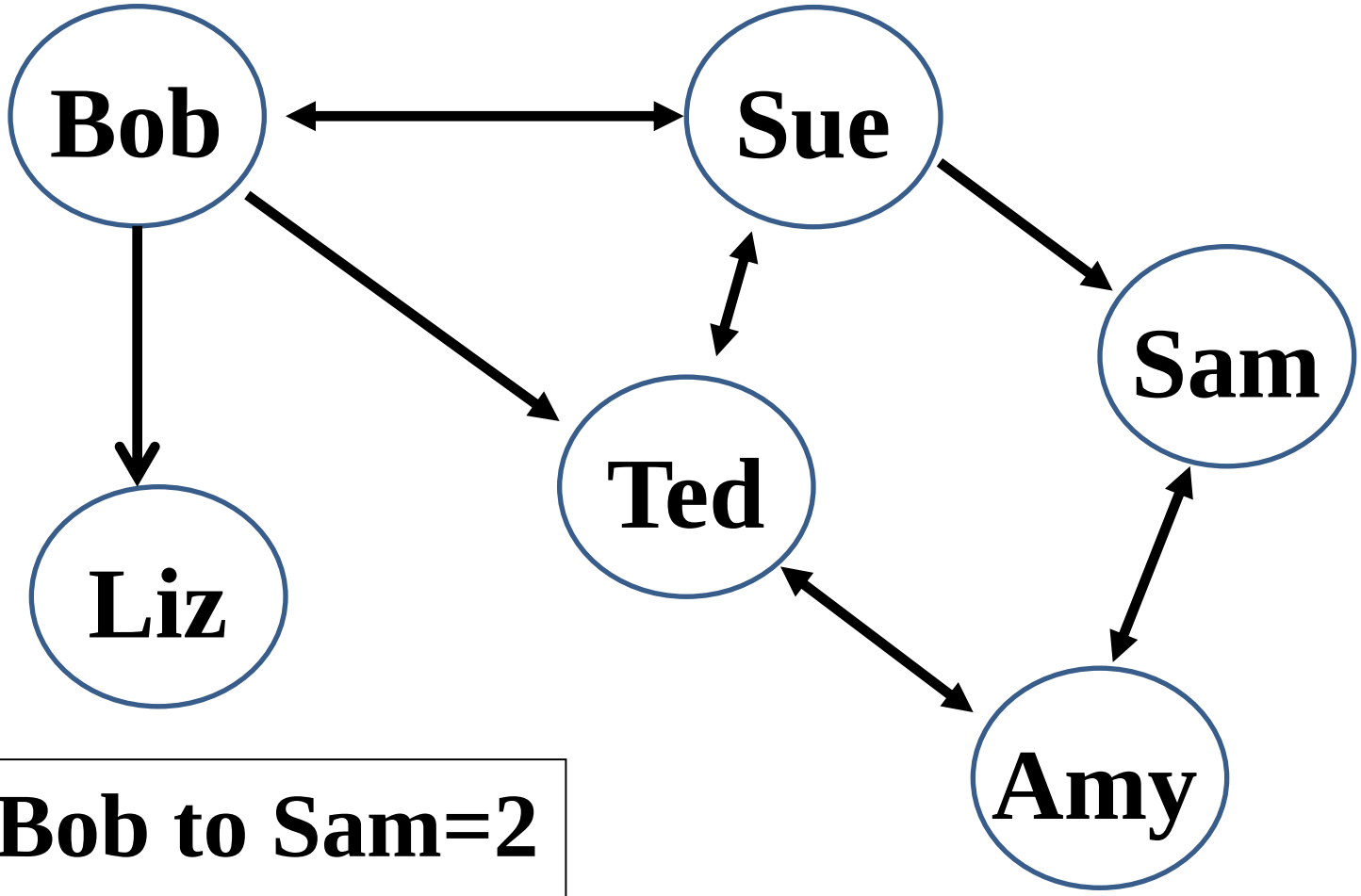


Rafols, Porter and Leydesdorff (2009)

What is a network?

- A set of relations connecting units
  - Friendships (e.g., in schools or onlin)
  - Trading relations among countries
  - Exchanges between firms
  - Collaboration & cooperation among organizations.

Sample Social Network



Distance Bob to Sam=2
Distance Sam to Bob=4

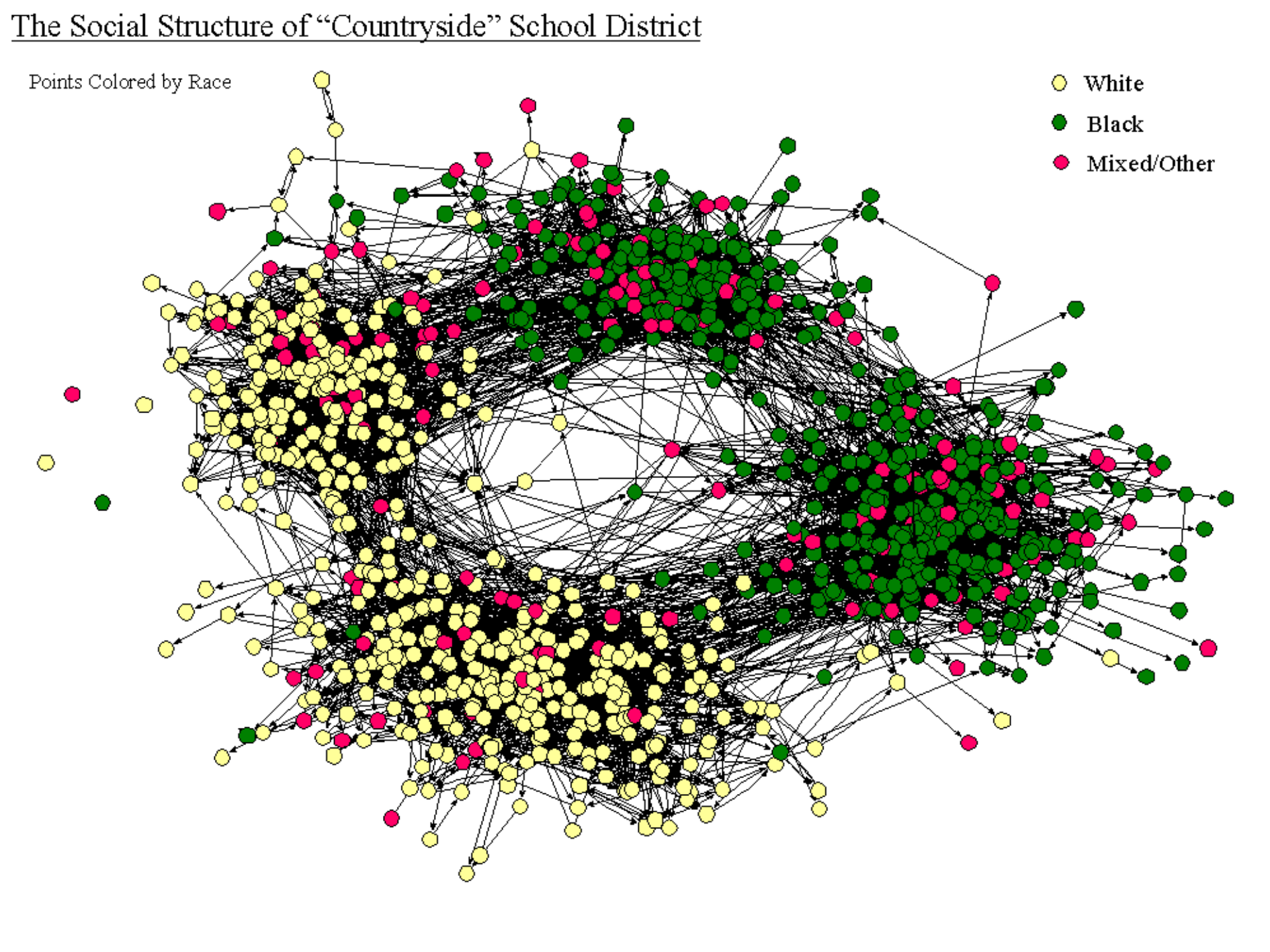
2. What Do Networks Look Like ?

a) Homophilous
b) Transitive
c) Centralized (scale free)
d) Small World – like

a) Networks are Homophilous

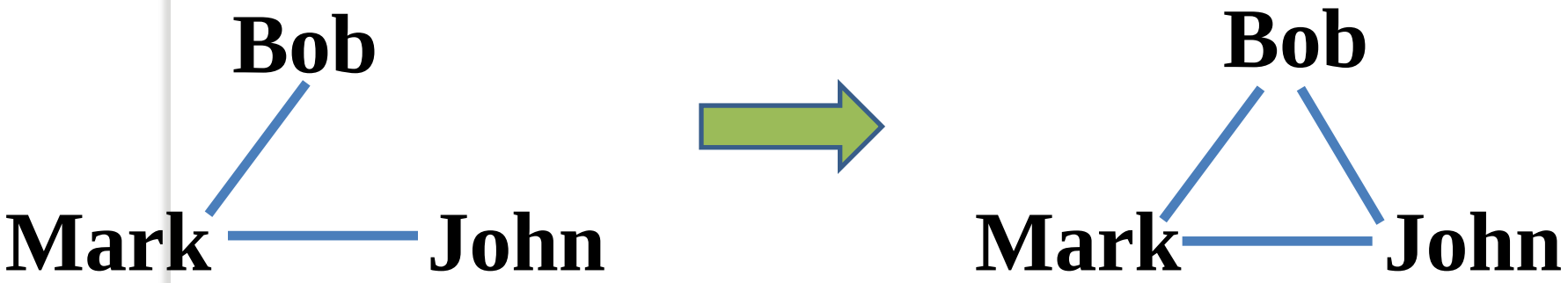
- Like sorts with like
- People tend to be connected to others like themselves
- Homophily occurs for socio-demographic and behavioral characteristics

The Social Structure of "Countryside" School District

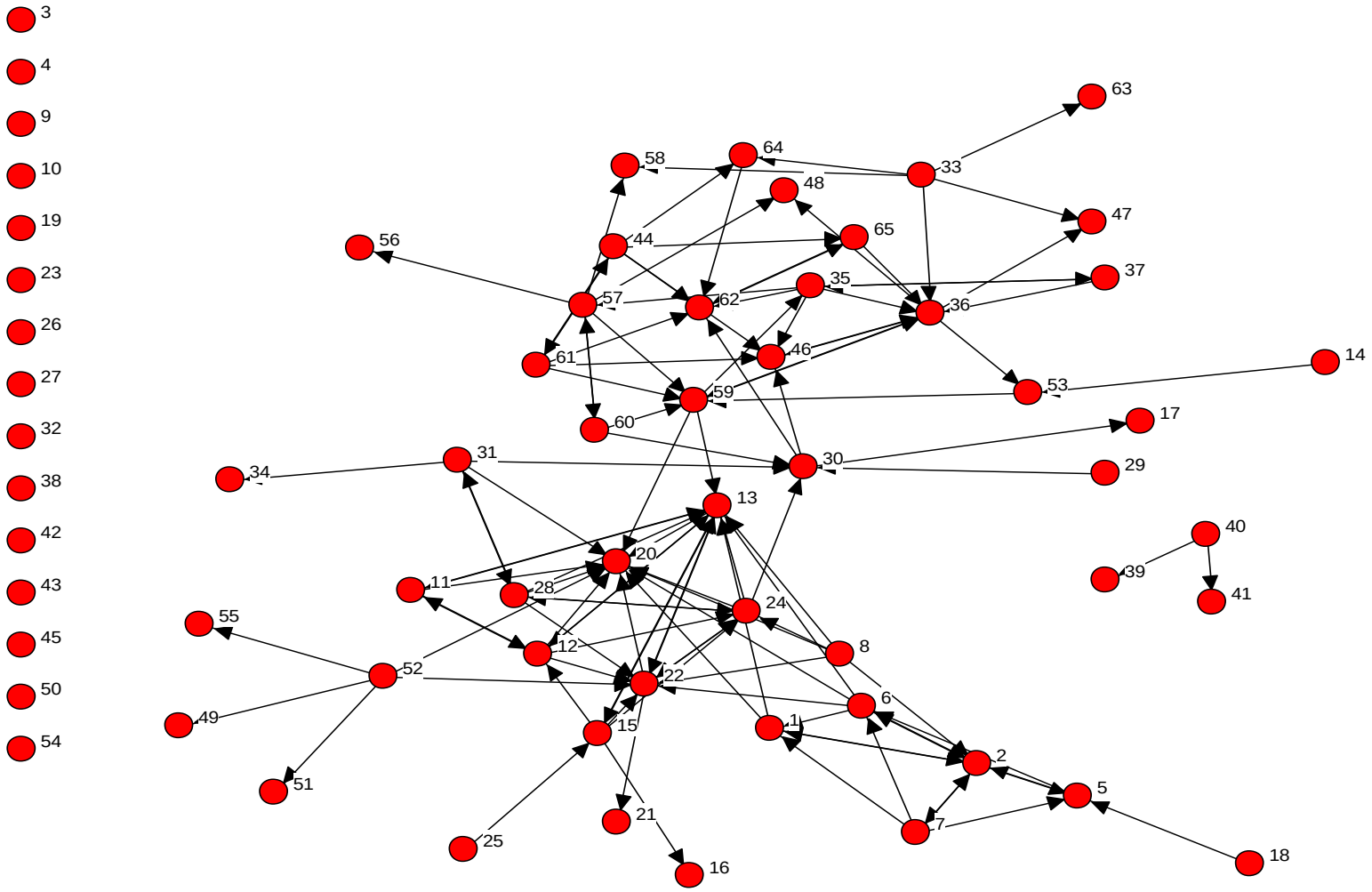


b) Networks Are Transitive

- Networks are transitive :
  - Bob knows Mark
  - Mark knows John
  - → Bob meets John
- Friends of friends become friends



Some People are Very Central



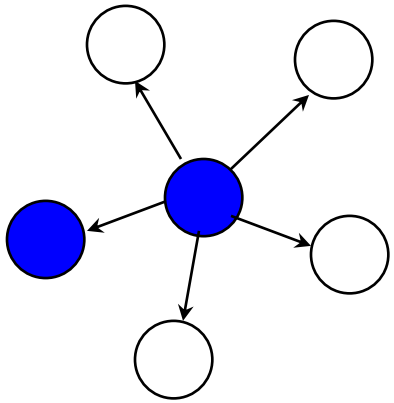
Evidence for network effects

- Adolescents with smoking friends are more likely to smoke;
- Physicians use the same therapies their colleagues use;
- Women in developing countries use the same contraception as their friends; and
- Smokers quit when their network quits.
- And so on …

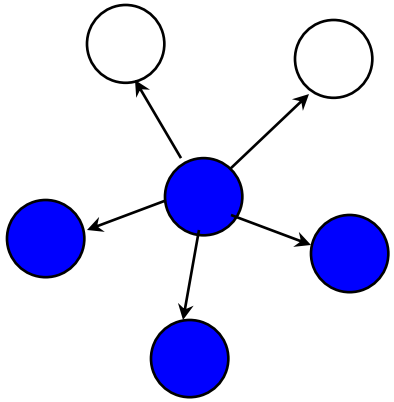
Network Exposure

= *Non User*

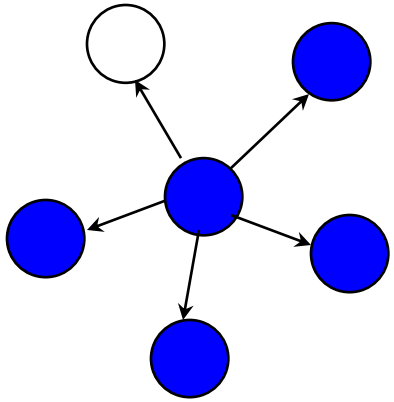
= *User*



Network Exposure=20%



Network Exposure=40%



Network Exposure=80%

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Opinion Leadership and Social Contagion in New Product Diffusion

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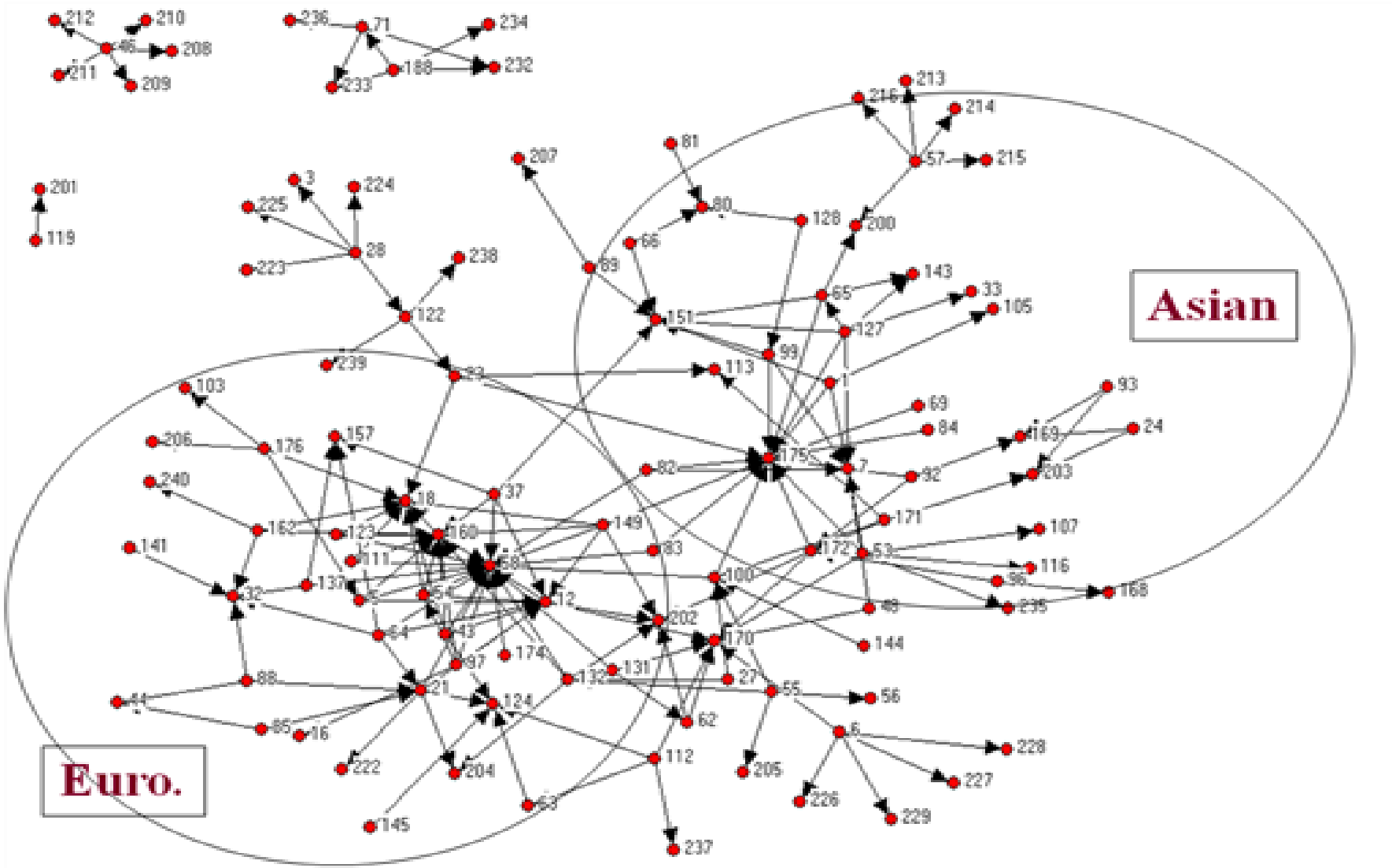
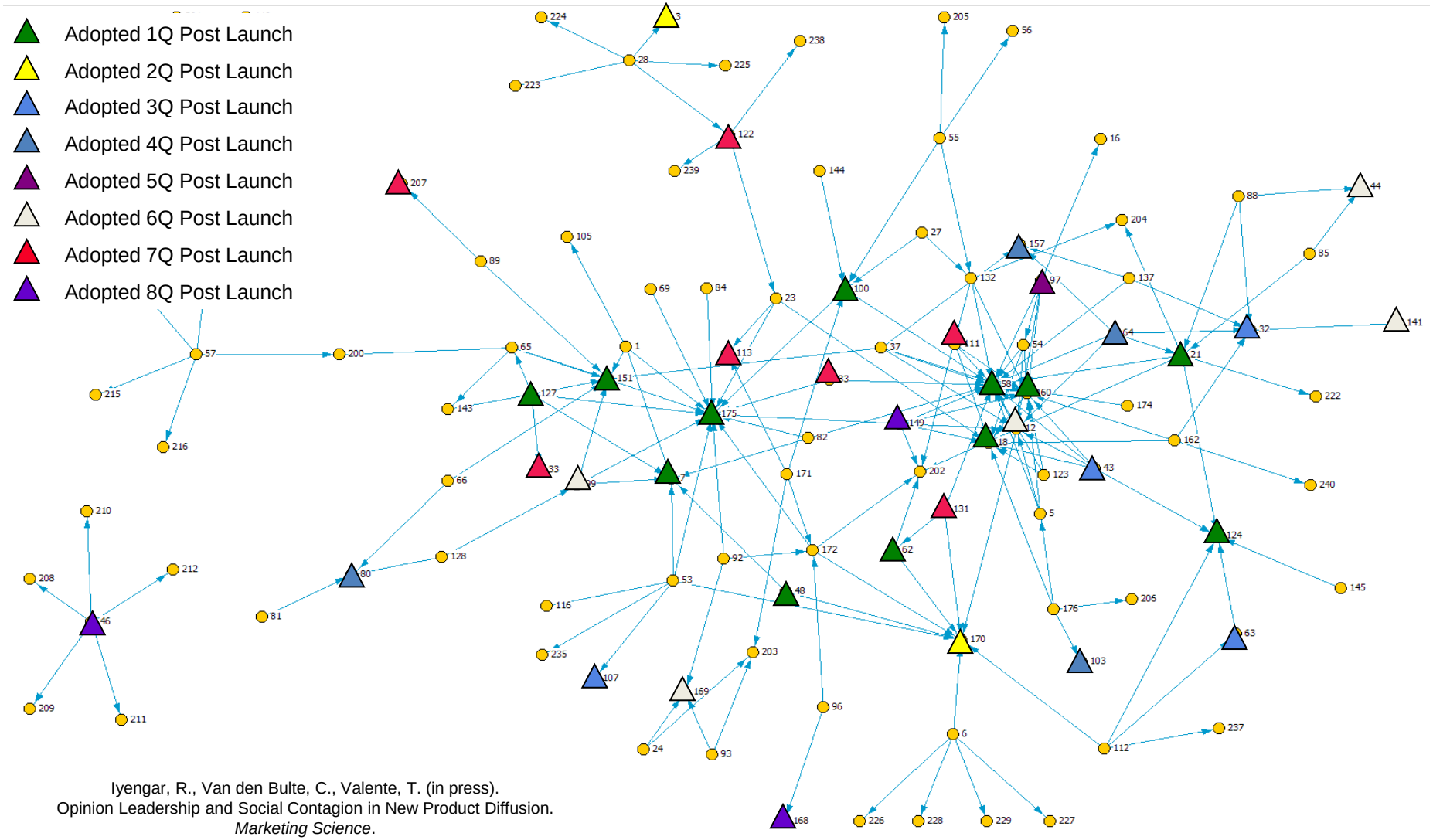
Data

- Discussion and referral networks in 3 cities: SF, LA & NY
- Prescribing records from product launch to 3 years post-launch

Discussion Network for SF



Network Effect on Product Adoption



Iyengar, R., Van den Bulte, C., Valente, T. (in press).
Opinion Leadership and Social Contagion in New Product Diffusion.
Marketing Science.

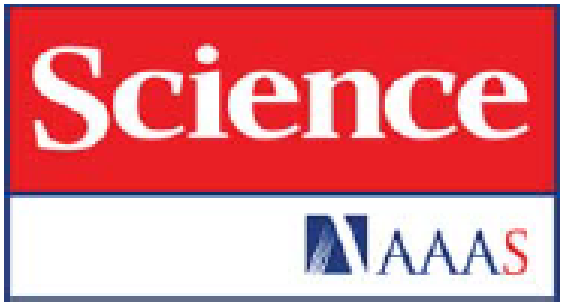
Contagion Term is Significant

Table 4 **Main Results Using the Total Network and Flexible Baseline**

	Basis of contagion			Basis of contagion		
	Adoption (1)	Use (2)	Volume (3)	Adoption (4)	Use (5)	Volume (6)
Intercept	−3.35**	−3.43**	−3.92**	−3.27**	−3.41**	−3.88**
	(0.68)	(0.68)	(0.69)	(0.71)	(0.71)	(0.74)
Indegree	0.15*	0.15*	0.15*	0.31*	0.32*	0.30*
	(0.07)	(0.07)	(0.07)	(0.14)	(0.15)	(0.15)
Outdegree	0.12	0.10	0.07	0.12	0.11	0.08
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)
Self-reported Leadership	0.19	0.19	0.19	0.37	0.38*	0.42*
	(0.14)	(0.14)	(0.14)	(0.20)	(0.19)	(0.18)
Contagion	−0.03	0.01	0.01*	−0.02	0.02	0.01
	(0.09)	(0.09)	(0.006)	(0.10)	(0.10)	(0.007)
Detailing stock	0.36**	0.36**	0.37**	0.39**	0.39**	0.41**
	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)	(0.14)
Detailing carryover	0.48*	0.47	0.43	0.44**	0.44*	0.44*
	(0.25)	(0.25)	(0.26)	(0.20)	(0.20)	(0.20)
Indegree × Contagion				0.01	0.01	0.001
				(0.04)	(0.05)	(0.005)
Indegree × Detailing stock				−0.05	−0.05	−0.05
				(0.04)	(0.04)	(0.04)
Self-reported Leadership × Contagion				−0.09	−0.09	−0.01*
				(0.07)	(0.07)	(0.005)
Self-reported Leadership × Detailing stock				−0.02	−0.02	−0.05
				(0.07)	(0.07)	(0.07)
LA dummy	−0.11	−0.09	0.19	−0.18	−0.14	0.09
	(0.38)	(0.43)	(0.40)	(0.39)	(0.39)	(0.42)
NYC dummy	−0.54	−0.49	−0.24	−0.57	−0.51	−0.27
	(0.41)	(0.42)	(0.42)	(0.42)	(0.42)	(0.43)
Solo Practice	0.04	0.07	0.11	−0.01	0.01	0.01
	(0.34)	(0.34)	(0.35)	(0.35)	(0.35)	(0.35)
University/Teaching Hospital	0.58	0.59	0.72	0.55	0.56	0.69
	(0.40)	(0.40)	(0.41)	(0.41)	(0.41)	(0.41)
Primary Care	−0.64	−0.65	−0.61	−0.60	−0.59	−0.57
	(0.76)	(0.76)	(0.76)	(0.76)	(0.76)	(0.77)
Early Referral	−0.63	−0.62	−0.64	−0.69	−0.68	−0.77
	(0.43)	(0.43)	(0.43)	(0.43)	(0.43)	(0.44)
Patients Managed	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Past Drug 1	0.003	0.004	0.003	0.004	0.003	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Past Drug 2	0.01**	0.01**	0.01**	0.01**	0.01**	0.01**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
LL	−231.22	−231.28	−229.40	−229.08	−229.14	−225.48

3. Network Interventions

"Network interventions are purposeful efforts to use social networks or social network data to generate social influence, accelerate behavior change, improve performance, and/or achieve desirable outcomes among individuals, communities, organizations, or populations."



Network Interventions
Thomas W. Valente
Science **337**, 49 (2012);
DOI: 10.1126/science.1217330

Principle 1: Program Goals Matter

- In some cases want to increase cohesion in others increase fragmentation
- Increase/decrease centralization
- E.g., slowing spread of STDs requires different strategy than accelerating adoption of office automation
- Network Interventions Are not Agnostic to Content.

Principle 2: Theory

- The type of change desired will be guided by theory (Behavior v Attitude)
- Understanding motivations for and barriers against behavior change is critical.
- A well-articulated theory of the behavior is often critical for successful interventions.

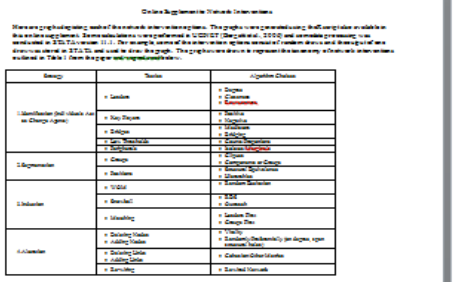
Principle 3: Learn As Well As Induce

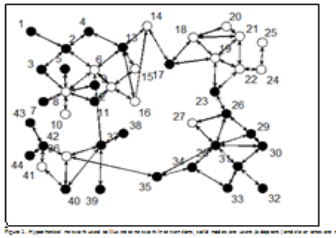
- The interventionist should use network methodology to learn from the community as much as try to influence it.
- Programs which meet the needs of their audiences are better received than those designed asymmetrically.

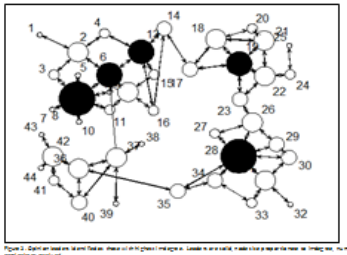
Network Interventions

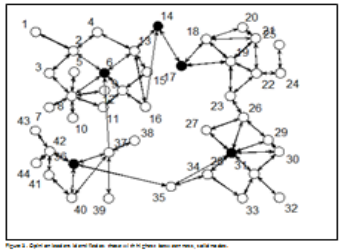
Strategy	Tactic	Operationalization
Identification	Leaders Bridges Key Players Peripherals Low Thresholds	Degree, Closeness, etc. Mediators, Bridges Positive, Negative Proportions, Counts
Segmentation	Groups Positions	Components, Cliques Structural Equivalence, Hierarchies
Induction	WOM Snowball Matching	Random Excitation RDS, Outreach Leaders 1st, Groups 1st
Alteration (Manipulation)	Deleting/Adding Nodes Deleting/Adding Links Rewiring	Vitality On Cohesion, Others On Network, On Behavior

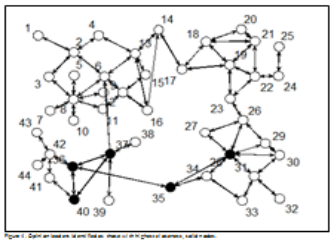
Graphical Displays of Intervention Choices

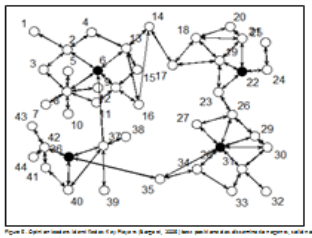


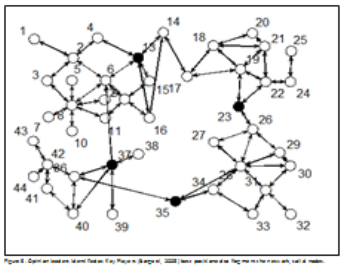


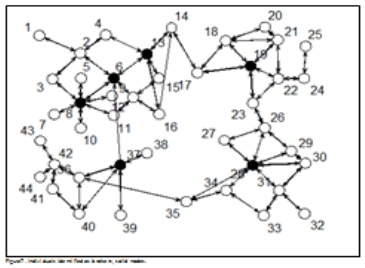


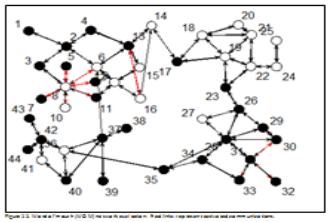


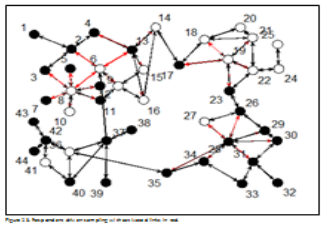


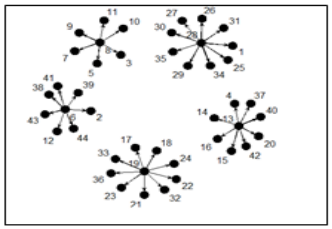


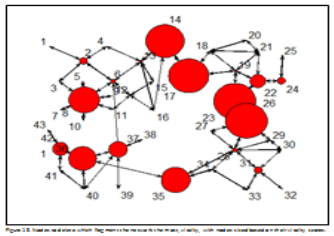


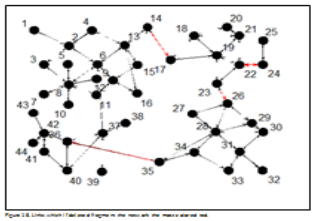


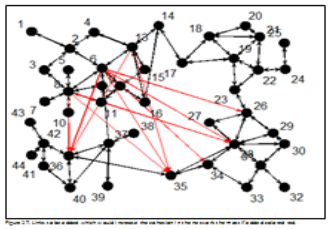


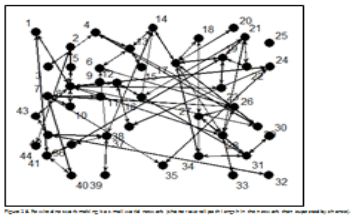












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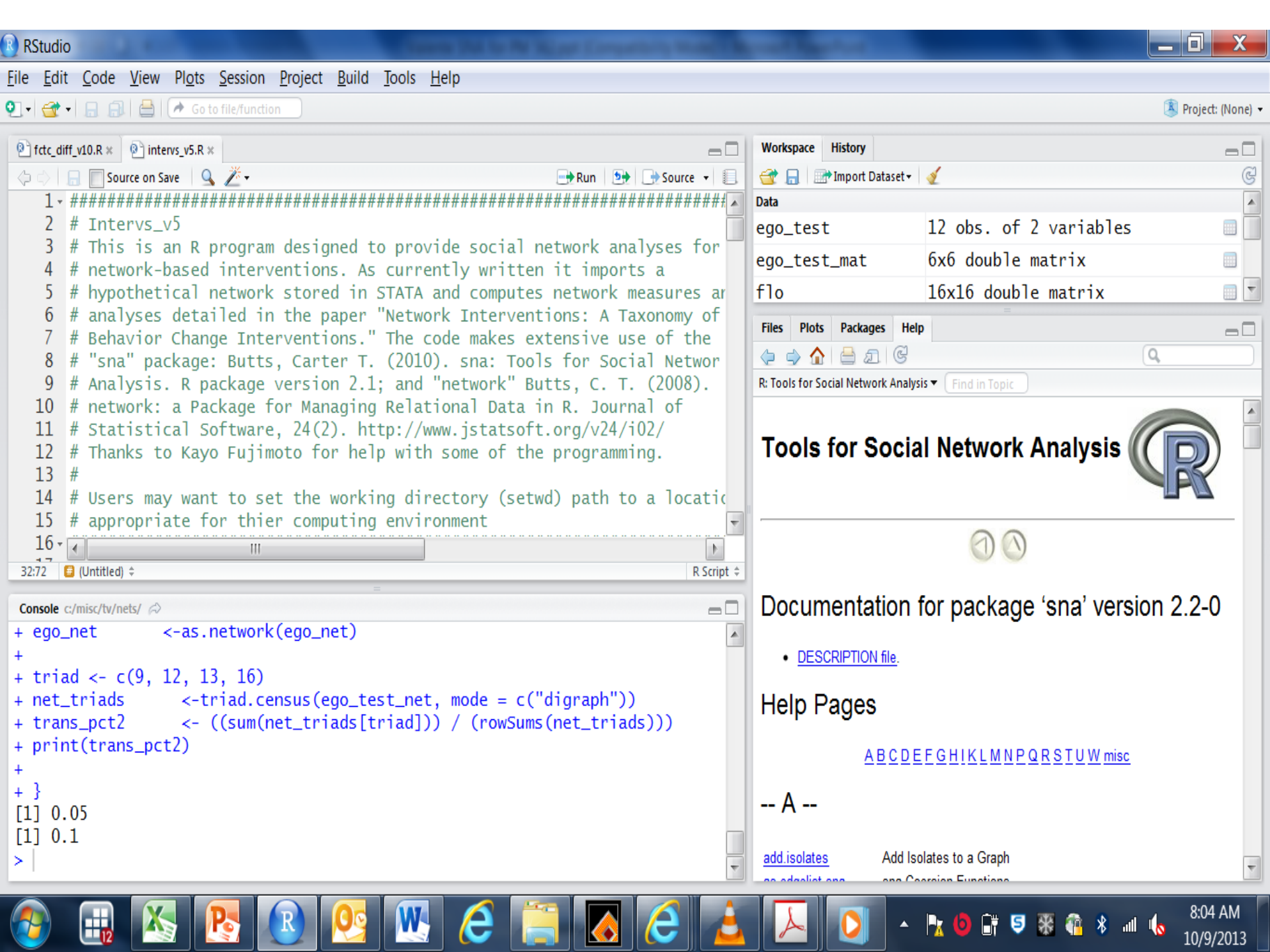
RStudio
File Edit Code View Plots Session Project Build Tools Help
Go to file/function
Project: (None)
fctc_diff_v10.R
intervs_v5.R
Source on Save
Run
Source
1 ##
2 # Intervs_v5
3 # This is an R program designed to provide social network analyses for
4 # network-based interventions. As currently written it imports a
5 # hypothetical network stored in STATA and computes network measures ar
6 # analyses detailed in the paper "Network Interventions: A Taxonomy of
7 # Behavior Change Interventions." The code makes extensive use of the
8 # "sna" package: Butts, Carter T. (2010). sna: Tools for Social Networ
9 # Analysis. R package version 2.1; and "network" Butts, C. T. (2008).
10 # network: a Package for Managing Relational Data in R. Journal of
11 # Statistical Software, 24(2). http://www.jstatsoft.org/v24/i02/
12 # Thanks to Kayo Fujimoto for help with some of the programming.
13 #
14 # Users may want to set the working directory (setwd) path to a locatic
15 # appropriate for thier computing environment
16
32:72
(Untitled)
R Script
Console c:/misc/tv/nets/
+ ego_net <-as.network(ego_net)
+
+ triad <- c(9, 12, 13, 16)
+ net_triads <-triad.census(ego_test_net, mode = c("digraph"))
+ trans_pct2 <- ((sum(net_triads[triad])) / (rowSums(net_triads)))
+ print(trans_pct2)
+
+ }
[1] 0.05
[1] 0.1
>
Workspace History
Import Dataset
Data
ego_test 12 obs. of 2 variables
ego_test_mat 6x6 double matrix
flo 16x16 double matrix
Files Plots Packages Help
R: Tools for Social Network Analysis
Find in Topic
Tools for Social Network Analysis
Documentation for package ‘sna’ version 2.2-0
DESCRIPTION file.
Help Pages
A B C D E F G H I K L M N P Q R S T U W misc
-- A --
add.isolates Add Isolates to a Graph
8:04 AM
10/9/2013

Selecting a NI

- Availability and type of data
  - Types of networks
  - Existing network structure
- Behavioral characteristics
  - Existing prevalence
  - Perceived characteristics such as cultural compatibility; cost; trialability; etc.

Linking Theory to Intervention Strategy

- There are several theoretical mechanisms that drive contagion and behavior change
- Evidence for a particular mechanisms suggests choice of intervention strategy or tactic

Influence Mechanisms Aligned with Interv. Choices

Mechanism	Tactic
Power Conflict Cohesion Isolation Thresholds	Leaders Bridges Key Players Peripherals Low Thresholds
Group Identification Structural Equivalence	Groups Positions
Information diffusion Hard to reach populations Closure Homophily	WOM Snowball Outreach Matching
Attributes Structure Structure!!	Deleting/Adding Nodes Deleting/Adding Links Rewiring

More reading and information: www-hsc.usc.edu/~tvalente/