CHAPTER CONTENTS

4 A Taxonomy of Communication Networks

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Communication network research is increasingly being used across the communication discipline. However, most social network research is limited in its generalizability because it focuses on either a single network case or ego-centric network data. In order to generate knowledge across network studies, a mechanism is needed to synthesize. This chapter presents a taxonomy of communication relations, differentiating between communication flow, affinity, representational, and semantic networks. Then, it demonstrates the utility of the taxonomy for synthesizing network research by reviewing 139 studies in communication journals, focusing on the antecedents, outcomes, and processes of each type of network.

Although social media, like Facebook and LinkedIn, and networked organizational forms, like the Network Society (Castells, 1996), have only recently made social networks part of the everyday vernacular, the network perspective has shaped communication thinking since the 1970s. The adoption of the network perspective and its increasing popularity in communication research (see Figure 4.1) is in part due to a general shift in the social sciences away from individualist, atomistic, and essentialist explanations toward more relational, systemic, and contextual explanations of social phenomena (Borgatti & Foster, 2003; Monge & Contractor, 2003). Despite the popularity of the network perspective, most social network research that extends beyond ego-networks may best be described as quantitative case analysis (Faust & Skvoretz, 2002). That is, most network research focuses either on a single network or uses ego-centric network data, where data only about a node's immediate connections is gathered. In order to draw conclusions across multiple cases, communication researchers need a network taxonomy.

In this chapter, we present a recently developed taxonomy of the multiple types of communication relations (Shumate & Contractor, forthcoming). We use this taxonomy to synthesize communication network research in communication journals across interpersonal, organizations, mass, health, political, and computer-mediated communication. In doing so, we present a case for what is known about particular communication relations based upon their type—specifically, communication flow, affinity, representational, and semantic relations—rather than synthesizing across either the node types (e.g., individual, group, organization) or contexts of the study. We review 41 years of research

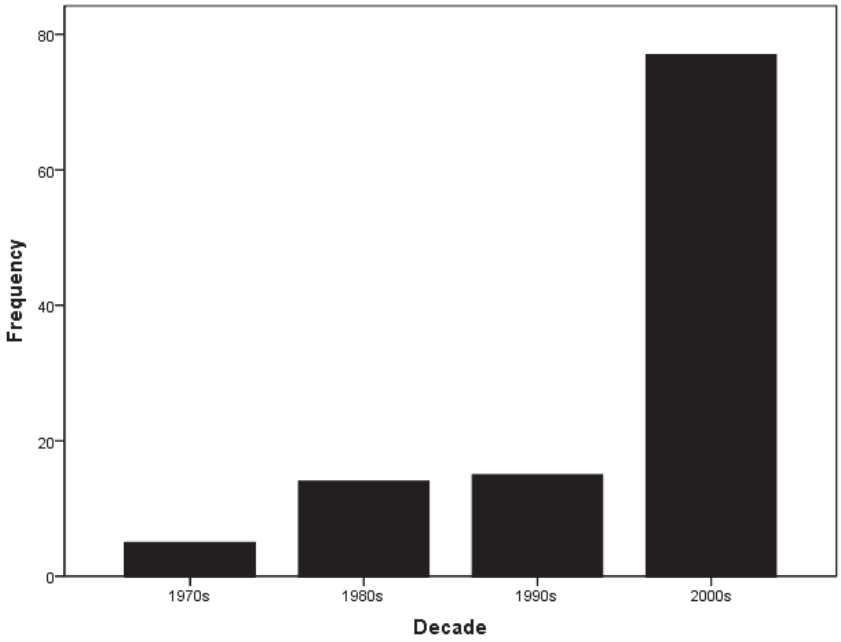

Figure 4.1 Frequency of communication articles using network analysis per decades (N = 111). Articles from 2010 and 2011 (N = 28) are not included in the chart.

(1970–2011) research that focuses on the antecedents, outcomes, and processes of communication networks, highlighting results for each relation type. This differs from the purposes of previous reviews of social network research (Farace, Monge, & Russell, 1977; Monge & Eisenberg, 1987, Shumate & Contractor, forthcoming) in two important ways. First, this review is more expansive than previous reviews, focusing on communication as a field rather than organizational communication network research. Second, this review aims to synthesize results across sub-fields, based upon relation type, suggesting ways for communication network research to move forward together.

This chapter makes three contributions to communication research. First, it utilizes a relatively new network taxonomy (Shumate & Contractor, forthcoming) that will allow for the synthesis of disparate communication research. In doing so, we demonstrate promising ways for communication network research, across sub-field divides, to be informative and generative of cumulative knowledge. As a field, communication research can and should be able to cumulatively make a statement about the nature of various communication network types. Without a taxonomy or mechanism for synthesis, communication network research provides an interesting method for the study of disparate phenomenon but does not contribute to cumulative knowledge. Second, the chapter highlights the importance of multiplex communication ties across relation types. Although previous research has addressed multiplexity, the current

review suggests that flow, affinity, representational, and semantic networks are mutually influential; however, little research has examined the ways in which these networks interact. Finally, beyond the call for research on multiplexity across relation types, we present a call for future research based upon relation types that have received scant attention in communication journals. We find that more research is needed on the (a) outcomes of semantic networks, (b) the outcomes of representational networks, and (c) the processes of communication networks across types.

Communication Networks

Communication networks are relations among various types of nodes that illustrate the ways in which messages are transmitted or interpreted. This definition is more expansive than that put forward by previous reviews of communication networks (e.g., Monge & Contractor, 2001; Monge & Eisenberg, 1987), because it includes research that examines semantic networks based on the interpretation of particular words or concepts and hyperlink research in which no message is exchanged between the actors directly. A network perspective on communication processes emphasizes structural patterns but is not necessarily a functional perspective. Although many think about communication networks as the exchange of messages among individuals, communication research across sub-fields have examined a variety of nodes and relations. Nodes that have been examined are as diverse as newsgroups (e.g., Choi & Danowski, 2002; Kang & Choi, 1999), organizations (e.g., Doerfel & Taylor, 2004; Shumate, Fulk, & Monge, 2005), and characters on television shows (e.g., Fine, 1981; Livingstone, 1987). Relations have included agreement (e.g., Stohl, 1993), membership (e.g., Barnett & Danowski, 1992), cooperation (Doerfel & Taylor, 2004), and telecommunications traffic (e.g., Monge & Matei, 2004).

Following Shumate and Contractor (forthcoming) this chapter suggests that relation types, not actor types, are the best way to synthesize findings about communication networks. This presupposition is supported by two distinct studies. First, Faust and Skvoretz's (2002) comparison of the structural characteristics of 43 networks, ranging from advice networks among managers to licking behavior among cows to communication among monastic novices, found that actor type did not explain the patterns of networks as well as relations did. Second, Leskovec, Kleinberg, and Faloutsos's (2007) study of positive link growth rates (i.e., the relationship between the rate in which links and nodes are added to a network) across 12 networks of 7 types found that the relationship between the addition of nodes and the addition of relations was much stronger for the citation networks than for the communication networks (e.g., communication via e-mail). Monge, Heiss, and Margolin (2008) suggested that Leskovec and colleagues' findings indicated that various types of relations have different carrying capacities, or limitations. This contention falls in line with one of the hallmark tenets of social network analysis, that

researchers should shift the focus of their analysis from attributes to relations (Marin & Wellman, 2011).

Communication Network Relation Types

Shumate and Contractor (forthcoming) argued that communication network relations can be classified into four categories: flow, affinity, representational, and semantic. Each of these relation types describe a way in which communication may be represented in a network. In the original work, Shumate and Contractor organized organizational communication research using the taxonomy, inclusive of interdisciplinary work in management journals. The purpose of presenting this taxonomy here is to enable researchers to cumulatively draw conclusions across communication network research that appears in communication journals.

Flow. Communication flow relations describe ties that indicate sending and receiving messages, information, or data (Shumate & Contractor, forthcoming). In other words, communication flow relations refer to the exchange or transmission of messages, information, and data among nodes. Communication flow can take place among individuals, as in information seeking (Palazzolo, 2005), or between individuals and other types of nodes, including technologies, documents, and other artifacts. For example, when individuals exchange messages or when a person retrieves information from a website, these relations demonstrate communication flow.

Affinity. In contrast, affinity relations refer to socially constructed relationships that have either a positive or negative valence (Shumate & Contractor, forthcoming). These relations do not explicitly indicate the exchange or transmission of messages, information, or data among actors; rather, they describe more enduring relationships among them. Individual affinity relations include friendship and marriage, whereas organizational affinity relations include collaboration and alliances. In each case, the type of relationship is symbolically constructed by one or both parties, and communication is assumed to be implicit in the relation. Thus, although it is difficult to conceive of friends or interorganizational partners that do not exchange messages or information, friendships or interorganizational partnerships do not represent flow relations as they do not explicitly refer to the transmission or exchange of messages, information, or data.

Representational. Representational relations involve messages about an association among actors communicated to a third party or the public (Shumate & Contractor, forthcoming). In other words, these relations describe messages about one node's affiliation with other nodes. Representational ties including hyperlink networks[1] (e.g., Tateo, 2005), bibliometric networks[2] (e.g., So, 1988), a network of USENET responses (Himelboim, 2008), and a network of

name mentions on websites (Shumate & O'Connor, 2010). These relations are distinguished from flow relations because no messages are exchanged between nodes. Additionally, they are distinguished from affinity relations because they do not necessarily entail enduring relationships among actors. Consider, for example, the contrast between conversing with a friend, a flow relation, having a friend, an affinity relation, and name-dropping, a representational relation. In the representational relation, the person whose name is dropped does not receive a message. Additionally, the person whose name is dropped may not even have a friendship or an enduring relationship with the person dropping his or her name. Unlike flow and affinity relations, there is no cost to receiving additional ties in representational networks. For example, a website being the recipient of an increasing number of hyperlinks bears no direct cost burden,[3] whereas being flooded with an increasing number of emails may result in costly information overload. As such, preferential attachment effects may drive the formation of these networks (e.g., exponential growth in links to a popular site).

Semantic. Semantic relations focus on shared meaning or symbol use. Semantic relations are examined on two levels: (a) the shared meanings as indicated by the patterns of word usage in text or discourse and (b) individuals' cognitive maps of shared meanings. An example of the first type is Doerfel and Barnett's (1999) analysis of the paper titles of the 1991 International Communication Association Conference. Word frequencies, combinations, and differences across divisions were compared to a prior affiliation analysis, based upon membership (Barnett & Danowski, 1992). In general, when members were jointly affiliated with two divisions, the authors of papers in those two divisions used similar words in their titles. Stohl (1993) provided an example of the second type of semantic network research. In her study, managers' ties to one another were based upon the number of common interpretations they had of the term *participation*. A semantic relation between the actors in this case indicated that they had similar perceptions of the same concept; it did not indicate a transmission or exchange of information (i.e., a flow relation), an enduring relationship (i.e., an affinity relation), or a message to a third party or the public about an association among actors (i.e., a representational relation).

The four types of relations have different types of logical network patterns. For example, flow relations have constrained degree distributions. The constraint arises from the capacity of an actor to process or send messages. In contrast, representational relations are relatively unconstrained because there is not a corresponding cost to receiving these types of ties. As such, we would expect that representational networks would tend to have highly skewed in-degree distributions.[4] For example, hyperlink networks composed of representational relations often have power-law degree distributions (Barabási, Albert, & Jeong, 2000), in which a small number of actors receive a significant number of ties and many actors receive very few ties. Affinity relations, especially if they are positively valenced, are expected to result in networks that

have a greater number of clusters, based upon balance theory (Heider, 1958; Holland & Leinhardt, 1972). Balance theory suggests that triangles of positively valenced ties are more likely to exist in networks (Monge & Contractor, 2003), which are the building blocks of clusters in a network. Representational network relations, in contrast, should have less clustering because they are not sentiment-based networks. Representational networks rely on impression management rather than sentiment as their foundational mechanism, and, as such, cognitive dissonance plays a lesser role in these networks. Consider the research of Shumate and O'Connor (2010) on corporate-NGO networks. In these representational networks, corporations seek to set themselves apart from other corporations by presenting unique relations with NGOs. As such, triangles of relationships are less likely than in affinity relations. Finally, Carley and Kaufer (1993) suggested concepts that have the most meaning will have higher connectivity and that semantic networks at the individual level tend to converge among actors who are similar to one another. In other words, similar individuals will think about the relationships among concepts in more similar ways than individuals with fewer similarities.

In addition to the four types of communication network relations defined earlier, Shumate and Contractor (forthcoming) identified other networks that enable and constrain the configuration of various types of communication networks, infrastructure networks. Infrastructure networks include technology networks, physical networks, and affiliation networks. Technology networks describe the supporting paths along which communication flow, affinity, representational, and semantic communication networks are made manifest. For example, consider the potential for mobile communication in a country where individuals must pay for "talk time" in order to use their phones. The technology network in any given point in time would be a network of those individuals who have "talk time" available, because only those individuals would be able to communicate with one another via mobile phone at that moment. Physical networks describe the proximity of actors to one another. Research on communication and affinity networks has consistently shown that physical proximity plays an important role in network structuring. For example, Sykes (1983) found that physical proximity explained much of the frequency of interaction among individuals. Finally, affiliation networks are two-mode networks (i.e., networks of two different types of actors in which connections are only permitted among actors of different types), where actors are affiliated with organizational entities (e.g., organizations, groups, social movements, online communities). Infrastructure networks do not explicitly or implicitly involve communication or shared meaning, but they affect flow, affinity, representational, and semantic network relations among actors.

In summary, communication research has been at the forefront of social network analysis, leading researchers to analyze an eclectic range of contexts, node types, and relationships. Despite this diversity, however, there have been few attempts to classify the state of the communication network field across

sub-disciplines (e.g., organizational, interpersonal, health, mass, computer-mediated, and political communication). In doing so, we submit that researchers across sub-disciplinary divides can be informed by one another's research and nuanced findings can be generated. Using a relation-driven approach, we offer a framework that synthesizes the field and identifies areas for future research.

Method

In the following section, we present a review of communication research articles in communication journals that use social network analysis. Employing the four relations defined above, and following Monge and Eisenberg's lead (1987), we examine the antecedents, outcomes, and processes of each type of network. Antecedents to networks describe research in which the communication network is the dependent variable, analyzing a variety of factors that predict particular network structural properties. Outcomes of networks describe research in which the communication network or some property of the communication network is the independent variable and predicts specific consequences. Processes of networks describe longitudinal communication research that explores the dynamic rewiring of the network over time.

In order to conduct this review of communication research, we explored all journals in the Communication Institute for Online Scholarship (CIOS) database from 1970 to 2011. We did not examine books, book chapters, or journal articles published by communication scholars in interdisciplinary journals; as such, our review is limited in its generalization to an examination of communication research in communication journals. We searched indices contained in these journals for network terms including *social network, network analysis*, *UCINET*, *density*, *centrality*, and *network data*. We discarded any article that did not conduct an empirical analysis or did not operationalize a communication network (i.e., any article that developed a scale or attitudinal measure of networking). We identified a total of 159 articles. Of these, 18 were interpersonal communication articles, 8 were health communication articles, 53 were organizational communication articles, 49 articles were computer-mediated communication articles, 14 were mass communication articles, and 17 were political communication articles. We excluded articles that simply visualized or described networks from our review (n = 7), because they did not examine antecedents, outcomes, or processes. Additionally, we excluded articles whose primary focus was infrastructure networks (n = 13). We then classified the remaining articles (n = 139) based upon relation type and whether the network was a dependent, independent, or longitudinal variable. The results of this classification are presented in Table 4.1. In addition, an online supplement, which identifies each article included, the type of network examined, and a brief description of the results of that study is available at www.michelleshumate.com/resources.

Table 4.1 Taxonomy of Network Studies in Communication Journals

	Antecedents	*Outcomes*	*Process*
Affinity	Atouba and Shumate (2010) Magdol (2000) Mueller, Kuerbis, and Pagé (2007) Neal (2010) Reese, Grant, and Danielian (1994) Roberts and O'Reilly (1978) Sykes (1983) Taylor and Doerfel (2003) Widmer (2006) Yuan and Gay (2006)	Beinstein (1977) Breidenstein-Cutspec and Georing (1989) Feeley and Barnett (1997) Lewis, Kaufman, and Christakis (2008) Parks (1977) Raile, Kim, Choi, Serota, Park, and Lee (2008) Sanders and Nauta (2004) Smith and Fink (2010) Sohn (2009) Taylor-Clark, Viswanath, and Blendon (2010) Wakabayashi, Yamashita, and Yamada (2009)	Bryant and Monge (2008) Chon, Choi, Barnett, Danowski, and Joo (2003) Doerfel and Taylor (2004) Shumate, Fulk, and Monge (2005) Terhell, van Groenous, and van Tilburg (2004)
Flow	Ang and Zaphiris (2010) Boase (2008) Cho and Lee (2008) Cho, Trier, and Kim (2005) Choi and Danowski (2002) Corman (1990) Ersig, Hadley, and Koehly (2011) Himelboim, Chang, and McCreery (2010) Hurt and Preiss (1978) Kim and Barnett (1996) Kim, Kim, Park, and Rice (2007) Ksiazek (2011) Mohammed (2001) Moon, Barnett, and Lim (2010) Nonaka (2005) Palazzolo (2005) Tardy and Hale (1998)	Balkundi, Barsness, and Michael (2009) Cho (2005) Danowski (1980) Dorsey, Scherer, and Real (1999) Eisenberg, Monge, and Miller (1983) Eveland and Hively (2009) Feeley (2000) Fink and Chen (1995) Gil de Zúñiga and Valenzuela (2011) Hartman and Johnson (1989) Huffaker (2010) Ikeda and Boase (2011) Ishii (2006) Kuhn and Nelson (2002) Leonardi (2009) MacDonald (1976) Papa (1990) Parks and Adelman (1983) Postmes, Spears, and Lea (2000)	Boulay and Valente (2005) Chung (2011) Danowski and Edison-Swift (1985) Lee, Monge, Bar, and Matei, (2007) Monge and Matei (2004) Palazzolo, Serb, She, Su, and Contractor (2006) Paollio (1999) Sinnreich, Chib, and Gilbert (2008) Susskind (2007) Yuan and Ksiazek (2011)

	Antecedents	*Outcomes*	*Process*
	Weber and Monge (2011) Yuan, Fulk, Monge, and Contractor (2010) Yum (1982)	Prell (2003) Rice (1993) Rice and Love (1987) Rojas, Shah, and Friedland (2011) Russo and Koesten (2005) Schmitz and Fulk (1991) Vergeer and Pelzer (2009) Wing and More (2005) Yuan, Cosley, Welser, Ling, and Gay (2009) Yuan, Fulk, Shumate, Monge, Matsaganis, and Bryant (2005)	
Represent-ational	Barnett and Sung (2005) Bennett, Foot, and Xenos (2011) Brooks, Welser, Hogan, and Titsworth (2011) Caiani and Wagemann (2009) Feeley (2008) Himelboim (2008) Johnson (2011) Kropczynski and Nah (2011) Park (2010) Park and Jankowski (2008) Park and Thelwall (2006) Park and Thelwall (2008) Reeves and Borgman (1983) Rice, Borgman, and Reeves (1988) Shumate and Dewitt (2008) Shumate and Lipp (2008) Shumate and O'Connor (2010) So (1988)	Biddix and Park (2008)	**None**

(*Continued*)

Table 4.1 \Continued

	Antecedents	*Outcomes*	*Process*
	Tai (2009) Tateo (2005) Tremayne, Zheng, Lee, and Jeong (2006)		
Semantic	Adam (2008) Becker-Beck, Wintermantel, and Borg (2005) Chow-White (2006) Doerfel and Barnett (1999) Doerfel and Marsh (2003) Eveland, Cortese, Park, and Dunworthy (2004) Danowski (2008) Dunwoody (2004) Gilpin (2010) Kim, Su, and Hong (2007) Kwon, Barnett, and Chen (2009) Maynard (1997) Murphy (2001) Murphy and Maynard (2000) Reese, Rutigliano, Hyun, and Jeong (2007) Rice and Danowski (1993) Stohl (1993) Zywica and Danowski (2008)	**None**	Murphy (2010)
Multiplex	Albrecht and Ropp (1984) Birnie and Horvath (2002) Bryant, Sanders-Jackson, and Smallwood (2006) Goering and Breidenstein-Cutspec (1989) Haythornthwaite (2003) Haythornthwaite (2005)	Campbell and Kwak (2011) Colon-Ramos, Atienza, Weber, Taylor, Uy, and Yaroch (2009) Feeley, Hwang, and Barnett (2008) Hampton (2011) Pollock, Whitbred, and Contractor (2000) Xia, Yuan, and Gay (2009)	Whitbred Fonti, Steglich, and Contractor (2011) Igarashi, Takai, and Yoshida (2005)

Communication Flow

Research on communication flow traditionally has been regarded as communication network research. For example, Monge and Contractor (2001) defined communication networks as: "the patterns of contact between communication partners that are created by transmitting and exchanging messages through time and space" (p. 440), or communication flow relations. For our purposes, any work that examines the transmission of messages or frequency of communication between individuals, organizations, or media outlets focuses on communication flow. Indeed, communication flow relations are the most commonly studied type of communication relation in communication journals (n = 59, 42.4 %).

There are 20 studies of **antecedents** to communication flow networks. Together, research on antecedents to communication flow networks suggests that a combination of a node's resources, motivations, and perceptions of others in the network influence the pattern of communication ties. Examples of node-level resources include lack of communication apprehension (Hurt & Preiss, 1978), time to make contacts (Yum, 1982), and economic development (Kim & Barnett, 1996). A few examples of motivational factors include special interest in a topic (Ersig, Hadley, & Koehly, 2011), similar department tasks (Cho, Trier, & Kim, 2005), and shared task interdependence (Yuan, Fulk, Monge, & Contractor, 2010). Examples of perceptions include others' expertise (Palazzolo, 2005; Tardy & Hale, 1998; Yuan et al., 2010), similar demographics (Mohammed, 2001), perceptions of technology utility (Kim, Kim, Park & Rice, 2007), and partner's social role (Kim et al., 2007). However, no study examined all three of these factors together, suggesting the need for greater synthesis across sub-fields and studies in this area. One prescription from this review is for future research on antecedents to communication flow networks to include node resources, motivational factors, and perceptions of others to determine their relative effects.

There were 29 articles that focused on the **outcomes** of communication flow networks. The most common theme evident in results across cases is that social influence occurs via communication networks. For example, consider the work of Schmitz and Fulk (1991). In their study of e-mail use, a relatively new technology at the time, both the richness of the media and individual's social networks influenced perceptions of the technology. Thus, social influence plays an important role in attitude formation. In examining the results across studies in communication networks, however, a more nuanced conclusion can be drawn. Attitude change appears to occur through weak ties, whereas dense communication networks tend to support and reinforce uniform opinions. For example, consider the work on political knowledge and civic engagement. Eveland and Hively (2009) and Gil de Zúñiga and Valenzuela (2011) suggested that political knowledge is positively related to a diversity of ties. Papa (1990) found that network diversity increased the likelihood of adoption of a new technology. In all three of these studies, new information came from a diverse set of communication interactions. In contrast, consider

the work of health communication scholars on engaging in risky health behavior. For example, binge drinking (Dorsey, Scherer, & Real, 1999) is reinforced by dense communication with a network of others also engaging in the same behavior. In sum, the diversity of communication contacts creates the opportunity to learn more and brings opportunities for attitude and behavior change, whereas dense communication with similar nodes reinforces both attitudes and behavior. Social influence, to a large extent, depends on the configuration of communication networks. Specifically, networks that emphasize diverse connections and weak ties create opportunities for new information to shape attitudes and behavior. In contrast, cohesive, dense networks of like others reinforce existing attitudes and behaviors.

Research on the **processes** of communication flow networks has examined the ways in which changes in network positions or structures (i.e., relative centrality, mutuality, transitivity) are related to attributes and outcomes for individual actors ($n = 10$). In many ways, these studies are extensions of the two logics already identified in the examination of the antecedents and outcomes of flow networks; node-level resources, motivations, and perceptions of others are antecedents to and differential access to information results from the configuration of social networks. However, current research on the process of communication flow examines *increases* in network ties/properties and the impact of *changes* in communication networks on outcomes.

As an example of the first logic, consider the article by Lee, Monge, Bar, and Matei (2007). They examined the ways in which economic and telecommunications development *increases* the tendency to connect and reciprocate ties among nations. The primary difference between the logic in this article and that of the antecedents' articles is the examination of changes in these network properties. Similarly, Danowski and Edison-Swift (1985), Monge and Matei (2004), and Palazzolo, Serb, She, Su, and Contractor (2006) examined the antecedents to changes in communication networks. In general, the researchers concluded that nodes that have greater resources are likely to *continue to increase* their centrality and mutuality in communication networks. Resource types in these studies include economic, knowledge, and development resources.

In contrast, four studies examined the outcomes of dynamic communication flow networks. Researchers involved in these studies generally found that communication centrality and connectedness matter. For example, Susskind (2007) examined a network of employees at an international hotel company across three time periods. He found that increased centrality is related to increased perceptions of information adequacy during downsizing and was negatively related to turnover intentions. In these studies in general, greater connectedness led to better information, which is an important resource.

In summary, network research in communication journals has focused largely on flow relations. Research on antecedents to these networks and process research has examined changes to the configuration of these networks over time and focused on node resources, motivations, and perceptions as determinants. However, these related findings have not been well synthesized,

and much of the research to date has examined only one of these factors. In contrast, most of the research on outcomes of communication flow networks and process research has focused on the ways by which information flows transform nodes, by either giving them better information resources or by changing their attitudes over time.

Affinity

A second type of communication network research has focused on socially constructed relationships among actors in a network. Examples of such relations include friendships, alliances, and various types of cooperation. In communication journals, affinity relations are often assumed to imply communication flow relations between actors without examining such flows. However, such research also has tended to examine enduring states rather than message flow.

Together, the 10 studies that have considered **antecedents** suggest that two factors play a significant role in the social construction of affinity relations across node types: interdependent network structures (e.g., mutuality, transitivity) and node homophily. Although not exclusively (see Weber & Monge, 2011), research on affinity relations has a greater tendency to focus on network structures than research on communication flows. Interdependent network structures describe the ways in which the social construction of relationships is a coordinated effort among actors. For example, if two individuals are friends with a third person, they are more likely to report that they are friends with each other; maintaining a dislike would result in significant psychological discomfort for the individuals (Heider, 1958). Similarly, communication researchers have found that reciprocating ties and transitivity (Atouba & Shumate, 2010), bridges and liaisons (Roberts & O'Reilly, 1978), and centrality (Reese, Grant, & Danielian, 1994) influence the configuration of the affinity network. Because affinity relations focus on states rather than dynamic flows of information among participants, it may be that affinity networks are better suited for the study of network structures of these types.

Second, communication researchers have examined homophily as a powerful predictor of the presence of affinity ties. Atouba and Shumate (2010), Mueller, Kuerbis, and Pagé (2007), Neal (2010), Widmer (2006), and Yuan and Gay (2006) found evidence of homophily, or at least a type of similarity that makes relations more likely, across affinity networks. However, the node characteristic examined varies across studies and, as illustrated by the Yuan and Gay study, homophily effects differ by attribute type (e.g., gender, location, and job specialization). As such, more efforts are needed to discern which attributes influence the configuration of affinity networks.

Eleven articles focused on the **outcomes** of affinity networks. All but one of these studies (Wakabayashi, Yamashita, & Yamada, 2009) were concerned with friendship networks. Intriguingly, these studies had tremendously varied outcomes. Perhaps because friendship is a socially constructed affinity relation that varies a great deal across cultures (Adams & Plautt, 2003), the effects of

friendship networks may be relative across cultural populations. More theoretical work is needed to understand the ways in which differently understood friendship networks influence both individual and systemic outcomes. For example, would Granovetter's (1973) classic work on the outcomes of weak ties in finding employment in the US differ across cultural understandings of friendship?

To date, researchers interested in the **processes** of affinity networks have examined only the antecedents of network ties ($n = 5$). However, in contrast to the communication flow research, affinity researchers have studied the influence of past network ties on future network ties. For example, Doerfel and Taylor (2004) found that occupying structural holes[5] in a network at one time was related to the level of cooperativeness at a later time. Again, the durability of affinity ties, by their very nature, makes such an inclusion more logical than with communication flow ties.

Affinity ties are more durable, socially constructed relations between actors in a network. Their antecedents include network interdependencies and homophilous attributes. Over time, future relations build on past relations. The outcomes of these networks, however, are poorly understood. A stronger, cumulative line of research on the outcomes of affinity relations is needed to better understand their implications.

Representational Communication

Research on representational communication has significantly increased in the last decade in communication journals. Before 2000, there were 3 articles that focused on representational networks, all of them focusing on bibliometric networks (Reeves & Borgman, 1983; Rice, Borgman, & Reeves 1988; So, 1988). Since 2000, there have been 19 articles, mostly focusing on hyperlink networks. Almost all the studies of representational relations have focused on the antecedents to these networks ($n = 21$).

Two conclusions about the **antecedents** to representational networks can be drawn. One overarching finding of this research is that clusters are prevalent based upon socially constructed groupings of actors. These clusters can vary from external characteristics outside the network (e.g., Ciaani & Wagemann, 2009) to properties of the nodes themselves (e.g., Park & Jankowski, 2008). For example, framing of the fair trade issue has influenced the hyperlink network among websites in two countries (Bennett, Foot, & Xenos, 2011). Similarly, the framing of some research as mass communication and other research as interpersonal communication has influenced citations patterns in communication journals (Rice et al., 1988; So, 1988). The second finding is that representational networks tend to have highly skewed indegree distributions (Barnett & Sung, 2005; Himelboim, 2008; Shumate & O'Connor, 2010). Unlike other relation types, there is no cost of receiving additional ties, making such distributions more likely.

Only one article to date has considered the **outcomes** of representational networks. Biddix and Park (2008) used an innovative combination of interviews and hyperlink analysis in studying the living wage campaign. Using

interviews, they described the ways in which hyperlinks helped to support the geographically-distributed movement.

Representational networks differ significantly from both communication flow and affinity relations. There is little cost to "receiving" a representational link, and, as such, these networks tend to have highly skewed or power-law degree distributions. Further, because these networks are about messages communicated to a third party, they tend to be influenced by the framing of messages about the nature of the social issue or node sets. Through 2011, there has been little research on either the outcomes or processes of these networks, suggesting an area for future research. However, more theorizing is needed to understand the implications of these networks for publics.

Semantic Networks

Semantic network research focuses on the ways that words are used or interpreted by publics. Research to date on semantic networks, much like representational networks, has focused on its antecedents (n = 17); no research to date has focused on the outcomes associated with these networks.[6] In addition, one article (Murphy, 2010) examined the process of semantic network transformation, but like research on antecedents, focused on network structure.

Scholars have examined semantic relations on two levels: (a) the shared meanings as indicated by the patterns of word usage in text or discourse and (b) cognitive maps of shared meanings. Research on the **antecedents and processes** of semantic networks has tended to focus on the first type (for the one notable exception, see Stohl, 1993). Unfortunately, there has been relatively little theory driving most of this research. Instead, researchers have identified general word clusters or themes (e.g., Chow-White, 2006). They have noted differences across outlets or channels in the frequency of words (e.g., Adam, 2008, Doerfel & Marsh, 2003; Gilpin, 2010). However, they have not adequately examined the reasons driving these patterns.

Becker-Beck, Wintermantel, and Borg (2005) suggested a useful direction for semantic network research. They used an experimental design to understand the differences between face-to-face and computer-mediated teams. Using an innovative combination of sequential and semantic networks analysis, they demonstrate that uttered concepts are more specific in the computer-mediated condition than those uttered in the face-to-face condition. This conclusion is both consistent with and furthers theory and research in group communication. This study is unique in that it combined semantic network analysis with another research design.

Multiplexity Across Relation Types

Sixteen articles included multiplex ties across relation types. Multiplexity, or the inclusion of multiple relation types with the same set of nodes, is a relatively old concept in social network research (e.g., Hartman & Johnson, 1989). What is unique about this category is the focus on multiplexity across relations (i.e., flow,

affinity, representational, and semantic). In other words, rather than considering multiplexity within relation type (e.g., three different communication flow networks about different topics), multiplex relations across different network relation types is the focus (e.g., considering both friendship and communication frequency). Since we argue that the essential way to organize communication network research across studies is to focus on relation types, the next logical step is to consider how these various types of relations are related to one another.

All of the articles examining the antecedents, outcomes, or processes of multiplex networks focus on the relationship between communication flow and affinity networks. Research on the **antecedents** to multiplex networks ($n = 6$) and one article focusing on the process of communication networks (Whitbred, Fonti, Steglich, & Contractor, 2011) have tested the implicit assumption of much of affinity network research, that communication flow relations are necessary for the formation and maintenance of affinity networks. Research on the **outcomes** of affinity and communication flow relations ($n = 6$) and one article on the processes of communication networks (Igarashi, Takai, & Yoshida, 2005) compared their effects, hinting that communication networks of different types (i.e., flow, affinity, representational, and semantic) have different outcomes.

Discussion

The purpose of this chapter is to use a network taxonomy of communication networks based upon relations (Shumate & Contractor, forthcoming) to synthesize network research in communication journals. By examining network research findings in communication journals across node types, we are able to point to areas where conclusions across the field can be drawn. Such a synthesis is important for the future of network research as generative of new knowledge beyond case studies and single contexts. Based upon this review, researchers can justify new hypotheses and compare findings with what is known about certain network relation types to those types in other contexts.

We were able to draw conclusions about the antecedents to and outcomes of communication flow networks, the antecedents to affinity networks, and the antecedents to representational networks. In particular, communication flow networks were influenced by node resources, motivations, and perceptions. They resulted in information resource benefits for individuals with greater centrality. Weak ties were sources of new information leading to attitude change, but strong ties reinforced already held attitudes. Affinity networks were influenced by network interdependencies and homophily. Representational networks were influenced by popularity effects, as evidenced by skewed distributions and the framing of issues or sets of actors.

When synthesizing the results, comparisons across network types can also be drawn. In examining the antecedents to flow, affinity, and representational networks, different variables dominated. The nature of the relation explains why. Communication flow relations are about the creation of messages. As such, node resources, motivations, and perceptions of audiences are critical. However, affinity relations are socially constructed. As such, network interdependencies

can take shape because these relations are more enduring. Further, other ways in which individuals socially construct the world make a difference, including through dominant categories (Turner, 1987). Representational relations do not bear the same cost as either affinity or flow relations; as such, they are more likely to have unconstrained degree distributions. Further, since they are communicated to third parties, they are more likely to be shaped by the framing of social issues than other types of relations that are about the parties in the network.

Moreover, through an examination of the four types of relations, we are able to identify uncharted areas of communication network research for future exploration. These include (a) the examination of the outcomes of semantic networks, (b) the examination of the outcomes of representational networks, (c) further examination of the processes of communication networks, and (d) the examination of multiplex relations across relation types. Each of these opportunities for future work is discussed in turn.

Although communication scholars were among the first to introduce semantic network analysis (Danowski, 1988; Monge & Eisenberg, 1987), most of the studies about these networks are inductive, concluding about prominent themes, or clusters. As such, a model of the types of outcomes expected from different semantic network configurations, especially derived from textual analysis alone, is difficult. Although the prevalence and ease of computer-generated content analysis software makes generating semantic networks relatively easy, in order to gain theoretical insight into these texts, research is needed that combines this analysis with other research designs. By integrating semantic network analysis into a larger design, more robust research on antecedents and new research on outcomes are within reach.

Second, communication scholars have readily embraced the study of the antecedents of representational relations, including hyperlink and bibliometric networks. However, to date, this research in communication journals has not examined the expected outcomes of such networks as frequently (for a notable exception, see Biddix & Park, 2008). This presents a puzzle: Why are communication researchers so interested in the structure of these networks, but not interested in the outcomes of these very same structures? Research questions that might be advanced in this area include: Are there advantages to being central in a hyperlink or bibliometric network? Are there consequences to clustering in these networks? Such inquiries need both research and theorizing.

Third, comparatively few studies have examined the processes of communication networks, regardless of relation types (n = 18, 13%). Almost all of these studies focus on the processes of communication flow networks (n = 10). By examining networks at only one point in time, researchers miss the dynamics that may have led to a particular network configuration or a particular outcome. In short, examining a network at one point in time represents only a snapshot of a stream of activity that may or may not be representational of the processes that led to that moment in time. Further, current communication research on processes typically examines changes in networks across a single period (n = 7), neglecting the potential for variations in rates of change and

effects across multiple time periods. Finally, to date, communication research has focused on individual-level outcomes of network processes. Research on sub-group and whole network outcomes is necessary to understand the impact of network rewiring; examples of such outcomes include whole network effectiveness, sub-group efficiency, and community-level health (e.g., levels of obesity for the whole network).

Monge, Farace, Eisenberg, Miller, and White (1984) offered three explanations for the paucity of research on communication processes that, in our view, still hold today. They traced the lack of process research in communication studies to three factors: "methodological determinism, the inaccessibility of process techniques, and the perceived scope of effort required from the researcher" (p. 28). They suggested that the survey and experimental methods that dominated empirical communication research in the 1980s were not suitable for the study of processes, techniques like Markov analysis and time series analysis were seen as arcane and difficult, and that collecting longitudinal data was too time-consuming and difficult. According to Poole (2007), the scarcity of research on communication processes may also be due to a submersion of process under other constructs. Poole suggested this is due to the lack of methods for the study of process and the adoption of approaches from other disciplines, such as psychology, that do not emphasize process as much as communication.

Fourth, more research is needed on multiplex networks across the relation types. In our review of research, there were 16 studies that addressed multiplexity in communication networks. Each of these studies focused on affinity and flow relations. Future researchers should seek to examine other types of relation multiplexity, including semantic and representational relations. Such research has the potential to highlight the interrelatedness of different facets of communication including message flow, social construction, impression management, and linguistic variation.

The current chapter makes three contributions. First, it demonstrates the utility of a taxonomy that allows for the synthesis of disparate communication research. We presented four types of communication networks—flow, affinity, representational, and semantic—and three types of infrastructure networks—technology, physical proximity, and affiliation. We reviewed network research across communication journals, demonstrating the utility of this approach for identifying common findings across traditional communication discipline divides and types of nodes. For example, consider the review of the outcomes of communication flow networks. In order to draw our conclusion about social influence, we drew upon organizational communication, political communication, and health communication research. Studies in each of these sub-fields aided us in understanding the ways in which communication flow relations lead to social influence as an outcome. In addition, this approach assisted us in identifying areas for future research and theorizing.

Second, the chapter highlights the importance of multiplex communication ties. To date, relatively few communication studies have examined the intersections and overlaps between the four types of communication relations,

and all of that research has examined the relationship between affinity and communication flow relations. Further, infrastructure networks that support communication networks represent an important covariate in communication networks. Multiplexity is foundational to the relational perspective of network studies (Lee & Monge, 2011); as such, this chapter serves as a call for more communication research to fill this gap.

Finally, we present a call for future research based upon relation types and questions that have received scant attention from communication scholars. These areas include any research examining semantic networks, outcomes of representational relations, and processes of all types of communication networks. Each of these areas of research suggests opportunities for both innovative theory and new empirical projects.

In sum, this chapter uses a taxonomy of communication networks based upon relations to examine the state of network research in communication journals. Although communication research has been examining networks for almost 40 years, the sub-field remains in its adolescence in many ways. Synthesizing findings and drawing conclusions across studies is the next important steps to transform this body of research into a more mature field.

Notes

1. Hyperlink networks describe the hypertext relationships that exist between websites.
2. Bibliometric networks describe the citation and authorship relationships that exist, often in academic papers.
3. However, there may be an indirect cost resulting from increased visibility in search engine results. This cost burden is imposed by a third party, as opposed to flow or affinity relations where the other actors doing the linking impose the cost.
4. An indegree distribution describes the spread of indegree centrality scores—or the number of links coming into a node.
5. Structural holes are gaps between two groups in a network. Nodes that occupy structural holes have brokerage benefits (see Burt, 1982).
6. Outside of communication journals, some research on semantic network outcomes does exist. For example, Doerfel and Connaughton (2010) find an association between the overall centrality in a semantic network in presidential debates and election outcomes. Although they stop short of suggesting causality, such research shows a promising association with outcomes.

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