NETWORK THEORY OF ORGANIZATION: A MULTILEVEL APPROACH*

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ABSTRACT

Management research regularly considers social networks and their effects on a wide range of organizational phenomena. Scholars employing the social network perspective have generated a considerable body of organizational research, with much of this scholarship single-level in its focus: exploring how networks of individuals, groups, or firms relate to organizational outcomes at the same level of analysis. However, given that organizations are multilevel systems, a network theory of the organization should, by definition, be multilevel in its scope, considering how networks at one level of the organizational system influence networks at higher and/or lower levels. In this article we overlay canonical multilevel theory on the social network perspective to derive postulates defining the broad theoretical domain of a multilevel network theory of organization. The link between these two theoretical perspectives is the graph theoretical notion of systems of nested networks, allowing us to examine how an observed network structure at one level of the system of organizational networks relates to network structures and effects at higher or lower levels of the system.

Keywords: network theory, organizational networks, social network analysis, multilevel theory, multilevel networks, nested systems
INTRODUCTION

Management research regularly considers social networks and their effects on a wide range of organizational phenomena. Indeed, as recent reviews demonstrate, scholars employing social network analytic logic and methodology have been prolific generating considerable theoretical insights (Baker & Faulkner, 2002; Borgatti & Foster, 2003; Brass, Galaskiewicz, Greve & Tsai, 2004; Gulati, Dialdin & Wang, 2002; Raider & Krackhardt, 2002). Yet despite its state of development, there remains an intriguing gap in the organizational social network literature. Specifically, while some recent network scholarship has begun considering multiple levels of analysis (Baum, 2002; Brass et al., 2004; Ibarra, Kilduff & Tsai, 2005; Kim, Oh & Swaminathan, 2006), the majority of scholarship in this area has examined single and within-level network structures and relationships. We propose that this single-level focus has limited development of an integrated network theory of organization: network analysis is still used primarily “as a tool for analyzing data about organizations rather than for understanding organizations” (Salancik, 1995: 345, emphasis added). In this paper we draw on multilevel theory (Kozlowski & Klein, 2000; Rousseau, 1985) to advance our efforts toward filling this gap.

Organizations are multilevel systems of relationships (Hitt, Beamish, Jackson & Mathieu, 2007), and as a result, a network theory of organization should similarly be multilevel in its scope and perspective. Network researchers who have begun to bridge levels of analysis have largely identified commonalities between findings at different network levels of analysis, and/or identified theoretical constructs that can be expanded by considering multiple levels of organizational networks; however, they have not built a true multilevel model (Kozlowski & Klein, 2000; Rousseau, 1985). While some network scholars have challenged the degree to
which organizational levels of analysis map meaningfully onto the network theoretic perspective (Borgatti & Foster, 2003), others recognize that “the potential is there for researchers to examine not just the often discussed micro-macro linkages between individual action and social structure, but the ways in which networks of relationships at one [organizational] level are embedded within and articulate networks at other levels” (Kilduff & Tsai, 2003)

In this paper, we take up this challenge and integrate multilevel and social network theoretical perspectives on organizational analysis to outline the broad theoretical domain of a multilevel network theory of the organization. The ‘missing link’ between multilevel and social network perspectives on organizations is the graph theoretic perspective on systems of nested networks (Harary & Batell, 1981), which suggests that each node in a network at a given level of analysis is, itself, a network at a lower level of analysis. Leveraging the idea of nested networks, we couple the multilevel and social network theoretical perspectives to show how an observed network structure at one level of the system of organizational networks relates to network structures and relationships at higher or lower levels of the system.

In overlaying multilevel theory on the social network perspective, we follow other scholars (e.g., Cappelli & Scherer, 1991; Ostroff & Bowen, 2000; Ployhart, 2006) who have found that viewing a particular theoretical perspective through a multilevel lens enhances and expands the original theory’s insights. In so doing, we contribute to management scholarship by suggesting a path forward to linking micro and macro levels of organizational network research into an integrated network theory of organization. We begin with a brief overview of the network theoretical perspective. We then introduce the notion of systems of nested networks (Harary & Batell, 1981) and use this concept as an organizing principle in our integration of the multilevel and network perspectives on organizations. A discussion of methodological considerations
follows. Finally, we conclude with some comments on the limitations and boundary conditions of our arguments.

**FOUNDATIONS OF MULTILEVEL NETWORK THEORY**

Social network analysis concerns how ‘actors’ (e.g., individuals, groups, organizations, etc.) are ‘tied’ by some sort of social relationship (e.g., advice giving, resource sharing, alliance partnership, etc.; Borgatti, Mehra, Brass & Labianca, 2009). We will refer to constructs that are specific to social network analysis as ‘network theoretic constructs.’ Examples include status (Bonacich, 1987), centrality (Freeman, 1979) and structural holes (Burt, 1992). Management scholars have generally modeled the association of network theoretic constructs with organizational phenomena; for example, Powell, Koput, and Smith-Doerr (1996) find that for start-ups in biotechnology industry, centrality in interorganizational networks is related to organizational growth rates.

Recent reviews of the organizational network literature underscore the breadth of empirical questions which management scholars have addressed using network analysis (Baker & Faulkner, 2002; Borgatti & Foster, 2003; Brass et al., 2004; Gulati et al., 2002; Kilduff & Tsai, 2003; Raider & Krackhardt, 2002), and so we will not provide another review here. Importantly for the discussion at hand, this literature shows that both network theoretic constructs and their associations can generally be studied with equal efficacy at different and distinct organizational levels of analysis (see related comments in Borgatti & Foster, 2003; Ibarra et al., 2005; Wasserman & Faust, 1994). For example, both Obstfeld (2005) and Ahuja (2000) examine the relationship between structural holes and innovation, but Obstfeld (2005) studies individual-level networks of engineers at an automotive manufacturer, while Ahuja (2000) considers inter-firm collaboration networks in the international chemical industry.
More generally, Ibarra et al. (2005: 359) observe that “micro” and “macro” streams have developed in the organizational network literature, and that there have been “few bridges linking [these streams], and no joint agenda.” They define ‘micro’ as the egocentric network, whereas ‘macro’ denotes the overall network structure. In other words, ‘levels’ here refer to levels of network analysis and not, necessarily, organizational levels of analysis. In the same vein, Contractor, Wasserman, and Faust (2006) use the ‘multilevel’ term to describe the dyadic, triadic, and global levels of network analyses. What is potentially confusing is that all three of these levels of network analysis can occur at what we would consider to be a single organizational level of analysis. Thus, there can be dyads, triads, and global networks of individuals; or of units; or of organizations (Borgatti & Foster, 2003; Brass, 2000). Similarly, a recent Special Topic Forum on networks in the Academy of Management Review included several articles invoking multilevel concepts and language (Hagedoorn, 2006; Joshi, 2006; Oh, Labianca & Chung, 2006; Parkhe, Wasserman & Ralston, 2006), even if none conceptualize ‘multilevel’ in the organizational sense described by Kozlowski and Klein (2000).

Definitional issues notwithstanding, the arguments outlined by Ibarra et al. (2005), and the related observations in Kilduff and Tsai (2003), are conceptually consistent with the core proposition in the current research; namely, that a full understanding of network theoretical constructs at one level of analysis—and their association with within-level organizational outcomes—requires an attendant understanding how those constructs are impacted by networks at higher and/or lower levels of organizational analysis. Fully developing that understanding, however, requires a full integration of the multilevel (Kozlowski & Klein, 2000; Rousseau, 1985) and network theoretic (Borgatti et al., 2009) perspectives.
The Missing Link: Systems of Nested Networks

We suggest that the ‘missing link’ in making a fuller integration of network and multilevel theory is the concept of systems of nested networks (Harary & Batell, 1981). This idea hinges upon the observation that many networks are ‘systems’ characterized by two attributes: first, they are comprised of “units and their interactions,” and second, these units are grouped together in “a hierarchical or nested structure” (Harary and Batell 1981, p. 30). Applying the insights of graph theory (Harary, 1969), we can think of the structure of the system in terms of a simple graph, where each node or point is, in fact, a graph itself. For example, consider a hypothetical 3-level system of organizational networks. Let the highest level (Level 3) represent an interorganizational network of firms (e.g., an industry). In this network each actor is a firm, with the ties representing, for example, joint ventures. However, each of these organizational actors (i.e., each node in the Level 3 network) is comprised of an intraorganizational network of groups, departments, or divisions; let this be the Level 2 network, where network ties between the departmental actors may be resource exchange. Finally, each of these groups (i.e., each node in the Level 2 network) represents a network of individuals where advice relationships may form the theoretically relevant network tie; let this be the system’s Level 1 network. Of course, the exact nature of the system of nested organizational networks will be context-specific. Thus the network system for a diversified multinational firm may contain many more nested levels (e.g., country, region, business unit, department, and individual). Other systems, such those found in entrepreneurial settings, may manifest a simple two-level system where ties exist between firms, and nested within each firm is a network of founding members.

Moving from the abstract to the concrete, consider, for example, the multilevel system of networks that exists in the automobile industry (see Obstfeld, 2005 for more on the social
networks in this context). At Level 3 we observe an interorganizational network of firms, where the relevant ties between actors may be competition in the same geographic market. Each of these firm-level actors, in turn, represents a network of product lines (the Level 2 network), with shared design platforms potentially the theoretically interesting and relevant tie between actors. Finally, each of the Level 2 actors (i.e., the individual product lines) represents a network of employees who make up its development team. In this Level 1 network, the actors are individuals and the network ties are, perhaps, prior collaborations or common functional backgrounds. As another example, consider a Level 3 network of colleges within a university: each college in turn consists of a Level 2 network of departments within the college, and each department consists of a Level 1 network of individual faculty. Here, the relevant network ties may be joint faculty appointments (Level 3); serving across departments on doctoral committees (Level 2); and intradepartmental research collaborations (Level 1).

Applying the system of nested networks concept as a point of entry to a multilevel network theory of organization is essentially a mapping of graph theory (Harary, 1969) onto the long-held observation that “organizational entities reside in nested arrangements,” where individuals are nested in groups; groups are nested in departments; departments are nested in business units, etc. (Hitt et al., 2007: 1387). If the social network perspective is that individuals, groups, and units are not isolates but rather embedded in a systems of social relationships (Granovetter, 1985) that result in “relational processes” (Wasserman & Faust, 1994: 8) then the “nesting” described by Hitt et al. (2007) must necessarily imply the nesting of organizational networks as we describe above.

The nested network concept outlined here serves at the lynchpin coupling the multilevel and social network perspectives on organizations. The social network literature in management
scholarship has described network theoretic constructs and their associations with organizational outcomes of interest at discrete levels of organizational analysis. Multilevel theory, in turn, argues for shifting from analyzing organizations through a single-level lens to considering how organizational phenomena at one level affect organizational phenomena at other (higher or lower) levels (Kozlowski & Klein, 2000; Rousseau, 1985). Thus, while single-level analyses of the relationship between networks and organizational outcomes of interest have provided important insights, it may equally have obscured important cross-level relationships and causal mechanisms. Overcoming this shortfall is the power of the multilevel perspective: understanding relationships between organizational levels affords the researcher greater theoretical insights into the system as a whole, and helps avoid fallacious conclusions and misspecifications that can stem from ignoring cross-level effects and processes (Rousseau, 1985).

In sum, recognizing organizational networks as hierarchically related in a system of nested networks allows us to employ the tools and concepts of multilevel theory to consider how the levels within a system of nested networks relate to each other. In the next section, we articulate six theoretical postulates that are manifest through this integration of multilevel and social network theoretical perspectives. Taken together, we propose that these postulates conceptually define the domain of a network theory of organization.

**TOWARD A MULTILEVEL NETWORK THEORY OF ORGANIZATION**

At the outset of this integration, it is necessary to comment briefly on multilevel theory in general. Beginning in the early 1980s, organizational scholars increasingly and formally acknowledged that many organizational outcomes have their antecedents and/or consequences at different levels within the organization (House, Rousseau & Thomas-Hunt, 1995; Rousseau, 1985). With roots in general systems theory (Simon, 1973; von Bertalanffy, 1968), this
multilevel theoretic perspective on organizational analysis represents a shift away from analyzing organizations through a single-level lens and toward the view of organizations as complex and interconnected social systems (Katz & Kahn, 1978). Within this broad theoretical domain, Kozlowski and Klein (2000), Rousseau (1985), and more recently, Hitt et al. (2007) articulated the core theoretical connections that apply multilevel theory to the organizational context. Accordingly, in applying multilevel theory as a way to understand the system of organizational networks, we draw heavily upon the core theoretical tenants articulated in these seminal contributions.

We will describe those core concepts of multilevel theory in greater detail as we proceed with our integration of multilevel and social network theoretical perspectives. Briefly, and as a point of departure, an important distinction between multilevel and single-level approaches to organizational scholarship is that multilevel models are concerned with how relationships occur or are leveraged across levels of organizational analysis. Within-level relationships encompass parallel processes or constructs occurring simultaneously at different levels of analysis (Rousseau, 1985). However, while similar in content and function within levels, these parallel processes may or may not share common antecedent conditions (Chen, 2005; Morgeson & Hofmann, 1999). In contrast, multilevel models consider how ‘bottom-up’ and/or ‘top-down’ mechanisms link levels of organizational analysis (Chen & Kanfer, 2006; Hitt et al., 2007). For example, Barsade’s (2002) study of emotional contagion demonstrates a bottom-up effect: an individual behavior or expression of emotion can then be felt or observed by members of the group to which the individual belongs, and also manifest into a sharing of emotions within that group. In general, bottom-up and top-down relationships describe the interplay between levels,
Isomorphism in Systems of Nested Networks

In multilevel theory, one of the primary associations of interest between levels of analysis is the degree to which constructs are isomorphic across levels of analysis: that is, to what degree do “constructs mean the same thing across levels” of analysis (Rousseau, 1985: 8)? We define isomorphism in terms of theoretical and functional representations of a construct at different levels of analysis (Rousseau, 1985), and not in terms of the reliability of higher level measures of aggregations of lower level empirical observations (Bliese, 2000). In other words, a multilevel model in general should be able to specify whether, and how, a particular construct manifests similarly across organizational levels.

The multilevel theory of organizational networks needs to demonstrate explicitly, then, that network theoretic structural constructs are isomorphic across organizational levels of analysis. Fortunately, network research shows considerable promise in this regard. Network theoretic constructs such as centrality and structural equivalence (see Wasserman & Faust, 1994) would appear, by definition, to be scale-invariant with respect to organizational level of analysis. The actors in an organizational network can be individuals, groups, or organizations, but the structure of the ties that connect them can be analyzed using the same network theoretic constructs. Consider, for example, Burt’s (1992) description of “structural holes,” or places in a network structure where one actor in a network is tied to two others, who are not themselves tied to each other. This network theoretic construct would appear to be isomorphic across organizational levels of analysis, as can be seen in two well-known studies in the organizational social network literature; namely, Ahuja (2000) and Obstfeld (2005), both of which measure
structural holes and model the association of this network theoretic construct with innovation outcomes. However, the studies focus on two distinctly different levels of analysis, with Ahuja (2000) focused on interfirm networks and Obstfeld (2005) focused on networks at the individual level. Through a joint consideration of these two studies, we find evidence supporting isomorphism of the structural hole construct as a potential component of a multilevel network theory of organization. We shall return to these two studies throughout this section to illustrate the postulates we propose as defining the domain of a multilevel network theory of organization.

We focus here specifically on the cross-level isomorphism of network theoretic constructs. In the next section we focus on cross-level isomorphism of network theoretic relationships—defined as the association between network theoretic constructs and organizational outcomes of interest—inasmuch as the question of consistent relationships across organizational levels is a separate component of multilevel theoretical models (Rousseau, 1985). Our argument here is that a multilevel network theory of organization explicitly explores and demonstrates the degree to which network theoretic constructs themselves are isomorphic across organizational levels of analysis. Thus, Obstfeld (2005) and Ahuja (2000), when considered together, advance multilevel network theory although they each explore single- and within-level phenomena.

**Postulate 1A:** Multilevel network theory explicates the degree to which core network theoretic constructs are isomorphic across levels of the system of nested organizational networks.

We now extend our focus beyond multilevel manifestations of network theoretic constructs and consider multilevel network theoretic relationships. Multilevel theory builds upon “some basic proposition whose components have meaning at several levels” (Rousseau, 1985:
Thus a multilevel network theory of organization will propose network theoretic relationships that are isomorphic across levels of analysis and/or illuminate the cross-level processes which result in different within-level manifestations of network theoretic relationships. A recent, but non-network, example that is illustrative of this principle can be found in Chen, Kirkman, Kanfer, Allen and Rosen (2007) which demonstrates—among a number of multilevel effects—an isomorphic relationship between empowerment and performance at both the individual and team levels of analysis.

Given the existing single- and within-level approach that has dominated organizational network analysis, there exist many studies that model network theoretic effects at different levels of organizational analysis. For example, network centrality has been demonstrated to be associated with innovation at the individual (e.g., Ibarra, 1993), group (e.g., Tsai & Ghoshal, 1998), and organizational (e.g., Ahuja, 2000) levels of analysis, and so we might expect that this association is a component of a robust network theory of organization. Obstfeld (2005) and Ahuja (2000) are again illustrative in this regard. While working at different organizational levels of analysis, each study found a relationship between the density of social networks and innovation. In other cases, however, cross-level comparisons have uncovered different observed relationships between network theoretic constructs and organizational outcomes of interest at different levels of analysis. An example can be found in Ibarra et al.’s (2005) overview of organizational research on social capital. Generally conceptualized as “the goodwill that is engendered by the fabric of social relations and can be mobilized to facilitate action” (Adler & Kwon, 2002: 17), social capital is often measured in terms of social network ties at different organizational levels of analysis, and Borgatti and Foster (2003) identify numerous organizational outcomes with which social capital has been associated. Ibarra et al. (2005: 360)
summarize this body of work, observing that at the individual level, the social capital construct is associated with individual benefits (e.g., positive job search outcomes), where as at the “collective” level, the network theoretic relationship of interest tends to be between social capital and “public goods” that are enjoyed by all members of the network.

The foregoing examples are illustrative of the theoretical development required to progress from the single-level network scholarship to a multilevel network theory of organization. In the case of the network theoretic relationship between centrality or density and innovation outcomes, the empirical findings noted above suggest that the relationship may be isomorphic across levels of analysis. In contrast, the underlying variability in the consequences of social capital across levels of the system of organizational networks (Ibarra et al., 2005) represents two complementary opportunities for researchers. Researchers may take the cross-level variation in the network theoretic relationships as given and generate a cross-level theoretical model that reconciles them. This is the approach taken by Ibarra et al. (2005). At the same time, cross level differences in network theoretic relationships provide the opportunity to identify and test structural explanations for the observed differences.

Making the observation that network theoretic relationships examined in the organizational literature have not universally been shown to be isomorphic across organizational levels does not diminish our previous comments regarding the importance of within-level work network research that has been conducted in the organizational literature. Rather, we suggest that this body of research represents an opportunity for network researchers interested in developing a multilevel network theory of organization. As described above, even when a collection of empirical work demonstrates that network theoretic relationships manifest isomorphically across levels of organizational analysis, scholarly effort must explicitly illuminate the cross-level effects
that link network structures at one of level of the system with innovation outcomes at higher or lower levels. We will turn to the question of such cross-level effects next.

**Postulate 1B:** Multilevel network theory explicates the degree to which network theoretic relationships are isomorphic across levels in the system of nested organizational networks.

### Cross-level Nested Network Effects

Postulates 1A and 1B consider the degree of isomorphism in the system of organizational networks: whether network theoretic constructs and relationships are the same, or different, at different levels of the system. Now we extend our focus to consider cross-level effects in the system. As a point of departure, it is important to note that central to multilevel theorizing and modeling in general is the distinction between the “level of theory” and “level of measurement” (Hitt et al., 2007; Kozlowski & Klein, 2000; Rousseau, 1985). Specifically, the level of theory is the organizational level at which a particular construct or effect is predicted to exist, whereas the level of measurement is the organizational level at which the construct or association is analyzed. We note that the levels of theory and measurement in the social network literature are generally at the same level of analysis. For example, in Seidel, Polzer, and Stewart’s (2000) study of the association between a new job recruit’s social ties and the outcomes of his or her salary negotiations, both the level of theory and measurement are at the individual level, whereas the level of theory and measurement is at the group level in Tsai’s (2001) analysis of network position and knowledge transfer among business units. In other words, when network scholars are interested in firm-level outcomes such as performance or diffusion through a firm-level network (i.e., the level of theory is at the firm level), then firm-level networks have historically been examined (i.e., the level of measurement is at the firm-level); when the phenomenon of
theoretical interest is at the individual level, then individual-level networks have generally been measured.

Indeed, there is nothing inherently problematic with such single-level research, and network scholarship has generated considerable organizational insights when theory and measurement have been at the same level (Baker & Faulkner, 2002; Brass et al., 2004; Gulati et al., 2002; Raider & Krackhardt, 2002). However, applying the nested system concept to organizational network research allows us to examine how network structures measured at one level of the system impact network structures—and the organizational outcomes with which they are associated—at higher or lower levels of the system. This is an important extension to organizational network scholarship, inasmuch as failure to model such cross-level effects can result in interpretation and validity errors (Rousseau, 1985): we may simply misinterpret or misspecify network theoretic relationships if we do not consider cross-level effects in the system of organizational networks. Indeed, the idea that network activity at one level of the system is related to network structures and outcomes at another level aligns with Salancik’s observation that a network theory of organization should “propose how a network structure enables and disenables interactions between two parties” (1995: 348), and in echoed in Brass’s (2000) reflection on the challenges of integrating multilevel and social network theories.

We depict a general model of cross-level effects for multilevel organizational network theory in Figure 1. Points A, B, and C represent generic actors (i.e., teams, groups, organizations, etc.) who are members of a network where actors A and B are tied, and actors B and C are tied,
but A and C are not. Let us call this the Level $i$ network, which we indicate with a dotted circle and superscripts. Existing network research has generally considered the association between the Level $i$ network and a network theoretic organizational outcome of interest (e.g., innovation, job search outcomes, knowledge diffusion, etc.). Thus, the level of theory and measurement are both at Level $i$. Illustrating the system of nested networks concept, we depict each of the Level $i$ actors as representing networks at the lower, and nested, Level $i-1$. The multilevel network theory of organization, then, argues for moving beyond focusing theory and measurement on Level $i$, and considering how Level $i$ structures and relationships are affected by Level $i-1$ networks as well. For example, does the variation in the nested Level $i-1$ network structures in Figure 1 account for the structural hole (Burt, 1992) between actors $A^{(i)}$ and $C^{(i)}$? We next move beyond this general model by first considering how network structures at one level relate to structures at higher (or lower) levels, and then by extending our focus to examine how network structures at one level of the system affect network theoretic relationships at higher (or lower) levels of the system.

**Network structures.** We first consider how networks at one level of the system affect networks at higher or lower levels. To illustrate such cross-level processes, it is helpful to consider Figure 1, where we observed that in general a multilevel network theory of the organization needs to examine whether the Level $i-1$ network structures might impact the existence of a tie between actors A and C in the Level $i$ network. This is a bottom-up cross-level structural effect, inasmuch as the nested (Level $i-1$) networks are shaping the structure of the higher level (Level $i$) network; our arguments likewise apply symmetrically to top-down cross-level effects. An initial conceptual articulation of our argument here can be found in Kim et al. (2006), who propose that an organization’s reluctance to dissolve interorganizational network
ties may, in part, be a function of introrganizational network characteristics. While the focus in Kim et al. (2006) is specifically on how the lower-level network structure constrains higher-level network ties, thereby resulting in “network inertia,” our focus is more general and concerned with the mechanism by which cross-level structural effects occur.

To better understand how such cross-level structural effects are manifest, Contractor et al.’s (2006) distinction between “endogenous” and “exogenous variables” is helpful. In particular, these network scholars observe (Contractor et al., 2006: 686):

Both [endogenous and exogenous variables] explain structural tendencies of the network [i.e., the probability of a network tie creation]. Structural tendencies based on configurations of the focal relation itself … are defined as endogenous variables. In contrast, structural tendencies that incorporate factors other than the focal relation itself—for instance, the attributes of actors in the network—are defined as exogenous variables.

To illustrate the application of these ideas to the multilevel network theory of organization, let us suppose that Figure 1 depicts a collaboration network in a research college, where Actors $A^{(i)}$, $B^{(i)}$, and $C^{(i)}$ are departments within the college, and the nested graphs $A^{(i-1)}$, $B^{(i-1)}$, and $C^{(i-1)}$ are the individual-level collaboration networks within each department. An endogenous variable that might increase the probability of a tie between $A^{(i)}$ and $C^{(i)}$ may be a college-wide initiative to engage in interdepartmental research. In contrast, an exogenous variable driving the same tie creation might be a lack of a doctoral program in either department $A$ or $C$, inasmuch as the presence of a doctoral program is an attribute of the respective departments. The structure of the respective collaboration networks $A^{(i-1)}$ and $C^{(i-1)}$ within each department similarly can be understood as an attribute of each department. Accordingly, the structure of the nested networks $A^{(i-1)}$ and $C^{(i-1)}$ is an exogenous variable measured at Level $i-1$. 
that drives tie creation at Level \( i \). Extending the collaboration network example makes this point clear: an individual with a dense collaboration network within his or her department is less likely, \textit{ceteris paribus}, to seek research collaborations outside the department, whereas an individual with fewer research ties within the department may seek collaborators in other departments. In short, the structure of the nested networks at Level \( i-1 \) becomes an attribute of Level \( i \) actors that is an exogenous variable effecting the probability of tie existence in the higher Level \( i \) network.

\textbf{Postulate 2A:} Multilevel network theory explicates the cross-level effects whereby higher (lower) level network structures affect lower (higher) level network structures.

\textbf{Network theoretic relationships.} What management scholars may find more interesting, perhaps, is moving beyond the cross-level network \textit{structural} effects we have just described and considering how network structures at one level in the system of nested networks may impact within-level network theoretic \textit{relationships} at another level. In other words, does the association between a network and an organizational outcome of interest change as a result of networks at a higher (lower) level in the system? So, in Figure 1, if researchers are interested in the relationship between the Level \( i \) network and a particular organizational outcome (e.g., the relationship between network density and innovation outcomes), then the multilevel network theory of organization provides a point of entry into exploring how that relationship is affected by networks at the nested Level \( i-1 \).

We can illustrate our argument here by returning again to the multilevel example that exists in our joint consideration of Obstfeld (2005) and Ahuja (2000). While working at different levels of analysis, both researchers find that network density (i.e., a lack of structural holes) leads to greater innovation activity. Obstfeld (2005) adds additional nuance to this finding by also
demonstrating support for the association between a “tertius iungens strategic orientation” and innovation involvement among actors at the individual network level. Briefly, one of Obstfeld’s (2005) arguments is that by facilitating network ties between structurally disconnected people (i.e., taking a tertius iungens orientation), an actor who closes an existing structural hole can effectively create additional structural holes in the network, thereby increasing the information diversity that accrues to networks rich in structural holes. Accordingly, for this example we will focus on this particular network theoretic relationship between closing structural holes (i.e., creating a denser network structure) and innovation (i.e., the organizational outcome of interest).

Let us then consider this network relationship using the multilevel system of networks. Figure 2 depicts two unit-level actors, A and B, and Figures 2A and 2C differ only in that they depict two possible structures for the network that is nested in unit A. Note that if we undertook a single level network analysis, we would observe no difference between A(1) and A(2): to use the terminology described above, variation in the exogenous variable measuring nested network structure would be obscured. Now consider a de novo network tie between A and B, represented with a dotted line. Following the “duality principle” (Breiger, 1974), where “actors are linked by being in the same groups … and they in turn link the different groups of which they are members” (Brass et al., 2004: 808), it is possible (if not likely) that the newly created tie between A and B is manifest as a tie between individuals at the nested network level: we depict this with a dotted arrow at the nested level. Indeed, we are familiar with this kind of network activity. Recall the above example of research collaborations between departments in a college: naturally,
such collaborations occur as ties between individuals in the different departments, even though we may depict and analyze the department-level network. A powerful empirical example of the duality principle can be found in Broschak (2004), which found that network ties between professional service and client firms dissolve as a function of manager career mobility: when the individuals who establish and maintain ties between firms exit the organization, the interfirm ties tend to dissolve.

We now consider Figures 2B and 2D, which illustrate the resulting individual-level networks following creation of this new relationship between A and B. Note that the \textit{ex ante} difference in nested, individual-level network structures between A(1) and A(2) results in two very different individual-level networks once the tie between A and B has been established. Importantly, and as Obstfeld (2005) observes, the linkage of the two previously disconnected individual-level actors opens up new structural holes in the network, and as a result new brokerage opportunities are created. However, variation in the \textit{ex ante} nested network structures result in fewer individual-level brokerage opportunities in the network depicted in Figure 2D than that shown in Figure 2B. As a result, and applying Obstfeld’s (2005) insights outlined above regarding the association between closing structural holes and innovation, we would expect an attendant variation in the amount of innovation activity across the two individual-level networks depicted in Figures 2B and 2D, \textit{ceteris paribus}.

We can now see how within-level network relationships are affected by networks at different levels of the system. If we had considered only the unit-level network in a single-level network analysis of the system of networks depicted in Figure 2, we would have likely observed a unit-level increase in innovation activity as a function of the unit-level tie between A and B (Ahuja, 2000), regardless of whether we were considering the system depicted in Figure 2A or
3C. But once we expand our focus to the multilevel system of networks, our perspective changes somewhat, since a single-level approach would obscure differences in nested network structures between \( A^{(1)} \) and \( A^{(2)} \). However, this variation in nested network structure—which is exogenous to the unit-level network—has implications for the outcomes associated with the unit-level network tie between A and B. Accordingly, we need to understand the structure of these nested networks in order to fully understand how (in this example) a tie between A and B relates to innovation outcomes.

We can state these observations in methodological terms. Again, single-level organizational network research has generally been concerned with the main effect between the Level \( i \) network and an organizational outcome of interest at that level. However, by recognizing the importance of nested network structure as a variable that is exogenous to the Level \( i \) network, we are able to consider both mediated and moderated relationships. A mediated model would suggest that the structural characteristics of the Level \( i-1 \) networks affect the probability of certain network structures occurring in Level \( i \) of the network (Contractor et al., 2006), and this in turn drives organizational outcomes of interest at Level \( i \). For example, if the network tie between A and B in Figure 2 only comes into existence as a result of an actor at the nested level in Unit A forging a relationship with an actor at the nested level in Unit B, then by definition, no higher-level network tie would exist without lower-level network activity. As a result, we would not expect to see unit-level network theoretic organizational outcomes. Quite simply, a network theoretic relationship can not exist if the requisite network structure does not exist. In contrast, a moderated model would suggest that the nested network structure at Level \( i-1 \) affects the nature of the Level \( i \) network theoretic relationship. Our extended example discussing Figure 2, above, essentially described a moderated model. Of course, mediated and moderated models will be
theoretically and contextually determined by distinct research objectives. In short, however, the within-level network theoretic relationship may be incorrectly specified if researchers do not consider the cross-level effects driven by nested network structures.

The challenge for researchers extending the network theory of organization, then, will be in identifying and modeling the mechanisms that drive these cross-level structural effects. In our example above, we drew upon the “duality principle” (Breiger, 1974), since ‘higher’ level networks of groups and firms are collectivities (Ibarra et al., 2005), and in many cases, when we are speaking of ties between two ‘actors’ at a network level higher than individuals (i.e., a network of groups or firms) we obscure the fact that these ties are often ties between individuals. Another example can be found in the network literature on board interlocks, in which two firms are considered to have a network tie when a given individual sits on both firms’ boards of directors (Mizruchi, 1996). More generally, if individuals have an upper bound on the number of relationships they can maintain (Burt, 1992), the duality principle suggests that the density of the individual-level network may be a limiting agent on higher-level network ties. In other words, individual-level ego network density may be an important measure of the exogenous variable driving higher (i.e., collective) level network structures. At the extreme, when intragroup network ties absorb all the relational attention of group members, there is potentially no ability to form an intergroup tie (assuming, of course, that intergroup ties depend on bridging individuals; see Oh et al., 2006). If the structure of ties in the group-level network is expected theoretically to be related to organizational outcomes, then it is important to understand the cross-level effects of individual-level networks on the group-level network structure (see Kilduff & Tsai, 2003 for related arguments in this vein).
We do not mean the foregoing to suggest that the duality principle is the only, or even the most, important mechanism driving the top-down and bottom-up processes behind cross-level network effects. However, it is outside the scope of this paper to fully articulate the range of such mechanisms, inasmuch as these should be motivated theoretically by researchers employing the multilevel network theory of organization. Without considering cross-level effects, however, network researchers risk under-specifying their models by not accounting for the exogenous variable measuring nested network structures.

**Postulate 2B:** Multilevel network theory explicates the cross-level effects whereby higher (lower) level network structures affect lower (higher) level network theoretic relationships.

**Origins of Cross-level Network Effects**

Having established that a multilevel network theory of organization should describe cross-level effects in the system of organization networks, we can now consider ‘where’ cross-level network effects begin and end (Kozlowski & Klein, 2000). This question entails more than a conceptual determination regarding whether the cross-level effects are fundamentally top-down or bottom-up. Cross-level relationships between networks at different levels of the network system are likely to be bidirectional (e.g., density of the individual-level network will be associated with density of the intergroup network, and vice versa; see Oh et al., 2006), and develop over time: we will return to the temporal component in the next section. Rather, the question of ‘where’ is concerned with the strength of the proposed cross-level relationships. Here, Kozlowski and Klein (2000) invoke Simon’s (1973) notion of “bond strength” to characterize the nature of the cross-level linkages: the simple existence of a multilevel system is a necessary, but not sufficient, condition for the existence of a cross-level effect. In some cases
the levels of the system are tightly coupled, and in other cases they are not. The presence and strength of cross-level effects will therefore be a function of linkage strength between levels.

Kozlowski and Klein’s (2000) question of ‘where’ has at least two clear implications for the network theory of organization. The first of these has to do with the degree of ‘coupling’ between levels in the system of nested organizational networks. Weick (1979) defines coupling as the degree to which systems have variables in common that are significant in influencing the system (note that Kozlowski and Klein’s (2000) use of the term ‘coupling’ has specific meanings not connoted in Weick’s use, which is more general): thus, “two systems that are joined by few common variables or weak common variables are said to be loosely coupled” (1979: 111).

Mapping this observation onto our prior discussion of isomorphism of network theoretic constructs across levels of the organizational system (Postulate 1A), we can now observe that the greater the degree to which network researchers can demonstrate isomorphism across network levels, the more appropriate, fitting, and important multilevel network theory becomes. That is, when network theoretic constructs are shown to be tightly coupled across organizational levels of analysis, it is proportionally more important to consider potential cross-level effects in the system of organizational networks.

The second implication of the question of ‘where’ is more spatial in conception. In general, organizational levels of analysis are linked in both physical and organizational space: individuals, units, and organizations can be separated by distance and/or bureaucratic levels. By extension, cross-level linkages between within-level networks in different organizational systems will similarly vary as a function of organizational complexity introduced by distance and bureaucratic levels. Consider, for example, the very different cross-level linkages between individual- and organizational-level networks in, say, a high-tech start-up company, and a
multinational diversified corporation. In the former, we might expect to see a considerable effect of individual-level networks on network theoretic relationships examined at the firm level (e.g., Shane & Stuart, 2002), whereas in the latter, cross-level effects might be more nuanced. For example, in the larger organization, two different individual-level networks exist among shop workers (e.g., Roethlisberger & Dickson, 1961) and members of the top management team (e.g., Collins & Clark, 2003), but we would only expect the latter network to have a cross-level effect on firm-level network theoretic relationships, whereas we might expect the former to have a cross-level effect on the intergroup network.

The implication of these observations is that researchers employing a multilevel network theory of organization must determine which networks in the system are likely to be affected by networks at lower or higher levels, and this determination will be driven both by the organizational context and the theoretical framework being tested.

**Postulate 3:** Multilevel network theory demonstrates where cross-level effects begin and end, taking into account the both the complexity of the organization and the degree to which network theoretic constructs are isomorphic across level of the system of organizational networks.

**The Role of Time**

Finally, Kozlowski and Klein (2000) observe that time is an important component of multilevel models. This is because the cross-level relationship between constructs varies over time: bottom-up effects impact the nature of a higher-level relationship, and the manifestation of that relationship drives a subsequent top-down effect. Longitudinal analysis unquestionably adds theoretical and empirical complexity to organizational research: coupled with the multilevel perspective, the implications of integrating a temporal component in theory development are
challenging, if potentially rewarding. Outside of the network literature, a recent exemplar of multilevel research in this vein is Ployhart, Weekley and Ramsey (2009) who demonstrate both that intertemporal variation in aggregations of individual-level employee attributes (i.e., “unit service orientation”) results in varying levels of unit-level performance over time and that this relationship decreases over time.

The question of network change has emerged as a timely one among network scholars, although much of this work has been done in the physics literature (Barabasi, 2002; Watts, 1999; Watts & Strogatz, 1998): organizational scholars are only just beginning to understand how within-level network theoretic organizational relationships develop over time. Perhaps the most ambitious empirical study to demonstrate the dynamics of organizational networks is the recent analysis by Powell et al. (2005) of the biotechnology field over the 12-year period of 1988-1999. The emerging work on network change suggests that network structures are themselves a function of evolution over time (Watts, 1999), although a recent theoretical argument in the management literature has been made for “network inertia,” or the temporal persistence of organizational network structures (Kim et al., 2006). However, even the ground-breaking research by Powell et al. (2005) is single-level in its focus on the firm-level network. If network structures such as those described by Powell and colleagues change over time as a function of within-level dynamics, then the cross-level effects we have suggested will necessarily also change over time inasmuch as we have argued that network structures at one level of the system impact network structures at higher or lower levels.

For a simple illustration of this point, we return to Figure 1, and consider the implications of a network tie developing over time in the Level $i$ network between A and C. We suggest that this will necessarily impact A and C’s Level $i-1$ networks. Perhaps the Level $i$ network is an
interfirm alliance network (e.g., a joint product development initiative), and the Level $i-1$ network is the intrafirm departmental resource sharing network. The emergent network tie between A and C might require C’s marketing group to collaborate in new and/or expanded ways with their R&D lab, thus resulting in a reconfiguration of the $C^{(i-1)}$ network. Alternatively, and invoking the cross-level implications we noted above of the duality principle (Breiger, 1974), consider the necessary implication on the $C^{(i-1)}$ network if the emergent tie between A and C in the Level $i$ network rested upon an individual serving as a bridging tie linking $A^{(i)}$ and $C^{(i)}$. If actors are necessarily limited in the number of network ties they can maintain (Burt, 1992), then to bridge $A^{(i)}$ and $C^{(i)}$, at least one actor in the $C^{(i-1)}$ network would either have to drop a Level $i-1$ tie if he or she were at their relational limit. At a minimum (and assuming that the bridging individual is not at his or her relational limit), he or she would be less able to form new ties in the Level $i-1$ network, thereby constraining the ability of the $C^{(i-1)}$ network to change over time.

The latter hypothetical example illustrates two additional points with respect to the role of time in a multilevel network theory of organization. First, in arguing for a temporal component of multilevel models, Kozlowski and Klein (2000) note that top-down and bottom-up effects occur in an iterative fashion. Thus a top-down effect whereby a higher-level network structure impacts a lower-level network leaves the entire system changed, such that future cross-level effects are impacted: future bottom-up effects will be a function of the new lower-level network structure. Of course, the same would be true if the initial iteration was a bottom-up effect, resulting in a change to the higher-level network: the new structure of the higher-level network would impact subsequent top-down effects. Second, the illustration above concluded with the observation that the Level $i$ network change resulted in a potential constraint on future change in the $C^{(i-1)}$ network. Thus the cross-level effects of network dynamics may have
implications for the idea of “network inertia” (Kim et al., 2006). Specifically, the persistence of network structures at one level of organizational analysis may be a function of network structures at lower or higher levels of the nested system. Interestingly, Kim and colleagues’ (2006) articulation of the “network inertia” concept is one of the few recent exemplars of multilevel network research as we describe it here, inasmuch as the authors argue that organizational resistance to network tie dissolution is a function, in part, of individual-level (i.e., ‘nested’ in the language we employ here) networks. While these scholars do not draw upon multilevel network theory as we do here, their arguments align with ours: “changes in interorganizational ties are … constrained by the internal [network] dynamics of the organization” (Kim et al., 2006: 707). Of course, applying the multilevel perspective we advocate here, an interesting extension of their arguments emerges: if interorganizational networks can grow inertial such that ties are persistent and slow to change, this likely has a top-down effect on the nested individual-level networks.

To this point, we have only been considering the implications of changes in network constructs and structures for networks at higher or lower levels of analysis (i.e., the effect of time on Postulate 2A). A simple extension of these arguments is that if there is a temporal component to cross-level effects on network structure, then there is necessarily a temporal component to the cross-level effect on within-level network theoretic relationships (Postulate 2B). If a change in network structure at a given level of analysis effects network structures at higher or lower levels, then the network theoretic relationships at that higher or lower level must also be affected. Taken together, these observations suggest that integration of the temporal component adds a considerable—but necessary—level of complexity to the multilevel network theory of organization.
Postulate 4: Multilevel network theory explicates how network theoretic relationships and structures at one level of the system of nested organizational networks change over time as a function of changes in higher and/or lower level network structures.

METHODOLOGICAL CONSIDERATIONS

Having articulated how our understanding of a network theory of organization would be advanced by applying multilevel theory to build upon the concept of systems of nested networks, we turn now to some methodological considerations for the empirical research necessary to validate and develop our theoretical arguments. The postulates we have developed broadly define the domain of a multilevel network theory of organization, and so it is reasonable to expect that a range of empirical tools will be required to test and develop our arguments. Here, we briefly describe a number of methodological considerations relating to our postulates.

Postulates 1A and 1B are fundamentally concerned with the isomorphism of network theoretic constructs and relationships. Throughout this part of our theoretical development, we jointly considered Ahuja (2000) and Obstfeld (2005) as two studies which, when taken together, allow examination of isomorphism across levels in the system of organizational networks. Moving forward, researchers will need to employ robust analytical techniques to validate the theoretical components of a multilevel network theory of organization. Integration of the rich and diverse body of organizational network scholarship into a unified network theory of organization will necessarily require meta-analyses (Hunter & Schmidt, 2004). Indeed, meta-analytical techniques are useful theory building tools when a considerable body of accumulated research considers a particular empirical relationship. Thus, when validating the core network theoretic relationships that comprise a multilevel network theory of organization, scholars may well meta-analyze relationships that have been found in the within-level network literature (e.g., the
association between structural holes and innovation). Such meta-analyses would not only validate these within-level effects, but would also enable researchers to identify network theoretic relationships that are not isomorphic across levels of analysis. For example, is the effect of cohesive network structures differentially predictive of innovation outcomes in nested individual-level networks than in higher-level networks? Evidence of such variation across levels of organizational analysis would then allow researchers to explore within-level moderators of the relationship.

As noted by Borgatti and Foster (2003), the constructs and analytical techniques used in social network research often apply equally to different levels of organizational analysis. This observation is central to the motivation for Postulates 1A and 1B. Accordingly, we expect that leveraging existing network analytical methodologies (Wasserman & Faust, 1994) will be necessary to empirically validate a complete multilevel network theory of organization, particularly that part articulated by Postulates 1A and 1B. Moreover, by incorporating the nested network concept, we are leveraging notions of “duality” as described in Breiger (1974), and so the network analytical techniques described there will also be applicable in the empirical validation of our arguments. Specifically, Breiger (1974) describes a set of techniques using sociomatrices that efficiently analyze the interrelations between individual- and group-level networks. As a tool for examining Postulate 2A, these techniques might generalize to any two-level system of networks where Level $i-1$ is nested within Level $i$ (i.e., individual and groups, respectively, in Breiger, 194).

However, advancing the multilevel network theory of organization by testing hypotheses derived from Postulates 2A, 2B, 3, and 4 may also present challenges for network scholars inasmuch as this will likely require extending the empirical toolkit traditionally used in network
analysis. Indeed, traditional statistical methods of network research are not ideally suited to multilevel analysis, where cross-level effects are the object of empirical interest (Borgatti & Foster, 2003; Contractor et al., 2006), and so fully unlocking such cross-level effects in systems of nested networks requires a different set of analytic tools than those most commonly used by network researchers. While a comprehensive discussion of multilevel methodology (e.g., Klein & Kozlowski, 2000; Ployhart, 2007) is beyond the scope of this paper, it is useful and informative to provide a brief overview and recommendations to guide researchers interested in testing multilevel network theoretic relationships.

As a point of entry, Harary and Batell (1981: 36-37) describe “an algorithmic approach to [network] systems analysis” that consists of four basic steps: 1) “determine the target set of hypotheses,” 2) “determine the levels in the structure,” 3) “analyze the structure of the highest level,” 4) “analyze the structure of the next highest level,” and 5) “examine the interconnection between the levels.” In many ways, this approach echoes observations in the multilevel literature concerning clear identification of the “level of theory” and “level of measurement” in a multilevel model (Hitt et al., 2007; Kozlowski & Klein, 2000; Rousseau, 1985), as well as the general observation that a full understanding of organizations requires moving beyond a single-level analysis. However, it is the final step in this algorithm, the focus on cross-level interconnections, which will likely present organizational network researchers with the greatest challenge. This task will be particularly challenging and complex if, as we have suggested, a temporal component is integrated in examining how network dynamics (Powell et al., 2005; Watts, 1999) at one level of the system relate to structural network change at higher or lower levels (Postulate 4; e.g., Kim et al., 2006). We propose two methodologies that appear promising for the testing of multilevel network theoretic relationships.
The first analytic approach relies upon the use of random graph models. While analytic techniques involving random graph models are widely accepted by researchers in the physical sciences, researchers in the social sciences have less frequently applied this approach (Borgatti et al., 2009). Contractor, Wasserman and Faust (2006), however, articulate how our understanding of network levels of analysis can be enhanced by employing random graph theory. We invoked this approach in our discussion of Postulate 2A, inasmuch as it is particularly well suited for testing relational hypotheses concerning the structures of organizational networks at differing levels of the nested system. For example, this approach would enable researchers to test hypotheses concerning communication ties in a Level $i-1$ network on the presence or absence of structural holes in the Level $i$ network. Using this approach, the researcher would model a graph theoretic (Harary, 1969) representation of the network at one level of the nested system, and then use graph theoretic techniques to predict the probability of achieving the graph realization of a predicted network structure at a different level of the system.

The second analytical approach is somewhat more familiar to organizational researchers in general and multilevel researchers in particular; namely, the use of hierarchical linear modeling (HLM). While a rich methodology exists for linking organizational levels of analysis in multilevel empirical research (Bliese, 2000; Ployhart, 2007), these empirical tools have not been employed in the study of organizational networks. If, as has generally been the case in the management literature, network data is used as an attribute of an actor in predicting an organizational outcome of interest (e.g., firm centrality used as a predictor of innovation productivity), then it may be possible to employ existing methodology to model cross-level network effects. For example, HLM would allow researchers to examine how the top-down effects of network density in the Level $i$ network might be predictive of within-level outcomes at
Level $i-1$. As a more concrete example, consider again Obstfeld (2005) where innovation involvement was modeled entirely at the individual level of analysis. However, each node (i.e., individual) in the focal network was a member of a higher, unit-level network. A researcher interested, then, in predicting individual-level involvement in innovation may also want to consider how an aggregate *tertius iungens* orientation at the unit level influences individual-level network ties. HLM would allow researchers to model and test such a cross level relationship: a simplified random-effects model may be

$$Y_{ij} = \gamma_{00} + \gamma_{01}(Mean\ Tertius\ Iungens_j) + \gamma_{10}(Tertius\ Iungens_{ij}) + u_{0j} + r_{ij},$$

where $Y_{ij}$ represents innovation involvement for individual $i$ nested in unit $j$. This model posits that individual involvement in innovation is both a function in the individual’s *tertius iungens* orientation ($\gamma_{10}$) and the aggregate *tertius iungens* orientation ($\gamma_{01}$) of the unit to which they belong.

Both analytic techniques afford researchers the opportunity to move beyond limitations of existing within-level models and test components of the theoretically rich multilevel network theory of organization. However, both approaches require researchers to identify the levels of interest within the organization and collect additional data—specifically data on the network theoretic constructs at each level—and even single-level network analysis represents a non-trivial challenge for data collection (see Wasserman & Faust, 1994). Expanding a particular network study to include multiple levels of organizational analysis will necessarily increase this challenge, inasmuch it will likely require multiple waves and strategies of data collection using survey, managerial reports, and archival data for individual, group, and firm-level networks, respectively. A clear implication of the Postulates we propose, however, is that collecting data to
model only one level of a system of nested network allows researchers to tell only part of the story behind the system of nested organizational networks.

**DISCUSSION AND CONCLUSION**

Social network analysis has become an established perspective in organizational scholarship (Borgatti et al., 2009). In this article we have suggested that despite the considerable insights to organizational phenomena which the social network perspective has yielded (Baker & Faulkner, 2002; Borgatti & Foster, 2003; Brass et al., 2004; Gulati et al., 2002; Raider & Krackhardt, 2002), management scholarship does not have an integrated “network theory of the firm” (Salancik, 1995). Our core argument is that organizational network scholarship has been predominantly single-level in its perspective; yet organizations are multilevel systems of relationships (Hitt et al., 2007; Kozlowski & Klein, 2000; Rousseau, 1985), and so a network theory of the organization should likewise be multilevel in its scope.

Accordingly, we have endeavored to advance the network theory of the organization by integrating the core principles of multilevel theory (Kozlowski & Klein, 2000; Rousseau, 1985) with the network perspective. In so doing, we relied upon the graph theoretic conception of systems of nested networks (Harary & Batell, 1981) to link networks at different levels of organizational analysis. While we believe that the postulates we have derived articulate the broad theoretical domain of a multilevel network theory of the organization, we also note that much work remains if organizational scholarship is going to realize the full potential of a network theory of organization. Indeed, in making a first effort to describe ‘the forest,’ we have certainly not described all ‘the trees.’ In this final section we briefly outline some implications and limitations of our own efforts.
Our arguments in support of a multilevel network theory of the organization have followed Kozlowski and Klein’s (2000) seminal framework for describing the “what, how, where, and when” of multilevel theory. But these scholars suggest that multilevel theory also describe the “why and why not.” That is, why are (or why aren’t) relationships linked across levels of organizational analysis? Our application of the nested networks concept (Harary & Batell, 1981) provides an answer to the question of why, and so it is perhaps more intriguing to consider why networks at different organizational levels not be connected via cross-level effects. We believe the answer to this lies in the theoretical mechanisms by which network structures at one level of analysis facilitate or block network structures at higher or lower levels. For example, we have argued that the duality principle (Breiger, 1974) is a theoretical mechanism which can drive cross-level effects. However, other network theoretic constructs may exist that do not suggest cross-level effects. Consider, for example, the brokerage benefits of a single-level network rich in structural holes (Burt, 1992): while we have applied insights from Obstfeld (2005) and Ahuja (2000) to discuss how brokerage at the individual-level might impact higher-level network theoretic outcomes (i.e., innovation involvement), it is not immediately clear how such a network structure would drive the presence or absence of network ties at higher or lower levels of organizational analysis. The implications of these observations are two-fold. First, and as we have observed a number of times, the multilevel perspective we suggest should not be interpreted as dismissive of the rich single-level network theoretic insights that exist in the literature. It is entirely consistent with our perspective to note that network theoretic relationships may be limited to single-level organizational insights. Indeed, even in their specification of an algorithmic approach to systems analysis, Harary and Batell (1981: 37) suggest that if a hypothesis can be fully explained at a single level of analysis, the research “need go no further.”
Second, the question of “why and why not” fundamentally presents a challenge for future research. Articulating the mechanisms that link nested networks across organizational levels of analysis is the next step in fully developing a network theory of organization—particularly when network theoretic constructs and/or relationships do not manifest consistently across levels in the system of nested organizational networks.

Finally, in mapping the multilevel theoretical perspective onto the idea of organizational social networks, our arguments are limited only to those areas where the two theoretical perspectives necessarily overlap. Stated differently, we can think of our efforts here as a Venn diagram, where the two circles represent the multilevel and social network perspectives. We have endeavored to suggest the theoretical insights that may be at the intersection of those circles. But, by definition, there is much theoretical ground in each area that we have not considered. For example, a considerable focus of multilevel theory is on how measurement of lower level constructs aggregate to higher level measures, with two mechanisms—composition and compilation—being suggested as the underlying processes of aggregation (Bliese, 2000; Kozlowski & Klein, 2000). While this is a central component of multilevel theory, it is not clear how, if at all, this would apply to social network analysis. Specifically, in composition and/or compilation models of aggregation, the researcher aggregates measurement of a lower-level construct in the creation of a measure of a higher-level construct. A common illustration can be found in group conflict literature where group conflict has traditionally been operationalized by aggregating the individual member’s perceptions of conflict (Korsgaard et al., 2008). To ensure validity of the higher-level measurement, it is important that the appropriate aggregation mechanism be specified. In the system of nested networks, however, we do not have an analogous aggregation challenge. An individual-level network might be nested in a group-level
actor, but when considering the higher-level network we still consider that actor as distinct.

Stated differently, we can accurately measure the group-level actor’s position in the group-level
network without necessarily measuring the individual-level network. In short, we do not mean to
suggest that all insights from multilevel theory apply to our proposed network theory of
organization. The task we have set for ourselves, which we hope others will find informative, is
to map those multilevel insights which naturally occur when considering the system of nested
organizational networks.

In sum, network analysis has become a powerful approach to organizational scholarship.
At the same time, management research has realized the theoretical insight which can be
garnered by viewing organizations through a multilevel lens. Indeed, this Special Issue bears
testimony to the latter point. In this paper, we have described the implications of merging the
multilevel and social network streams in the management literature. Our argument throughout
has been that the vast body of social network research fundamentally describes within-level
relationships. Thus ‘micro-level networks’ have been associated with ‘micro-level’
organizational outcomes (e.g., the association between communication networks among
individuals and turnover; Krackhardt & Porter, 1986), while ‘macro-level networks’ have been
associated with ‘macro-level’ outcomes (e.g., the association between board interlocks and the
diffusion of corporate innovations; Davis, 1991). By connecting these micro- and macro-level
networks as we describe here, scholars might take the next step toward developing and testing an
integrated network theory of organization. We have argued that progress can be made in this
regard by leveraging the graph theoretic idea of systems of nested networks to apply the core
principles of multilevel theory. It is our hope that this article spurs additional work in this vein.
REFERENCES


FIGURE 1

General Framework for Cross-level Network Effects

Organizational Outcome of Interest
FIGURE 2
Comparing Brokerage Opportunities in Nested Networks

(2A) Group Level Tie at Nested (Individual) Level

(2B) New Brokerage Opportunities in Individual Level Network

(2C) Group Level Tie at Nested (Individual) Level

(2D) New Brokerage Opportunities in Individual Level Network