

Social Network Analysis in the Organizational Sciences

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Dr. Methot conducts research on intra-organizational social networks—with a focus on multiplexity, informal communication, and relationship dynamics—and the emotions implicated in work relationships. Her research is published in leading academic journals including the *Academy of Management Journal*, *Academy of Management Review*, *Academy of Management Annals*, *Personnel Psychology*, *Journal of Management*, and *Journal of Organizational Behavior* and has been featured in over 300 popular media outlets including *Harvard Business Review*, *NPR*, *Forbes*, *Fortune*, *The New York Times*, *Wall Street Journal*, *Bloomberg*, *Fast Company*, and *NY Times Magazine*.

She is an Associate Editor at the *Academy of Management Review* and formerly *Personnel Psychology*; served on the executive committee of the OB Division of the Academy of Management and the Editorial Review Boards of AMR, JAP, PPSych, AMD, and HRM; is the Director of the Rutgers IRHR PhD Program; and is co-founder of the website WorkTies.org, a cultivated repository for academic research and news on work relationships.

**What is Social Network
Analysis (SNA)?**

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Criticisms of SNA?**

01

**What is Social Network
Analysis (SNA)?**

What is a Social Network?

A set of actors and the ties connecting them (Borgatti & Foster, 2003)

- Actors (or nodes) represent any discrete entity in the network (e.g., person, team, organization, place, or collective social unit)
- Ties (or, links, arcs, edges) represent the linkages between actors (e.g., some type of relationship, exchange, or interaction between actors) that serve as:
 - Pipes (or, conduits) through which resources such as information, trust, goodwill, advice, and support flow and
 - Prisms through which to make inferences and shape perceptions

What is Social Network Analysis?

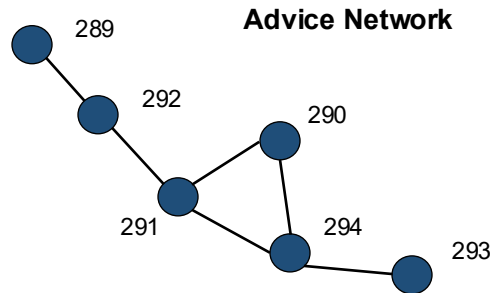
The use of graph-theoretic and matrix algebraic techniques to study the social structure, interactions, and strategic positions of actors in social networks

- SNA allows us to:
 - visualize and analyze webs of ties to pinpoint the composition, content, and structure of organizational networks, and
 - identify their origins and dynamics, and link these features to actors' attitudes and behaviors

- Traditionally, social science research focused on attributes of individuals to predict individual outcomes
 - For example, height as a predictor of income (Judge & Cable 2004)

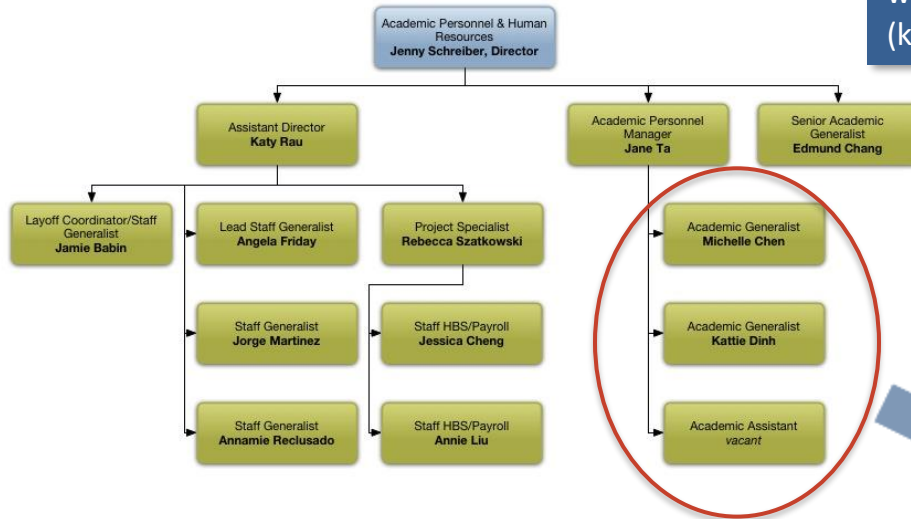
	Age	Gender	Height	Income	...
289					
290					
291					
292					
293					
...					
...					

- SNA directs focus to relationships between individuals

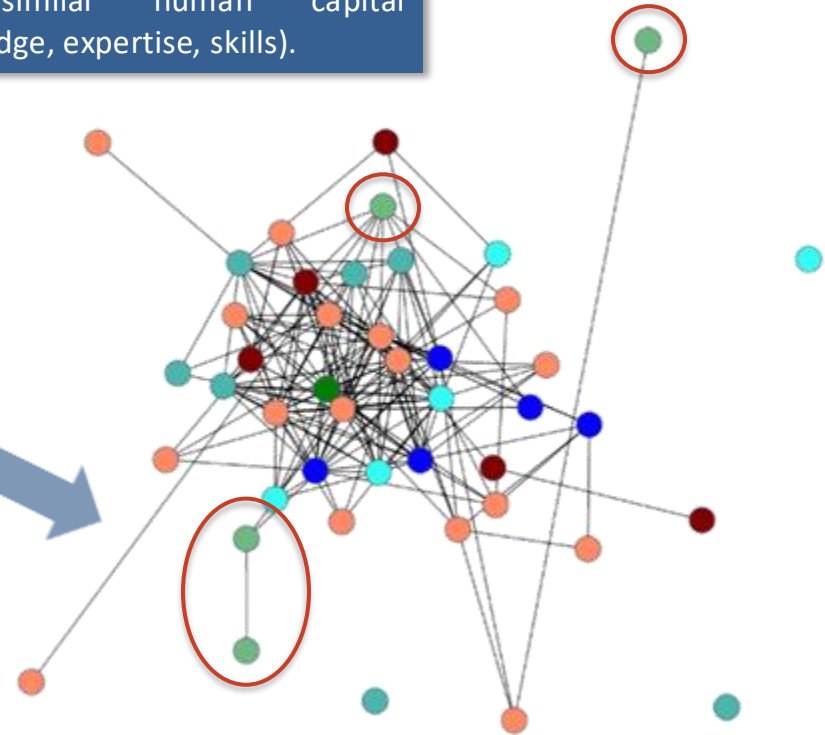


	289	290	291	292	293	294	...
289	x	0	0	1	0	0	
290	0	x	1	0	0	1	
291	0	1	x	1	0	1	
292	1	0	1	x	0	0	
293	0	0	0	0	x	1	
294	0	1	1	0	1	x	
...							

Firms are made of clusters of people with similar human capital (knowledge, expertise, skills).



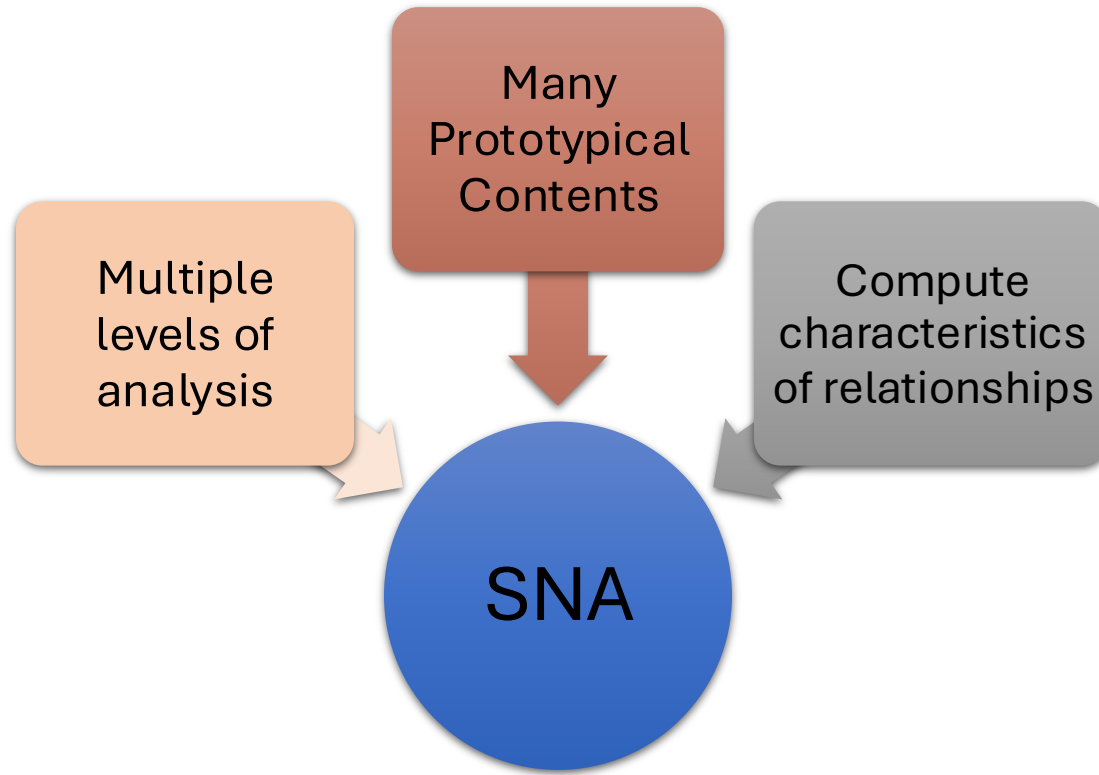
The return on human capital depends on the connections within and between those clusters (i.e., social capital)



70% of all value-adding work is done in the informal network

02

**Why (and How) Should we
use SNA?**

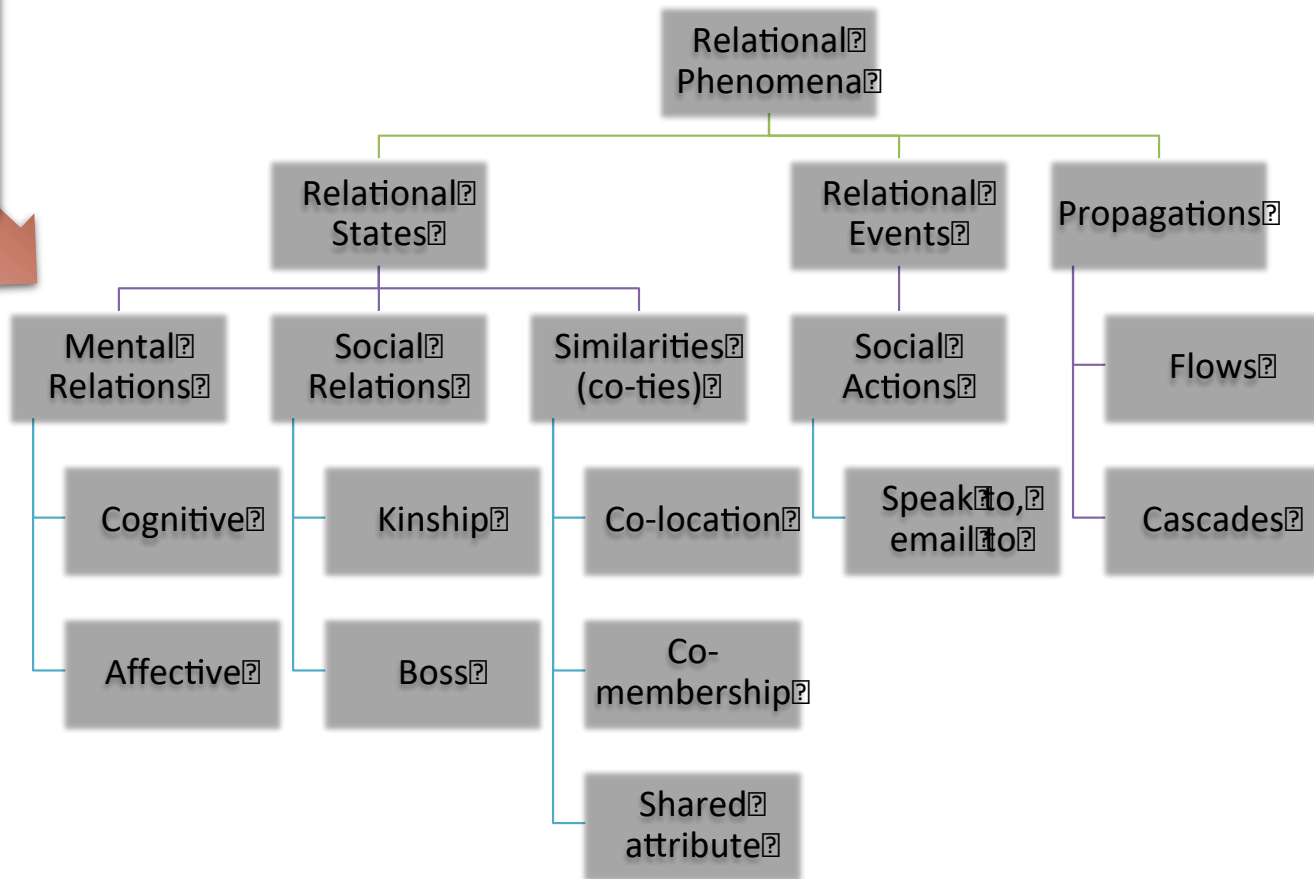


Multiple levels of analysis



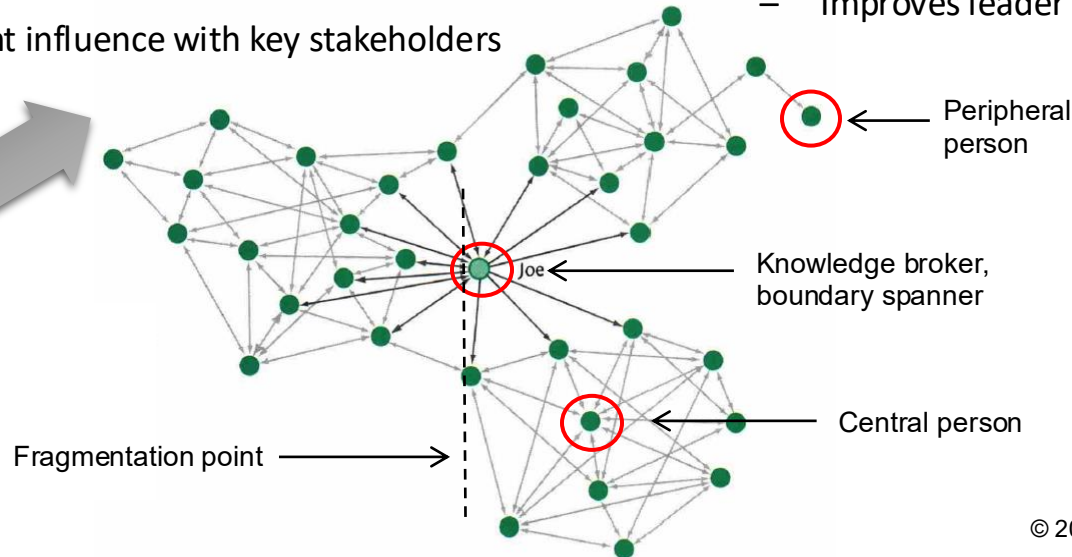
- Dyad level ($n(n-1)$)
 - Units are pairs of people
 - Variables include presence or absence of a certain kind of relationship
- Node level (n)
 - Units are individual people
 - Variables include the number of friends a person has
- Group/network level (1)
 - Units are whole networks (e.g., teams, firms)
 - Variables include density of trust ties, cohesion, average degrees of separation

Many
Prototypical
Contents



- **Central People**
 - Are an important source of expertise
 - May become bottlenecks
- **Peripheral People**
 - Are underutilized resources
 - Feel isolated from the network
 - Have a higher likelihood of leaving
- **External Connectivity**
 - Provides balanced and appropriate sources of learning
 - Holds relevant influence with key stakeholders

- **Brokers**
 - Are critical connectors between diverse information sources and specific kinds of expertise. High leverage points.
- **Fragmentation Points/Silos**
 - Affect information flow across boundaries (e.g., cross-functional, hierarchical, geographical)
- **Personal Connectivity**
 - Improves leader effectiveness



What Research Questions Can SNA Help Answer?

1

Who is influential
(positive or negative)
for driving change?

2

Which employees
are most at risk of
burnout?

3

Where will attrition
put us most at risk of
losing knowledge &
connections?

4

What are the effects
of rivalries between
friends on a team?

5

What relationships
predict
performance?

6

How do our HR
practices impact the
firm's internal social
structure?

7

How can we
stimulate innovation
within the
organization?

3

Who are our "real"
subject matter
experts and HiPOs?

Steps in the SNA Process



Data Collection

Passive vs Active

Gather data via surveys,
Sociometric badges,
digital exhaust (emails,
intranet communications)

Data Visualization

Map Collaborative Networks

Position nodes to illustrate
patterns of interaction,
communication, and
collaboration to identify
diagnose pressure points

Data Analysis

Predictive Analytics

Analyze the economic
benefits and costs that
key interactions within
those networks create

Interpret & Intervene

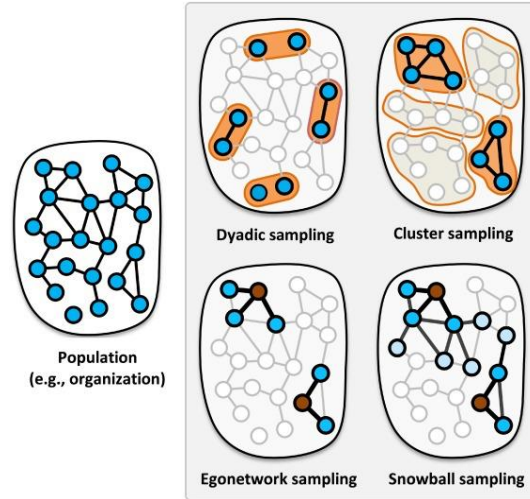
Intervention Recommendations

Straight-forward, cost-
justified interventions,
including replicating high-
performers' networks, and
improving expertise
awareness and access

Defining the Boundaries of a Network

STEP 1

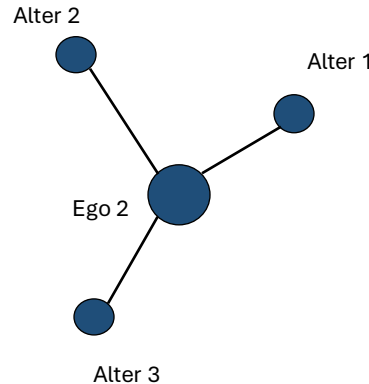
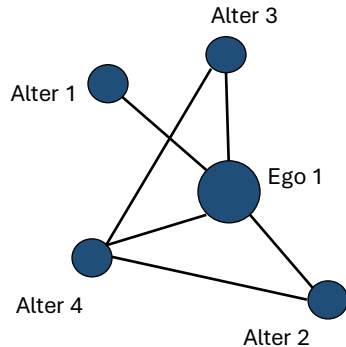
- Who is included in the network?
- What interactions or relationships are relevant to study?



Research Designs

Ego network design (e.g., developmental networks)

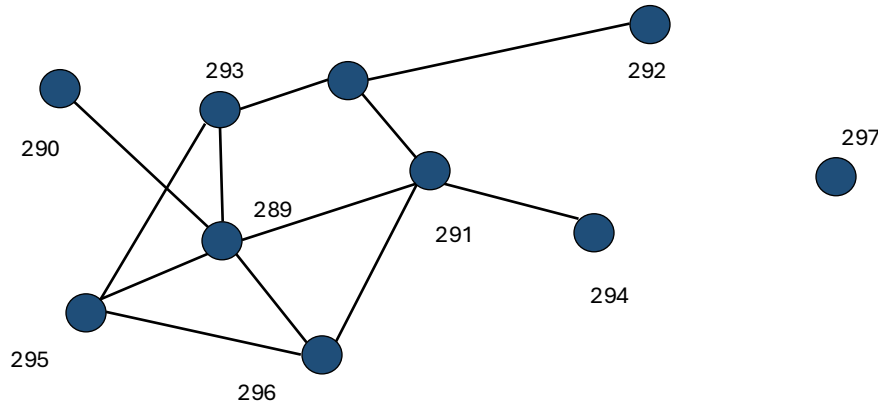
- Name generator method
- Each respondent (ego) identifies set of people (alters) in their network in response to a question (e.g., who in your life takes concerted effort to advance your career?)
 - Indexes ego's local or direct connections to other individuals (or, alters) to whom they are directly connected
- Ego reports about each alter's personal characteristics (e.g., age)
- Ego reports about nature of relationship between alters (e.g., Is alter 1 friends with alter 2?)



Research Designs

Whole network design

- Roster Method
- Begin with bounded set of people (employees in an organization)
- Each respondent indicates presence/absence, strength, and/or type of tie with every other actor in the set
 - extent to which individuals are embedded in more macro-organizational network structures (including their direct and indirect connections)
- Can't be too big



Collecting Network Data



STEP 2

- Active Methods
 - Surveys (e.g., roster, name generator)
 - Observations
- Passive Methods
 - Archival data (e.g., extraction and creation of historical network data sets and relational data from online digital repositories) (Blocha et al., 2020; Robbins et al., 2022)
 - Organic data/Digital exhaust (e.g., digital activity such as email, calendar, social media, collaboration platforms) (Leonardi & Contractor, 2018; Xu et al., 2020)
 - Electronic sensors (e.g., digital badges) (Chaffin et al., 2017)

Commonly Measured Ties

- Knowledge: Do you know this person?
- Interaction: How frequently do you interact with this person?
- Friendship: To what extent are you friends with this person?
- Advice: Do you go to this person for work-related advice?
- Liking: To what extent you like this person?
- Trust: To what extent do you trust this person (willing to be vulnerable to them)?
- Energy: To what extent is this person an important source of energy and enthusiasm for you at work?

Analyzing Network Data



STEP 3

Ways of structuring network data

- DL format
 - *Nodelist* - Defines the individual entities (nodes) and their attributes (e.g., gender) that make up the network
 - *Edgelist* - Defines the relationships or interactions (edges) that connect the nodes (i.e., source and target)
- Matrix format (Adjacency)
 - nodes constitute both the rows and the columns, and the cells specify if and what kind of relationship exists between the nodes in the row and in the column

Analyzing Network Data

STEP 3

Nodelist

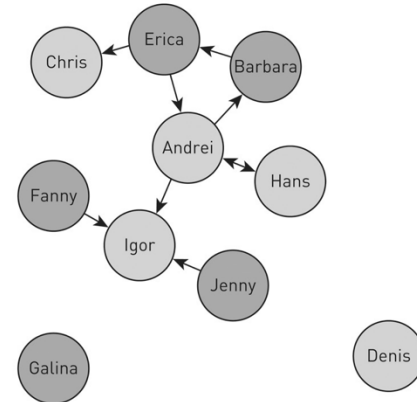
A	Andrei	male	Russian
B	Barbara	female	US
C	Chris	male	US
D	Denis	male	Russian
E	Erica	female	German
F	Fanny	female	British
G	Galina	female	Russian
H	Hans	male	German
I	Igor	male	Russian
J	Jenny	female	British

Adjacency matrix

	A	B	C	D	E	F	G	H	I	J
A	0	1	0	0	0	0	0	1	1	0
B	0	0	0	0	1	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0
E	1	0	1	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	0	1	0
G	0	0	0	0	0	0	0	0	0	0
H	1	0	0	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0	0	0	0
J	0	0	0	0	0	0	0	0	1	0

Edgelist (directed)

Source	Target
A	B
A	H
A	I
B	E
E	A
E	C
F	I
H	A
J	I



Data Manipulation Process

- Input into social network software (e.g., UCInet, R, Pajek, Gephi), which apply mathematical routines to summarize and find patterns and produce network metrics
 - Ego networks involves less challenging data collection procedures compared to whole networks, but the analytic techniques available are limited because only local connections are reported
 - Many metrics can be applied to both ego networks and whole networks

Individual Measures	
In-degree centrality	Number of incoming ties an actor has (i.e., nominations from others; network size)
Out-degree centrality	Number of outgoing ties an actor has (i.e., nominations of others; network size)
Betweenness centrality	Extent to which an actor lies on the shortest path “between” all other actors in a network
Closeness centrality	The average of the shortest path length from the actor to every other actor in the network (i.e., how few links connect the actor to others)
Brokerage	Extent to which the actor bridges a structural hole, connecting otherwise disconnected others
Dyadic Measures	
Homophily	Similarity in attributes (e.g., gender, values) between ego and their alters
Equivalence	Extent to which two actors have similar network profiles (i.e., similar patterns of connections with alters)
Tie strength	Quality of the relationship between two actors; compared to weak ties (e.g., acquaintances), strong ties are characterized by greater emotional intensity, mutual confiding, and reciprocal exchange
Multiplexity	Coexistence of multiple types of relations simultaneously in a tie between two actors (e.g., task information and emotional support)
Network Measures	
Density	Percentage of ties that exist out of the total possible ties that could exist in a network (i.e., connectedness, or closure, of a network)
Structural holes	Extent to which disconnects between actors exist in the whole network

Analyzing Network Data

- Network metrics can be entered as independent or dependent variables in traditional regressions or structural equation models
- Can run dyad-level analyses using analytic methods such as multiple regression quadratic assignment procedure (MRQAP)
 - E.g., having one type of relation (e.g., trust) predicts the formation of another type of relation (e.g., gossip)
 - Accounts for the non-independence in observations that arises from having individuals provide multiple ratings of one another

Analyzing Network Data

- Relational event models (REMs)
 - Statistical models for analyzing sequenced or time-stamped dyadic network data, where a relational event is a “discrete event generated by a social actor and directed toward one or more targets” (Butts, 2008, p. 159)
- Exponential random graph models (ERGMs)
 - Predict the existence (or not) of ties in a network and are an advancement on a logit model (Robins et al., 2007)
- Autologistic Actor Attribute Models (ALAAMs)
 - Allow for modelling individual attitudes, cognitions, behaviors, and outcomes based on networks of relationships (Parker et al., 2021); specifically, they model social contagion mechanisms, to explore how behaviors and attitudes spread through a network (Daraganova & Robins, 2013)
- Stochastic actor-oriented models (SAOMs)
 - Examine longitudinal data (Snijders et al., 2010), taking as the starting point individual actors and then using simulations to unpack how networks change over time

04

**How do we Overcome
Criticisms of SNA?**

Criticism 1: Network Analysis is Atheoretical

- Granovetter (1979) suggested that there is a “theory gap” in SNA
- Salancik (1995, p. 348) famously argued that network research was powerfully descriptive, but not theoretical
- Roots of this criticism:
 - “SNA” inherently implies a statistical approach
 - Shift from focusing on individuals to dyads necessitates different types of statistical analyses and specialized software programs
 - Many of the network metrics covered earlier in this article can be expressed in mathematical formulas

Criticism 1: Network Analysis is Atheoretical

- Scholars now acknowledge SNA is ripe with theory
 - Network Theory versus Theory of Networks (Borgatti & Halgin, 2011)
 - Network theorizing has emerged in virtually every area of organizational sciences, including **leadership** (Balkundi & Kilduff, 2006), **teams** (Park et al., 2020), **employee turnover** (Ballinger & Holtom, 2020), **mentoring** (Higgins & Kram, 2001), **employee communication** (Monge & Contractor, 2001), **careers** (e.g., Methot & Seibert, 2021), **emotions** (Casciaro, 2020), **human capital** (Methot et al., 2018), and **gender and diversity** (e.g., Brands & Kilduff, 2014; Chanland & Murphy, 2018).

Criticism 1: Network Analysis is Atheoretical

- Traditional Network Theories

- Social Capital (e.g., Nahapiet & Ghoshal, 1998)
- Strength of Weak Ties (Granovetter, 1973)
- Structural Holes (Burt, 1992)
- Simmelian Ties (Krackhardt, 1999)
- Balance Theory (Heider, 1946)

- Contemporary Network Theories

- Network Leadership Theory (Balkundi & Kilduff, 2006)
- Configural Theory of Team Processes (Crawford & LePine, 2013)
- Developmental Networks (Higgins & Kram, 2001)
- Network Architecture of Human Capital (Methot, Rosado-Solomon, & Allen, 2018)
- Relational Coordination Theory (Gittell, 2006)
- Externalities of Brokerage Theory (Clement et al., 2018)

Criticism 2: Network Analysis Neglects Dynamics

- The “static position of the actor in the network has been assumed to explain his or her actions in social settings” (Stevenson & Greenberg, 2000, p. 652)
- A lot of research on **predictors** (e.g., personality, Fang et al., 2015; interdependence, Yakubovich & Burg, 2019) and **outcomes** (e.g., performance, Baldwin et al., 1997; turnover, Porter et al., 2019; innovation, Baer et al., 2015) of social network configurations at one point in time across different levels of analysis (Borgatti & Foster, 2003; Brass et al., 2004)
- Roots of this criticism:
 1. Network data often take a cross-sectional “snapshot” rather than longitudinal panels
 2. By prioritizing metrics like centrality, we implicitly assume the network and individuals’ positions in it are static
 3. We often do not take into account that actors have agency and are actively and consistently changing their connections to others

Criticism 2: Network Analysis Neglects Dynamics

- Network scholars have, for some time, acknowledged that networks change over time (e.g., new ties form and existing ties dissolve) and have identified several drivers of that change
 1. **Propinquity** (i.e., physical and temporal proximity) (e.g., Festinger et al., 1950; Lee 2019)
 2. **Compatibility** (i.e., homophily) (for a review, see Lawrence & Shah, 2020)
 3. **Structural tendencies** (i.e., reciprocity, transitivity, preferential attachment) (e.g., Dahlander & McFarland, 2013)
- Burgeoning stream of research explicitly recognizes that organizational networks are dynamic systems that continuously emerge and evolve, and that these changes have meaningful implications for firms and the people in them (Jacobsen, Stea, & Soda, 2022; Rivera et al., 2010)

Criticism 2: Network Analysis Neglects Dynamics

- “network emergence” (Maclean & Harvey, 2016)
- “network churn” (Sasovova et al., 2010)
- “network genesis” (Quinn & Baker, 2021)
- “network disruption (Methot et al, 2018)
- “network origins (Shah et al., 2021)
- “network evolution” (Doreian & Conte, 2017)
- “network change” (Parker, Halgin, & Borgatti, 2016)
- “network dynamics” (Berends et al., 2010)
- “network volatility” and “network oscillation” (Burt & Merluzzi, 2016)



‘Network dynamics’ refers to the processes by which network change is related to its antecedents and outcomes.

Criticism 3: Network Analysis Neglects Actor Agency

- The notion of **agency**—whether and how people make decisions purposefully and independently of the structures within which they are embedded—has historically been explained away (Borgatti et al., 2014)
- SNA “fails to show exactly how it is that intentional, creative human action serves in part to constitute those very social networks that so powerfully constrain actors in turn” (Emirbayer and Goodwin; 1994, p. 1413)
- Renewed emphasis on individual agency, such that individuals are active, purposeful, and instrumental in crafting a network of relationships (cf. Bensaou et al., 2014; see Tasselli & Kilduff, 2011 for a review)

Criticism 3: Network Analysis Neglects Actor Agency

- The act of **strategic networking** (see Porter & Woo, 2015 for a review)
 - The purposeful creation and nurturing of social ties in support of task and professional goals (Casciaro et al., 2014)—or the behavioral processes through which organizational actors shape others’ relationships (Halevy et al., 2019)
- **Brokerage orientations** (Grosser et al., 2018)
 - Brokerage as a process comprised of a set of social behaviors, and individuals’ tendencies to engage in these behaviors; individual differences in the ability to recognize and take advantage of structural-hole positioning (Obsfeld, 2014; Burt, 2005; Tasselli & Kilduff, 2021)
- **Network cognition** (for reviews, see Brands, 2013; Smith et al., 2020)
 - people spontaneously activate, or call to mind, different subsections of their networks; “people differ in their ability to capitalize on their networks in order to get ahead” and they “engage in purposeful action to meet their goals” (Smith et al., 2020, p. 166)

Criticism 4: Network Analysis Rarely Captures Multidimensionality

- Research privileges **unitary ties** (i.e., one-dimensional) at the expense of studying more complex **multiplex ties** (i.e., multidimensional) (Methot & Rosado-Solomon, 2020)
- Multiplexity capture unique tensions that are qualitatively distinct compared to one-dimensional (or uniplex) relationships
- If only one type of tie is studied (e.g., advice), **causal inferences may be inaccurate** because observed effects may actually be due to a different component of those relationships (e.g., friendship; Ibarra, 1993, Methot & Rosado-Solomon, 2020)
- Unclear whether more elements in a social relationship “strengthens the overall tie” (Cotton et al., 2011, p. 18) or “create conflicts of interest and expectations that weaken relationships” (Kuwabara et al., 2010, p. 245)

Criticism 4: Network Analysis Rarely Captures Multidimensionality

- One type of tie may be appropriated for a different use (e.g., friendship ties may be leveraged to serve business ends; Coleman, 1990; Methot et al., 2016) and economic transactions are often embedded in social relationships (e.g., Granovetter, 1985; Uzzi, 1996)
 - Friendships with co-workers (Ibarra, 1992; Methot et al., 2016; Shah et al., 2017), mentors (Cotton et al., 2011; Kram & Isabella, 1985), and supervisors (Bridge & Baxter, 1992; Kiefer, 2016); own and operate companies with their spouses (Fabrikant, 2008; Hays, 1995) or family members (Gomez-Mejia et al., 2001); and develop rivalries with their teammates (Hood et al., 2017) and friends (Ingram & Roberts, 2000)
- Multiplex relationships have been found across diverse organizational contexts, including among **remote workers** (Schinoff et al., 2020), and have been linked to key organizational outcomes such as enhancing **organizational identification** and job **performance** (Bullis & Bach, 1991; Methot et al., 2016; Shah et al., 2017), facilitating access to **divergent perspectives and advice** (Marineau et al., 2018), and **curtailing unethical behavior** (Brass et al., 1998)

Closing Remarks

Closing Remarks

- Social network analysis is an integral paradigm and essential methodological tool for management and organizational scholarship (Borgatti & Foster, 2003)
- Fast growth is accompanied by corresponding criticisms (for reviews, see Borgatti et al., 2014; Kilduff & Brass, 2010)
 - Recent trends are helping combat these concerns and advance social networks research
- Moving beyond network structure to consider network content (e.g., multidimensionality of dyadic relations), network dynamics (i.e., how ties emerge and evolve over time), and network cognitions (i.e., systematic biases in how people perceive social networks)
- Expanding sources for network data beyond active surveys responses to passive and organic data and developing rich theories of networks in organizations

Supporting Resources

Methot, J. R., Zaman, N. & Shim, H. (2022). Social network analysis in organizations. In *Oxford Research Encyclopedia of Business and Management*. Oxford University Press.

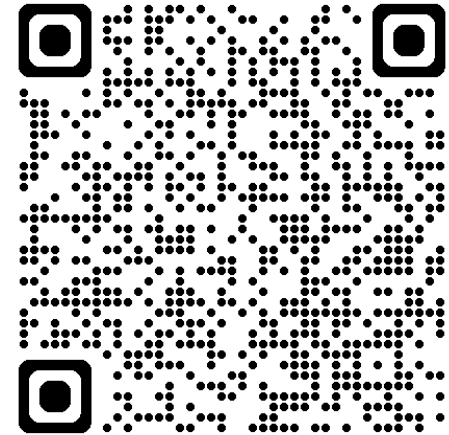
<https://doi.org/10.1093/acrefore/9780190224851.013.228>

Let's Continue the Conversation About Networks...

- Join the Academy of Management's **Social Networks Society (SNS)** Community (use QR code or shortened link to **join our mailing list**)
- We seek to foster greater connection among scholars (600+ so far) interested in organizational networks or network ties, even if it's not your main research focus.
- The executive committee is happy to answer your questions: Raina Brands, Julia Brennecke, Hongzhi Chen, Kristin Cullen-Lester, Fabio Fonti, Joe Labianca, Daniel Levin, Jessica Methot, Francesca Pallotti, Stefano Tasselli



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tinyurl.com/sns-join