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Teams and Organizing in the Digital Age:
How Team Networks Form and Why They Perform

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ABSTRACT

Teams and Organizing in the Digital Age:

How Team Networks Form and Why They Perform

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This dissertation explores the relationship between how teams form and what they need to perform. It adopts the perspective that technology is fundamental to organizing in modern workplaces and examines how technology may both enhance and constrain teamwork. By adopting this perspective, two questions naturally follow. First, how do teams organize using technologies? Second, how can technologies enable teams to organize effectively?

Addressing these two questions are of utmost importance due to two recent trends in contemporary organizations. The first trend is the rise of teams in the workplace, whereby firms are reorganizing as team-based structures to promote agility and fluidity. A 2018 Deloitte report that surveyed over 11,000 businesses found that an astounding ninety-one percent of executives ranked redesigning their organizations as a "network of teams" their number one priority (Deloitte Insights, 2018). The second trend is the rise in social media use for *internal* communications within the workplace. Unlike external uses of social media that cross many public platforms (e.g., Facebook for social networking, Twitter for microblogging), most organizations implement an integrated social media platform for internal communications that contains several functions (Leonardi, Huysman & Steinfield, 2013). These platforms are

collectively referred to as *enterprise* social media or ESM and recent reports show that two-thirds of organizations are already using ESM for their internal communications and this percentage continues to grow (Bughin, 2015). Yet despite the growing adoption of ESM, organizational scholars have been slow to study their impact on organizing and teamwork. Hence, many of the opportunities that social media offers workers remains at the potential level rather than evidence based.

These two trends not only reveal that organizations are replacing traditional hierarchical structures with flatter, team-based designs but also suggest that traditional approaches to studying work teams and technology may no longer be sufficient for understanding how teams function. Accordingly, this dissertation provides a new framework for understanding contemporary teams that specifically examines how teams naturally organize with technologies and subsequently, how technologies may enable teams to organize effectively. Towards this end, it adopts a social network approach to evaluate the structural signatures or network structures that emerge from team members' interactions.

Chapter 1 introduces the framework for investigating team properties and phenomena in this dissertation: the *team form-perform paradox*. This paradox refers to the disconnect between what teams do and what they ought to do to be effective. In particular, the literature on teams over the past century of research has found that teams need certain enabling conditions (Hackman, 2012) that increase the odds that they are effective. These needs include features such as diverse composition or sharing unique information. Yet the features that research has found to be most important for team performance are often disincentivized by self-formation tendencies or default team behaviors that lead to unintended consequences when people team up together.

Chapter 1 proposes that the team form-perform paradox is a useful lens for synthesizing the research on teams to date and proposes that studies on teams ought to consider both the self-formation tendencies and team performance requirements in tandem, rather than as distinct entities.

Building on the team form-perform paradox framework introduced in Chapter 1, Chapters 2 through 4 explore how this lens can be used to first assess, and then improve team functioning. More specifically, Chapter 2 examines how team communication networks naturally form, and then explores how formal interventions or simple team messages can improve the effectiveness of communication in the context of online team discussions. This chapter finds that formal interventions aimed at structuring group process can be a useful way to help teams overcome some of their self-formation tendencies.

Chapters 3 and 4 then explore how the design features of modern technologies, namely enterprise social media, alter the self-formation tendencies of teams. Essentially, ESM offers teams unprecedented opportunities for organizing, and it is possible that these capabilities may facilitate new ways for teams to communicate, interact, and collaborate that can help teams overcome their form-perform paradox. To better understand the nature of these new opportunities, Chapter 3 develops a conceptual model for examining how social media use impacts teams. It proposes that the *teaming environment* shapes how social media affordances are enacted to alter how teams carry out team processes. Affordances refer to the potential for new actions that are offered by the features of an object, such as a technology, and provides a useful lens for examining both the positive and negative consequences of social media use on teams.

Lastly, Chapter 4 explores some of these new opportunities empirically by examining how team communication networks form on social media and how they perform. Towards this end, Chapter 4 investigates how social media networks may complement and enhance traditional forms of informal communication within the workplace and examines the implications of these new capabilities on performance.

In short, this dissertation is about how contemporary teams use technologies to accomplish their work. The basic premise is that the rapid pace of technological improvement in the digital age offers unprecedented opportunities that potentially enable teams to overcome their self-formation tendencies to achieve their needs and accomplish their goals.

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CHAPTER 1. THE FRAMEWORK

1. INTRODUCTION

The past century of research has uncovered much about the inner functioning of work teams. Research on teams has witnessed two key streams. In the first stream, social psychologists observed undesirable behaviors that resulted when individuals were members of small groups. Notable behaviors identified in this period include process loss (Steiner, 1972), groupthink (Janis, 1982), and social loafing (Latané, Williams, & Harkins, 1979). From the 1990s onwards, the phenomenon social psychologists had thought of as small groups, a context for individual behavior (Levine & Moreland, 1990), became what organizational psychologists and management scholars thought of as task-performing teams (Ilgen, Hollenbeck, Johnson, & Jundt, 2005), a basic unit of work accomplishment. This paradigm shift ushered in a contrasting perspective that played up Steiner's notion of synergy – that the performance of the whole can exceed the sum of the performance of the parts through coordination processes. There was an accompanying shift in tone, from negativist to positivist, when groups became teams. Taxonomies of processes and enabling conditions for teamwork proliferated (e.g., Cohen & Bailey, 1997; Ilgen et al., 2005; Marks, Mathieu & Zaccaro, 2001; Sundstrom, Meuse, & Futrell, 1990).

Although management scholars studying teams are well versed in these two streams, their connection goes beyond juxtaposition and has yet to be fully appreciated. I offer a unified explanation for the behaviors identified in the first stream that result from the *group as context*,

and the synergistic processes identified in the second stream representing *collective capability*. I dub this unified explanation the *team form-perform* paradox and argue that this paradox lens serves as a useful framework to better understand how teams function and perform.

The team form-perform paradox describes a disconnect between the microstructure tendencies that underlie team members' natural proclivities and behaviors and what they need to perform. At the same time, it offers a systematic way to unify the two streams of research on teams by proposing that *formation tendencies* were uncovered in the first stream, while *performance needs* or requirements were revealed in the second stream of research. In the first stream, research identified the natural organizing tendencies of individuals when under the influence of the small group context. In the second stream, research identified the patterns of affect, behavior, and cognition that underlie team performance and viability. These literatures have largely progressed in sequence, limiting the joint consideration of the team form-perform paradox. Furthermore, research on the first question tends to focus on individuals, whereas in the second question, research focuses on team level processes and properties. The implication of this parallel thinking to date is that little research has considered how the two streams shape and are shaped by each other. In other words, what individuals do in the context of a team ultimately affects the processes and properties that emerge at the team level – and so, exploring either question in isolation draws an incomplete picture of how teams function. Thus, I propose that rather than being distinct entities, the two streams are mutually dependent or "intertwined".

In this chapter, I develop the team form-perform paradox as follows. First, I review research on work team processes in organizations conducted by organizational scholars and the larger corpus of studies conducted by scholars in the fields of industrial and organizational

psychology, and social psychology. This enables me to create a bound and scope for conceptualizing the team form-perform paradox. Second, I synthesize the research on teams to identify the team processes and properties – for which a discrepancy exists between what teams need to do and what they tend to do. This synthesis of the literature reveals ten illustrative cases of the team form-perform paradox. Third, I conclude by providing four themes and implications for future research.

2. RELEVANT LITERATURE & CRITICAL ISSUES REVEALED

As shown in Figure 1, there continues to be wide interest in work teams across these disciplines. In this section, I review research on work team processes conducted by organizational scholars and the larger corpus of studies conducted by scholars in the fields of industrial and organizational psychology, and social psychology to identify the major themes, trends, and findings from the extant research on organizational teams. To structure this review, I focus on self-managing teams (Hackman, 1987) and use the Marks, Mathieu & Zaccaro (2001) framework of team processes to focus on processes or enabling conditions (Hackman, 2012) that have received replicable support in the literature for advancing team outcomes. To proceed, I begin by providing a summary of each of these concepts.

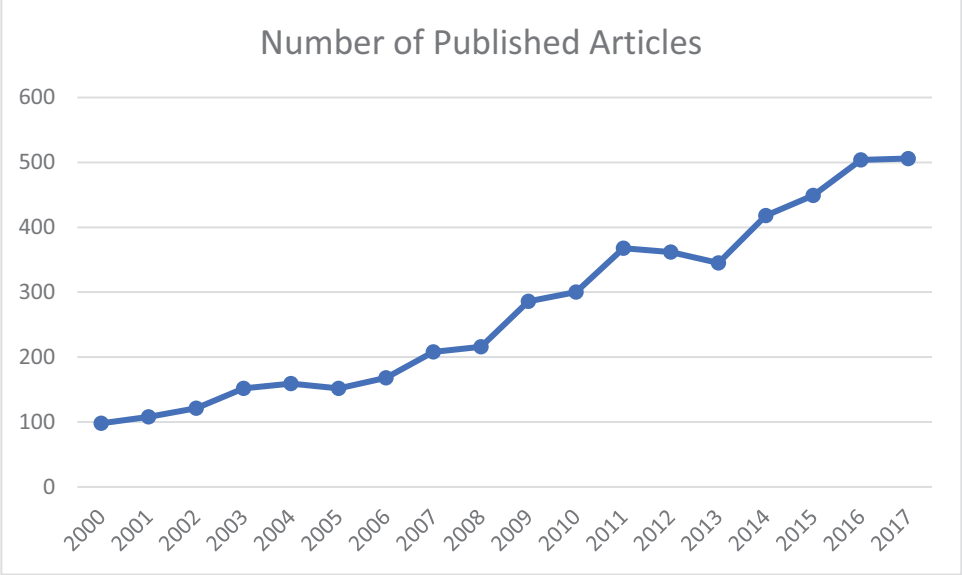


Figure 1. Yearly number of published scholarly articles in business, management, applied psychology and social psychology with "work team" in title or abstract.

2.1. Self-Managing Teams

Self-managing teams enable organizational flexibility, decision making and complete usage of employees' intellectual and creative capabilities (Wageman, 1997; 2001). The central principle behind a self-managing team is that the team members take responsibility for their own work, monitor their own performance as well as alter their performance strategies based on situational demands to solve problems and adapt to changing conditions (Wageman, 1997).

Specifically, four general functions need to be accomplished whenever work is performed by a work team in an organization (Hackman, 1987). First, a group needs to execute the work. Second, a group must manage and monitor work processes, and adapt as needed. Third, a group needs to structure the performing unit and its context, by setting up their task or tasks, staffing it, and arranging for the organizational resources it needs. Fourth, a group needs to specify the goals or objectives to be accomplished. Self-managing teams can be defined in terms of how authority

for these four functions is distributed (Hackman, 1986). There are four types of performing units: manager-led, self-managing, self-designing, and self-governing. Each has increasing level of autonomy: while members typically have authority only for executing the task in manager-led units, in self-governing units, members have full responsibility for setting their direction, structure and context, performance, and executing the work.

Recent digital advances, such as social media (Leonardi et al., 2013), crowdsourcing (Boudreau, Lacetera, & Lakhani, 2011), the gig economy and contingent work (Barley, Bechky, & Milliken, 2017) have fueled the trend for increasingly autonomous self-managing teams. As organizations shift towards networks of teams and team-based, ad hoc structures, self-governing units are gaining increasingly prevalence (Edmondson, 2012). These digital advances have also pushed the boundaries of self-managing teams since Hackman (1986)'s initial conceptualization, with individuals self-assembling into teams (Contractor, 2013; Wax, DeChurch & Contractor, 2017) and aided by autonomous agents (Contractor, Monge & Leonardi, 2011).

2.2. Team Processes & Team Effectiveness

Team processes describe "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals" (Marks et al., 2001, p. 357). Team processes, such as goal specification, coordination, and motivation, play an integral role in promoting team effectiveness because they are the vehicles that transform team inputs into outcomes (Hackman & Morris, 1975; Kozlowski & Bell, 2013; Kozlowski & Ilgen, 2006).

As a framework for organizing the literature, I draw upon the widely cited Marks & colleagues (2001) taxonomy of team processes to identify processes that have received replicable support in the literature for being positively related to successful team outcomes (Kozlowski & Bell, 2013; LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). Team *transition* and *action* processes describe the different types of interactions members use to accomplish team goals. Teams generally cycle through two recurring phases of activity (Marks et al., 2001). The first, transition phase, involves planning, analysis, goal setting, and reflecting on feedback and prior events. The second, action phase, involves coordinating, sharing information, actively monitoring goal progress, and backing up teammates. Team *interpersonal* processes are used to regulate motivation and emotions within the team. They tend to exist during both transition and action processes (Marks et al., 2001). I supplement the three "classic" processes introduced by the Marks et al. (2001) taxonomy with team *assembly* processes to capture the increasing autonomy of teams to select and manage their team composition and external interdependence.

Lastly, team effectiveness refers to the criteria used to assess the outputs of team activity and processes. It is widely agreed upon to have two components: (1) task performance, the degree to which the team's product or service meets the needs of those who use it (Sundstrom et al., 1990); (2) team viability, the degree to which the group experience is more satisfying than frustrating to team members (Hackman, 1990).

2.3. Team Formation Tendencies versus Team Performance Needs

Team formation tendencies refers to the first stream of literature dating back to Kurt Lewin and other social psychologists (e.g., Festinger, Black, French) in the 1950s, and focuses on studies with an *individualist orientation*, largely based on the premise of group influences on

individuals' attitudes and behaviors (Mathieu et al., 2017). This stream identifies studies where the interest was primarily on understanding group influences on individual behaviors.

In contrast, team performance needs refer to the second stream of literature review, circa 1990 to date, and combines a *group orientation* with team-level performance or behaviors as the outcomes of interest. This perspective focuses on members' actions, behaviors and processes at the group level of analysis. In this stream of research, the main criteria of interest relate to assessing the impact of team processes as enablers of team effectiveness. This work has triangulated in a prescribed set of normative recommendation that are bolstered by findings from meta-analyses and reviews on teams (e.g., see Cohen & Bailey, 1997; Kozlowski & Bell, 2013; Mathieu, Maynard, Rapp, & Gilson, 2008; Sundstrom et al., 1990).

The culmination of the literature review on work teams in the context of self-managing teams, team processes, and team effectiveness reveals two critical issues: 1) the review reveals that the relationship between the essential team "needs" or processes and outcomes is consistent across team effectiveness criteria; 2) there is a paradox that disconnects the factors that are required for performance and the factors that typically occur when people work together in teams. Some evidence supporting both issues is synthesized in Tables 1 and 2.

Observation #1: Consistency of Team Processes on Team Effectiveness. Although the literature has examined a range of outcomes (e.g., quality, performance, creativity, productivity, member satisfaction) for a myriad of team types (e.g., top-management teams, product design teams, decision-making teams, multiteam systems, cross-functional teams), the meta-analytic findings relating team processes to team effectiveness have not shown differences across team types. I provide three separate but convergent avenues for drawing this conclusion. First, Lepine

and colleagues (2008) conduct a meta-analysis relating the Marks et al. (2001) taxonomy of team processes to team effectiveness. The meta-analytic findings show support for the taxonomy, as well as strong, consistent relationships between team processes with team performance and member satisfaction across team types. Second, Hollenbeck, Beersma, & Schouten (2012) propose that there is greater consensus on the underlying dimensions differentiating teams than the growing number of taxonomies that have been used to classify team types. They introduce a dimensional scaling approach and propose that the three underlying constructs of skill differentiation, authority differentiation, and temporal stability can improve accuracy and consensus for describing teams.

Third, in Table 2, I provide the results of my own synthesis of the meta-analytic findings relating ten critical team processes to team effectiveness. These team processes are: 1) diverse composition, 2) external interdependence, 3) goal specification and prioritization, 4) information sharing, 5) coordination, 6) transactive memory, 7) motivation, 8) cohesion, 9) conflict and 10) leadership. Table 2 illustrates that a consistent relationship exists between each of the identified team processes and team effectiveness across lab and field settings. In the moderator or lever column in Table 2, the only consistent moderator or lever across the myriad of meta-analyses is *task type*, with respect to task complexity or task workflow interdependence. This evidence points to the consistency and applicability of the team processes and team effectiveness relationship across an array of self-managing work teams.

Table 1. Meta-Analytic Findings on Team Processes and Team Effectiveness

Team Process	**Dependent Variable**	**Meta-Analytic Findings**	**Citations**	**Moderators (Levers)**

#1: Team Diversity	Performance, Creativity, Innovation	Task and functional background diversity positively related to team performance; educational background diversity positively related to creativity/innovation and top-management teams	Bell, Villado, Lukasik, Belau, & Briggs, 2011; Bowers, Pharmer, & Salas, 2000; Horwitz & Horwitz, 2007; Joshi & Roh, 2009	Task type, Team type, industry, occupation
#2: External Inter-dependence	Performance	Boundary spanning positively related to performance	Burke, Stagl, Klein, Goodwin, Salas, & Halpin, 2006	N/A
#3: Goal Setting	Performance	More specific, difficult goals positively related with higher group performance vs. nonspecific goals	Kleingeld, van Mierlo, & Arends, 2011	"Egocentric" individual goals had negative effect on group performance
#4: Information Sharing	Performance, Cohesion, Decision Satisfaction, Knowledge Integration	Information sharing positively predicted team performance across all moderators	Mesmer-Magnus & DeChurch, 2009	Task type, unique vs. open information, discussion structure by uniqueness
#5: Coordination	Performance	Coordination (& adaptation) positively related to performance	LePine, Piccolo & Jackson, 2008; Salas, Nichol, & Driskell, 2007	N/A
#6: Transactive	Performance, Motivational	Team cognition positively related to	DeChurch & Mesmer-	Nature of emergence,

Memory	states, team behavioral process	team performance after controlling for behavioral and motivational dynamics	Magnus, 2010	type of cognition, task type (interdependence), team type
#7: Motivation	Performance	Team efficacy and potency positively related to performance	Gully, Incalcaterra, Joshi & Beaubien, 2002	Task type (interdependence)
#8: Cohesion	Performance	Cohesion positively related to performance	Beal, Cohen, Burke, & McLendon, 2003	Task type (complexity)
#9: Conflict	Performance, Team satisfaction	Negative association between relationship & process conflict and team performance; inconclusive evidence on task conflict	De Dreu & Weingart, 2003; De Wit, Greer, & Jehn, 2012	Task type (task complexity), top- vs. non-top management teams
#10: Leadership	Performance, Attitudinal/Behavioral Processes, Team Emergent States	Positive association between shared leadership and team effectiveness	Burke, Stagl, Klein, Goodwin, Salas, & Halpin, 2006; D'Innocenzo, Mathieu, & Kukenberger, 2014; Hoch & Kozlowski, 2014; Nicolaides et al. 2014; Wang, Waldman, & Zhang, 2014	Task type (task complexity), team tenure

Observation #2: Prevalence of the Team Form-Perform Paradox. In the review of the literature on work teams, another observation that emerged from the literature is a discrepancy or paradox between what the research prescribes as the team "needs" or processes that are required for effective outcomes and the self-formation tendencies of teams. This paradox highlights the fact that there are often unintended consequences when people work together as a team. Table 2 summarizes the disconnect between what teams need to perform (Column 1) and the natural tendencies that often emerge during team member interactions (Column 2).

Table 2. Team Process Recommendations and Team Self-Formation Tendencies

Evidence-Based Prescription for Teams	**Evidence Describing Behavior in Teams**
TEAM ASSEMBLY PROCESSES	
Team Process #1: Enable **Diverse Team Composition** **Recommendation:** Teams need functional diversity and a balance of incumbents and newcomers **Evidence**: Cummings, 2004; Cummings, Kiesler, Zadeh, & Balakrishnan, 2013; Horwitz & Horwitz 2007; Guimera, Uzzi, Spiro, Nunes & Amaral, 2005; Jehn, Northcraft, & Neale, 1999; Perretti & Negro, 2007; Ruef, Aldrich, & Carter, 2003; Uzzi & Spiro, 2005; van Knippenberg, De Dreu, & Homan, 2004	Self-forming teams generally avoid diversity and seek out prior teammates to reduce uncertainty (Lungeanu, Huang and Contractor, 2014; Zhu, Huang, and Contractor, 2013); People tend to prefer ingroup members over outgroup members and trust ingroup members more (van Knippenberg & Schippers, 2007); People's networks tend to be homophilous, and it is difficult to reach across network cliques to recruit diverse teammates (Ruef, Aldrich, & Carter, 2003); Also, there is a startup cost to socializing newcomers into the team once it has formed (Hinds, Carley, Krackhardt, & Wholey, 2000)
Team Process #2: Manage **External Interdependence**	Teams tend to view other teams competitively, and do not effectively span

Recommendation: Teams need to boundary span in order to promote the team, gather information from outside the team, and coordinate with teams who share superordinate goals **Evidence**: Ancona, 1990; Hinds & Kiesler, 1995; Heath & Luff, 1992; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; Mortensen, Woolley, & O'Leary, 2007	their boundaries (Ancona & Caldwell, 1992)
TRANSITION & ACTION PROCESSES	
Team Process #3: Identify & Prioritize **Specific Goals** **Recommendation:** Teams need to identify and prioritize specific, challenging yet attainable team-oriented goals **Evidence:** Bell & Kozlowski, 2002; Hertel, Konradt & Orlikowski, 2004; Kozlowski & Ilgen, 2006; LePine, 2005; O'Leary-Kelly, Martocchio, & Frink, 1994; Pieterse, van Knippenberg, & van Dierendonck, 2013	Teams set poorly conceptualized goals that are overly general, conflicting, ambiguous, unattainable, and not necessarily valued by team members (Kleingeld, van Mierlo, & Arends, 2011)
Team Process #4: Scaffold Team **Information Sharing** **Recommendation:** Teams need to explore members' unique information **Evidence**: Mesmer-Magnus & DeChurch, 2009; Mesmer-Magnus, DeChurch, Jimenez-Rodriguez, Wildman, & Shuffler, 2011; Rentsch, Delise, Mellow, & Staniewicz, 2014; Robert Jr., Dennis, & Ahuja, 2008; Scholten, van Knippenberg, Nijstad, & De Dreu, 2007; Stasser, Taylor, & Hanna, 1989; van Ginkel & van Knippenberg, 2008	Teams spend more time discussing common information, are less likely to consider unique information, and social motivation drives the kind of information team members attend to, encode and retrieve (De Dreu, Nijstad & van Knippenberg,2008; Mesmer-Magnus & DeChurch, 2009; Wittenbaum et al., 2004)

Team Process #5: Facilitate Member **Coordination** **Recommendation:** Team members need to coordinate their activities with one another **Evidence**: Fussell, Kraut, Lerch, Schertis, McNally, & Cadiz, 1998; Heath & Luff, 1992; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; Marks, Mathieu, & Zaccaro, 2001	Teams often suffer from "process loss" whereby members are less productive when working together because of coordination costs than the same individuals working alone (Marks, Mathieu, & Zaccaro, 2001; Steiner, 1972)
Team Process #6: Develop **Transactive Memory** **Recommendation:** Team members need to specialize expertise, and know who on the team holds what expertise **Evidence**: Austin, 2003; Hollingshead, 1998; Lewis, 2004; LittlePage & Silbiger, 1992; Wegner, 1986; Wegner, 1987; Wegner, Giuliano, & Hertel, 1985	It is difficult to know who has what information and trust others' expertise (Ellis, 2006; Lewis, Belliveau, Herndon, & Keller, 2007; Pearsall, Ellis, & Bell, 2008)
INTERPERSONAL PROCESSES	
Team Process #7: Generate Member **Motivation** **Recommendation:** Team members are more motivated when provided with feedback on work processes and performance **Evidence**: Dencheva, Prause, & Prinz, 2011; Geister, Konradt, & Hertel, 2006; Kluger & DeNisi, 1996; van Knippenberg, 2000	Teams without sufficient feedback on individual contributions suffer from "social loafing" wherein each individual contributes less effort than they would if working alone (Karau & Williams, 1993; Latané et al., 1979)
Team Process #8: Develop and Maintain **Cohesion** **Recommendation:** Team members need to identify strongly with the team and its	Teams, especially diverse teams, tend to form subgroups (Carton & Cummings, 2013; Homan, Hollenbeck, Humphrey, van Knippenberg, Ilgen, & van Kleef, 2008; Lau & Murnighan, 1998; van

purpose, and avoid forming subgroups within the team **Evidence**: Festinger, 1950; Ren, Kraut, & Kiesler, 2007; Tajfel, 1974, 1981; Tasa, Taggar, & Seijts, 2007; Wiggins & Crowston, 2011	Knippenberg, De Dreu, & Homan, 2004; Williams & O'Reilly, 1998)
Team Process #9: Manage **Conflict** **Recommendation:** Teams need to use cooperative conflict management to resolve task-based conflicts and generally avoid discussing relationship-based conflict **Evidence**: DeChurch et al., 2013; De Dreu & Van Vianen, 2001; Marks, Mathieu, & Zaccaro, 2001; DeChurch, Mesmer-Magnus, & Doty, 2013; Tekleab, Quigley, & Tesluk, 2009	Teams often use ineffective conflict management including individualistic strategies (competing, avoiding), or openly discussing rather than avoiding relationship issues (Alper, Tjosvold & Law, 2000; De Dreu & van Knippenberg, 2005; Montoya-Weiss, Massey, & Song, 2001)
Teaming Process #10: Support Collective **Leadership** **Recommendation:** Team members need to provide (and accept) leadership from each other, including direction setting and team process facilitation **Evidence**: Burke, Stagl, Klein, Goodwin, Salas, & Halpin, 2006; Contractor, DeChurch, Carson, Carter, & Keegan, 2012; Denis, Lamothe, & Langley, 2001; Kozlowski & Bell, 2003; Zaccaro, Rittman, & Marks, 2001; Zhu, Kraut, & Kittur, 2012	Team member personality and group prototypicality affect who emerges as a leader (Hogg, 2001; Hogg, van Knippenberg, & Rast, 2012); Platow & van Knippenberg, 2001; van Knippenberg & Hogg, 2003; van Knippenberg & van Knippenberg, 2005), whereas leaders should emerge based on expertise and match with current task demands (Zaccaro, Rittman, & Marks, 2001)

3. THE TEAM FORM-PERFORM PARADOX: TEN CASES REVEALED

The review of the literature has revealed ten cases where research on team formation tendencies are at odds with the research on team performance tendencies. This section presents each of these ten cases in greater detail, beginning with team assembly processes, advancing to team transition and action processes, and ending with team interpersonal processes.

3.1. Team Assembly Processes

The rapid proliferation of Web 2.0 technologies provides individuals with useful information about potential collaboration partners that facilitates new capabilities for people to assemble into teams. As a result, self-managed, self-governed, and self-assembled teams are becoming more prevalent, each possessing the autonomy to add and replace members to augment their teamwork abilities (Contractor, 2013; Edmondson, 2012).

Team assembly processes are influenced by the antecedent factors of individual demographic and psychological characteristics, skills, ideas, resources, and external member relations that form the foundation of team assembly mechanisms (Contractor, 2013; Guimera, Uzzi, Spiro, & Amaral, 2005; Kozlowski & Bell, 2013). Two important team formation processes that promote team effectiveness are diverse team composition (Team Process #1) and managing external interdependence (Team Process #2).

Team Process #1: Enable Diverse Team Composition. Team composition is the configuration of member attributes in a team (Levine & Moreland, 1990), and includes factors such as personality, abilities, demographics, and skills of team members (Bell, 2007; Ruef,

Aldrich, & Carter, 2003). Teams tend to be more effective when their members are functionally diverse with respect to member training, development and development (Bell, Villado, Lukasik, Belau, & Briggs, 2011; Cummings, Kiesler, Zadeh, & Balakrishnan, 2013; Eisenhardt & Tabrizi, 1995; Griffin & Hauser, 1992; Horwitz & Horwitz, 2007) and when they balance incumbents with newcomers who bring new ideas to the team (Guimera et al., 2005; Uzzi, Mukherjee, Stringer, & Jones, 2013).

Functional diversity can facilitate information sharing and integration of expertise, and teams that balance their newcomers with incumbents are better able to draw upon their diverse ideas, knowledge, and perspectives to generate more innovative solutions. Incumbents, on average know more than newcomers, but their knowledge is redundant, and has already been reflected in the organizational code. Hence, incumbents tend to increase exploitation, inertial behavior, and are less inclined to be critical and challenge the status quo (Perretti & Negro, 2007). Although newcomers are less knowledgeable, they bring new perspectives and are more likely to promote exploration and deviate from routine ways of doing things (Guimera et al., 2005). Accordingly, new configurations of team members are important for organizational learning and creativity (Perretti & Negro, 2007).

Despite normative recommendations, individuals generally avoid diversity and seek out prior teammates to reduce uncertainty. Research finds that teams tend to be homophilous (Hinds et al., 2000) — i.e., composed of members with similar ascriptive characteristics (e.g., gender, race, age), and the existence of strong ties (i.e., prior ties along several dimensions) limits the ability of members to reach across their network cliques to recruit diverse teammates (Burt, 2009; Granovetter, 1973; Ruef et al., 2003). This often occurs because members are simply

unaware of who other people are and what they might know (Carlile, 2004). Moreover, despite the potential for newcomers to spur creativity, newcomers present a potential challenge to the existing social structures (e.g., norms, values) established within a team, and are subject to efforts by team members to assimilate them (Perretti & Negro, 2007). Newcomers may also make their own demands, asking that the team accommodate their needs, values and capabilities (Kozlowski & Bell, 2013). Therefore, newcomers undermine the security that most individuals feel when working with past collaborators or incumbents (Guimera et al., 2005).

Team Paradox 1. Teams need functional diversity and to balance incumbents with newcomers, but team membership tends to be homophilous.

Team Process #2: Manage External Interdependence. External interdependence involves gathering information from external contacts, representing the team to outsiders, coordinating work with others in the organization, and negotiating intergroup actions to expand the team's network and connect with important external actors (Ancona, 1990; Marrone, 2010). In particular, external interdependence or "boundary spanning" has been shown to influence how information enters the organization (Tushman, 1977) and how knowledge is transferred across team and functional boundaries (Cross & Cummings, 2004). Thus, teams with boundary spanning ties crossing team, departmental, functional, and organizational boundaries are more likely to find relevant information and expertise and be more effective at solving problems (Cross & Cummings, 2004). Likewise, ties that span physical barriers increase opportunities for access to critical information (Cummings, 2004), while those that span hierarchical levels tend to have access to greater breadth of information and contacts (Cross & Cummings, 2004); both types of ties can positively impact performance.

Yet teams often view other groups competitively and do not always engage effectively in external activities. Instead, teams tend to focus on their internal activities that promote team cohesion and team efficiency at the expense of performance (Ancona & Caldwell, 1992). In particular, boundary spanning teams often face challenges with respect to balancing the competing demands for effective internal and external team processes (Choi, 2002), such as how members should allocate their attentional resources across different efforts when faced with competing goals, limited resource capacity and varying temporal rhythms (Marrone, 2010). These challenges associated with balancing competing demands can be particularly difficult for team leaders, who are often ineffective at distributing their attention between the team and the organization's needs (Druskat & Wheeler, 2003). Moreover, evidence shows that too much internal cohesion may contribute to groupthink and external stereotyping that limit the extent to which the team considers outside information (Ancona & Caldwell, 1992).

Team Paradox 2. Teams need to manage their external interdependence outside the team, but teams tend to be inwardly focused.

3.2. Transition & Action Processes

Team assembly processes are the foundation of a good team design that in turn supports the effectiveness of transition and action team processes (Kozlowski and Ilgen, 2006; Hackman 2012). After the team has assembled, transition and action processes describe the different types of interactions members use to accomplish team goals. Teams generally cycle through two recurring phases of activity (Marks et al., 2001). The first, transition phase, involves planning, analysis, goal setting, and reflecting on feedback and prior events. The second, action phase, involves coordinating, sharing information, actively monitoring goal progress, and backing up

teammates. The transition process of goal specification (Team Process #3), and the action processes of scaffolding team information sharing (Team Process #4) facilitating member coordination (Team Process #5) and developing transactive memory (Team Process #6) are four important processes that are directly related to task accomplishment.

Team Process #3: Identify & Prioritize Specific Goals. Goals play an integral role in motivating and regulating human action because they energize and direct behavior (Locke & Latham, 1990; 2002). To be effective, goals need to be specific, challenging, and accepted (Locke & Latham, 1990; Kleingeld, van Mierlo, & Arends, 2011). When goals are specific, team members know exactly what is required from them for effective performance, and they are better able to align their activities to reach this target (Rousseau, Aube, & Savoie, 2006). Goal specification refers to the identification and prioritization of goals and subgoals for task accomplishment (Marks et al., 2001). During goal specification, teams develop, assign, and prioritize goals and subgoals that indicate what needs to be accomplished within a certain time frame and within a threshold standard of quality (Martocchio, & Frink, 1994). Teams that set specific, challenging yet attainable goals with collective-oriented strategies, tend to be more effective than those who set more general goals because they enable members to establish a plan of action to reach their goals (Kozlowski & Bell, 2006). Goal setting can increase the amount of effort team members devote to a task (Levine & Moreland, 1990), team motivation and satisfaction (Hertel, Konradt, & Orlikowski, 2004) and agreement between members' individual and collective goals can help facilitate group performance (Mackie & Goethals, 1987).

However, teams often set ineffective goals that are poorly conceptualized, conflicting or ambiguous, as well as goals that are individual- rather than group-oriented (Kleingeld et al.,

2011). In addition, teams may intentionally neglect important aspects of goal setting principles, such as goal agreement or managers may not be adequately trained to administer them. These issues may be magnified by remote or virtual work (Wiesenfeld, Raghuram, & Garud, 1999). Thus, poorly conceptualized goals may be overly general, vague, unattainable, or impractical, and often do not stimulate effective strategies, timelines, or collective activities that are needed for effective performance (Marks et al., 2001).

Team Paradox 3. Teams need to identify specific goals, but teams set ambiguous goals.

Team Process #4: Scaffold Information Sharing. Information sharing involves conscious and deliberate attempts by team members to exchange work-related information, keep each other up to date of activities, and inform one another of key developments (Bunderson & Sutcliffe, 2002). It increases task-focused attention and is the primary means through which team members utilize their informational resources to arrive at a decision or outcome. Since information is often unequally distributed among team members, e.g., due to division of labor and accountability, teams need to leverage their informational resources to explore their members' unique information (i.e., information that is only known uniquely to one group member) and to discuss all available pertinent task information. By leveraging their unique perspectives and diverse opinions, teams create knowledge by integrating content, discussing its relevance and creating meaning. Thus, sharing unique information can engender better performance (Mesmer-Magnus & DeChurch, 2009; Robert Jr., Dennis, & Ahuja, 2008) and higher quality solutions (Rentsch, Delise, Mello, & Staniewicz, 2014).

Yet, despite normative recommendations for sharing unique information, teams spend more time discussing and oversampling shared information—i.e., common information that is

known to all group members (Mesmer-Magnus & DeChurch, 2009). A seminal study conducted by Stasser and Titus (1985) found that teams often make suboptimal decisions on tasks structured as hidden profiles because they tend to discuss and incorporate into their decisions information that is known to all members (i.e., shared) rather than information that is only known to a single member (i.e., unshared). As a result, teams deviate from the optimal utilization of information when making decisions whereby discussion serves to strengthen individual pre-discussion preferences rather than as a venue to share new information (Stasser & Titus, 1985). Several studies have replicated and extended these findings (Mesmer-Magnus & DeChurch, 2009). More recent studies have advanced the biased information sharing paradigm by positing that information exchange in decision-making groups is a deliberate or motivated process (De Dreu, 2007; Wittenbaum, Hollingshead, & Botero, 2004), whereby members share information that align with their goals. Thus, team members' goals influence what, how, and to whom information is mentioned, with these decisions subsequently impacting the quality of outcomes (Wittenbaum et a., 2004).

Team Paradox 4. Teams need to explore members' unique information, but teams are more likely to discuss common information.

Team Process #5: Facilitate Member Coordination. Coordination ensures that a team functions as a unified whole (Rico, Sánchez-Manzanares, Gil & Gibson, 2008). It refers to the activities required for managing the interdependencies of the team workflow, where the contribution efforts of all members and the correct and timely contribution of each member is often an important correlate of team effectiveness (Bell & Kozlowski, 2013; Marks et al., 2001). Coordination involves the management of synchronous activities and involves both information

exchange and the mutual adjustment of action (Brannick et al., 1993) so that the team can align the pace and sequencing of its members' efforts with goal accomplishment. A wealth of research shows that coordination plays a critical role for team (LePine, Piccolo, Jackson, Mathieu & Saul, 2008), particularly when tasks are highly interdependent or uncertain (Tesluk, Mathieu, Zaccaro, & Marks, 1997) and multi-team system performance (Marks, DeChurch, Mathieu, Panzer & Alonso, 2005).

However, coordination is difficult to achieve due to the costs associated with integrating disparate actions together and attaining temporal pacing of member contributions (Argote & McGrath, 1993). Teams often experience communication breakdown, become out of sync (Marks et al., 2001), or struggle with information overload (Fussell, Kraut, Lerch, Scherlis, McNally, & Cadiz, 1998). These factors can be magnified for highly diverse teams, action teams (e.g., medical emergency units, flight crews) in atypical situations, virtual teams, and larger teams. As a result, teams experience "process loss", whereby team members working together fall below their potential productivity level (Steiner, 1972).

Team Paradox 5. Team members need to coordinate their activities with one another but often suffer process loss due to coordination costs.

Team Process #6: Develop Transactive Memory. Transactive memory is a group-level shared system for encoding, storing, and retrieving information (Kozlowski & Bell, 2013). It is a set of individual memory systems that is distributed across members, and combines the knowledge possessed by team members with a shared awareness of who knows what (Wegner, 1986; Wegner, Giuliano, & Hertel, 1985). When each member learns what other team members know in detail, the team can draw on the detailed knowledge distributed across members. Thus,

it is especially useful for understanding how work teams can optimize the value of their members' knowledge (Lewis, 2003). To develop transactive memory, members need to communicate and update each other about the areas of other members' unique knowledge. Each member keeps track of other members' expertise, directs new information to the matching member, and uses that tracking to access the requested information (Wegner, 1987).

Transactive memory offers teams cognitive efficiency (Kozlowski & Bell, 2013). By encoding and utilizing information allocation processes, individual memories become increasingly specialized into a differentiated collective memory for the team. Specialization enables teams to make better use of its individual members because each member can build a deeper knowledge base in a narrowly defined area of expertise (Austin, 2003). This knowledge specialization helps to reduce cognitive load, provide access to an expanded pool of expertise and decrease redundancy of effort (Hollingshead, 1998). A well-developed transactive memory system is associated with better performance on problem-solving tasks (Littlepage & Silbiger, 1992), team viability (Lewis, 2004), team goal performance, as well as external and internal team evaluations (Austin, 2003).

However, transactive memory is complex, and empirical evidence is often not commensurate with its theoretical development. Teams often face impediments that limit the development and functioning of transactive memory systems. These include team inefficiencies, such as conflicts of expertise, failure to communicate and capture important information, turnover, and diffusion of responsibility (Kozlowski & Ilgen, 2006; Lewis, Belliveau, Herndon, & Keller, 2007; Wegner, 1987). In addition, there are time lags associated with accessing a distributed memory that can have detrimental implications on team effectiveness in time-

sensitive situations (Kozlowski & Bell, 2013). These impediments introduce the opportunity for errors to enter the system, such as the faulty attribution and interpretation of expertise to the wrong individuals and can result in information allocation errors and retrieval coordination errors (Pearsall, Ellis, & Bell, 2010). When such errors occur, team members must allocate attention to fixing their mistakes, which can significantly hamper or detract from team performance (Ellis, 2006).

Team Paradox 6. Team members need to specialize expertise and know who on the team holds what expertise, but it is difficult to accurately learn and trust others' expertise.

3.3. Interpersonal Processes

Interpersonal processes are used to regulate motivation and emotions within the team. They can be used during both transition and action processes, to regulate member emotions, confront conflict, and sustain motivation (Marks et al., 2001). I describe four interpersonal processes that increase the odds of an effective team: generate member motivation (Team Process #7), build cohesion and identity (Team Process #8), manage conflict (Team Process #9), and support collective leadership (Team Process #10).

Team Process #7: Generate Member Motivation. Team motivation is the direction, intensity, and persistence of effort that team members exert towards work processes and tasks. Pinder (1998) describes work motivation as the set of internal and external forces that initiate work-related behavior, and determine its form, direction, intensity and duration. Thus, team motivation is shaped by both environmental forces, such as the organization of the rewards system, and forces inherent to the individual, such as their individual needs (Ambrose & Kulik,

1999). Through team member interactions, teams develop shared beliefs regarding its general capabilities or team potency (Hu & Liden, 2011). Teams motivate members by developing a clear vision of individual contributions (Griffith, Fichman, & Moreland, 1989), and communicating their beliefs about team ability, competence on tasks, and feedback on team success (Marks et al., 2001). Teams that promote their task competency and provide feedback to their members on work processes are typically more effective (Dencheva, Prause, & Prinz, 2011; Geister, Konradt, & Hertel, 2006; Kluger & DeNisi, 1996).

That said, teams often engage in behaviors that are demotivating, such as providing insufficient feedback on individual contributions and negative comments about the team's lack of competence. Further, individuals may engage in social loafing behaviors based on the attributions they make about the motivation and performance of other team members (Erez & Somech, 1996). In particular, people may believe that other team members exert enough effort to achieve the team's goals, making their own efforts unnecessary or dispensable. This phenomenon is known as the free-rider effect (Kerr, 1983). Or, team members may be unwilling to contribute more than others, to avoid the possibility of being a sucker - the person who contributes to the collective good when nobody else does. These tendencies lead to productivity loss whereby individuals exert less effort when their efforts are combined, (Karau & Williams, 1993; Latané et al., 1979) that can lead to reduced collective performance (Marks et al., 2001).

Team Paradox 7. Team members are more motivated when provided with feedback on performance, but members often receive insufficient feedback.

Team Process #8: Build Cohesion and Identity. Team cohesion is the "resultant of all forces acting on members to remain in the group" (Festinger, 1950). It refers to the social and

motivational forces that exist between group members. Cohesion has three main components: task, social, and group pride (Beal, Cohen, Burke, & McLendon, 2003). Task cohesion is the group's shared commitment to the group task or goal; social cohesion is the members' attraction or liking of the group; and group pride is the extent to which group members exhibit liking for the status and ideologies that the group supports (Beal et al., 2003). Teams tend to be more cohesive when they communicate and conform to group norms (McGrath, 1984), develop similar attitudes, and work in close physical proximity (Sundstrom et al., 1990). When cohesion is strong, the group is motivated to perform well and is more able to coordinate its actions for successful performance (Cartwright & Zander, 1968). Thus, teams that develop and maintain cohesion by identifying strongly with the team and its purpose (Tajfel & Turner, 1986; Wiggins & Crowston, 2011) tend to have better performance and viability (Beal et al., 2003; Zaccaro & Lowe, 1988; Zaccaro & McCoy, 1988).

However, teams tend to develop identity-based subgroups, especially those formed according to the tenets of social identity where members share characteristics (e.g., gender, age) that suggest they share similar values (Tajfel & Turner, 1986). Evidence shows that members of newly formed teams tend to use salient demographics to implicitly categorize themselves into subgroups (Lau & Murnighan, 1998). These subgroups are known as faultlines, or "hypothetical dividing lines that may split a group into subgroups based on one or more attributes" (Lau & Murnighan, 1998, p. 328). These subgroups can limit cross-demographic communication and diminish cohesion by highlight ingroup-outgroup tensions (Carton & Cummings, 2013). The stronger the faultline, the higher the likelihood of outgroup bias between members of the homogeneous subgroup within a team. Such perceptions of differences in social categories can

negatively affect group dynamics, such as social loafing, and performance (Carton & Cummings, 2012; Thatcher & Patel, 2012).

Team Paradox 8. Team members need to identify strongly with the team and its purpose, but teams tend to form identity-based subgroups.

Team Process #9: Manage Conflict. Conflict is "a process that begins when an individual or group perceives differences and opposition between itself and another individual or team about interests and resources, beliefs, values, or practices that matter to them" (De Dreu & Gelfand, 2008, p. 6). In other words, team conflict refers to disagreement that arises from team members' natural attempts to cooperate and coordinate their efforts (Jehn, 1997; Jehn, Chadwick, & Thatcher, 1997). Team conflict tends to fall along two dimensions: affective and substantive. Affective conflict refers to conflict in interpersonal relations, whereas substantive conflict relates to conflict related to the group's task (Jehn, 1997). Evidence suggests that while interpersonal conflict is detrimental to team viability, regardless of the task, task conflict can be beneficial when teams perform nonroutine tasks, as it can promote critical evaluation of problems and options, and reduce thoughtless agreement (Cohen & Bailey, 1997).

Although conflict can promote different perspectives, and contribute to team effectiveness, teams need to use cooperative conflict management to resolve task-based conflicts and generally avoid discussing relationship-based conflict (DeChurch, Mesmer-Magnus, & Doty, 2013; De Dreu & Van Vianen, 2001; Tekleab, Quigley, & Tesluk, 2009). Cooperative conflict management promotes collaboration, cooperation and problem-solving (Montoya-Weiss, Massey, & Song, 2001) in two ways. First, teams can either establish preemptive conditions to prevent, control or guide team conflict before it occurs. Alternatively, they can develop reactive

strategies to effectively work through conflict and member disagreements (Marks et al., 2001). Examples of preemptive conflict management include establishing norms for cooperative rather than competitive or individualist approaches to conflict resolution (Tjosvold, 1985), specifying how members ought to handle difficult situations and developing team rules governing the nature and timing of conflict (Marks et al., 2001). Similarly, examples of reactive strategies include problem solving, compromising, openness and flexibility, as well as willingness to accept differences in opinion (Kozlowski & Bell, 2013).

Despite the need for cooperative conflict management strategies, teams often use individualistic strategies and openly discuss relationship issues (Alper, Tjosvold, & Law, 2000; Montoya-Weiss et al., 2001). For instance, team members often default to competitive conflict management behaviors, whereby people focus on individualistic strategies that attempt to dominate or control group decision and communication processes. Competitive conflict management involves a high level of concern for the self and a lower level of concern for the other party and is also known as a zero-sum or win-lose style (Rahim, 2001). Such competitive strategies can cause the team to "burn itself up" through unresolved conflict or divisive interaction that leave members unwilling to continue working together (Hackman & Oldham, 1980, p. 169). They can also frustrate communication and result in deadlocks or imposed solutions. When team members try to outdo each other, they do not utilize each other's ideas and resources; instead, they hide information and block others' efforts, and generate distrust (Somech, Desivilya, & Lidogoster, 2008). These tendencies can reduce team motivation, confidence, and morale (Marks et al., 2001), as well as team performance (Cohen & Bailey, 1997).

Team Paradox 9. Teams need to use cooperative conflict management strategies, but teams often use individualistic strategies.

Team Process #10: Support Collective Leadership. Collective leadership refers to a team property whereby leadership is distributed among team members rather than focused on a single designated leader (Carson, Tesluk, & Marrone, 2007). Collective leadership has become crucial for team effectiveness (D'Innocenzo, Mathieu, & Kukenberger, 2014) because of recent trends in team design, use and structure (Carson et al., 2007). The complexity and ambiguity contemporary teams face suggest that a single leader often cannot successfully perform all the necessary leadership functions (Pearce & Manz, 2005) that go beyond the respected "task leader" role and likeable "social leader" role (Homans, 1961, p. 286). The increased importance of knowledge-based work means that workers are increasingly diverse, specialized, and hold unique expertise. In turn knowledge workers desire greater autonomy to shape and participate in leadership functions, which operates in tandem with the growing number of self-managing teams that emphasize the process of emergent leadership within team (Mehra, Smith, Dixon, & Robertson, 2006; Yoo & Alavi, 2004). Due to these trends, there has been a "reorientation of leadership away from understanding the actions and interactions of 'leaders' to understanding the emergent, informal, and dynamic 'leadership' brought about by the members of the collective itself." (Contractor, DeChurch, Carson, Carter, & Keegan, 2012, p. 994). Collective leadership therefore emphasizes a process of mutual influence embedded in the interactions among team members as they work toward team objectives (Carson et al., 2007), where leaders emerge based on their expertise and match with the current task demands (Contractor et al., 2012; D'Innocenzo et al, 2014; Friedrich, Vessey, Schuelke, Ruark, & Mumford, 2009).

Despite the need for relevant leader expertise, team member personality and group prototypicality often determines who emerges as the group leader (Hogg, 2001; Hogg, van Knippenberg & Rast, 2012). Drawing from a social identity perspective, people turn to anyone who provides information about ingroup-defining norms, or the ingroup prototype (Hogg, 2001). According to this theory of leadership, group members engage in social psychological processes that determine whether a member will emerge as the leader of the group (Uhl-Bien, 2006). More specifically, information about the ingroup prototype reduces self-conceptual uncertainty, and is useful for prescribing one's attitudes, feelings, and behaviors in the current context (van Knippenberg & Hogg, 2003). Group members who reflect the ingroup prototype are more persuasive at changing attitudes than outgroups (van Knippenberg & Hogg, 2003). Accordingly, more prototypical group members have greater success in exerting influence on others, gaining consensual social attraction, attribution, and trust, and are subsequently more likely to emerge as group leaders (Hogg & van Knippenberg, 2003; van Knippenberg & Hogg, 2003). The research has also found that leaders consciously display and manipulate their own prototypicality and have been found to deliberately engage in group-oriented acts to enhance their effectiveness, follower identification and social identity salience (van Knippenberg & Hogg, 2003).

Moreover, team member personality traits typically affect leadership emergence. Meta-analytic evidence points to intelligence, masculinity-femininity, and dominance being significantly related to leadership perceptions (Lord, De Vader, & Alliger, 1986). Recent research has examined the relationship between the Big Five five-factor model of personality traits and leadership, and has pointed to extraversion, openness to experience and conscientiousness as being positively associated with leader emergence and effectiveness (Judge,

Bono, Ilies, & Gerhardt, 2002). The research on personality and leadership suggests that certain people, in the absence of performance data, are perceived as being more "leader-like" and are thereby more likely to emerge as group leaders (Hogan, Curphy, & Hogan, 1994).

Team Paradox 10. Teams need to support collective leadership with leaders emerging based on expertise and match with current task demands, but leaders often emerge based on personality and group prototypicality.

Thus far, I have provided evidence from the literature highlighting ten team form-perform paradoxes. Each of these paradoxes is supported by research demonstrating a contradiction in what is natural, and what is optimal. In the next section, I situate the body of literature on work teams onto the paradox lens to generate new insights and opportunities for advancing research on organizing in teams.

4. NEW INSIGHTS ON ORGANIZING IN TEAMS

The previous sections of this chapter have provided the reader with an overview of the existing research on work teams and team processes in organizations that is theoretically-grounded and has received replicable support, along with a systematic review that is organized around the Marks and colleagues' taxonomy for teamwork processes. By structuring the review around the two streams of research on teams – namely the team formation tendencies with the team performance needs, I offer a way to bridge these streams through the lens of a team form-perform paradox. I then proceeded to highlight ten cases of such paradoxes in the literature. For the remainder of this chapter, I discuss the implications of the team form-perform paradox lens and set an agenda for future research for organizing in teams.

4.1. Implications & Opportunities for Theory & Practice

The team form-perform paradox has implications for theory and application. From a theory perspective, it advocates for an integrated perspective on teams that considers, jointly, formation and performance tendencies. Studies of individuals in teams should consider the implications for what emerges at the team level. Studies of team processes and properties need to consider how likely, given the confluence of factors shaping individual behavior, these states are to arise in the first place. From an application perspective, the team form-perform paradox provides an integrated approach to advance studies on organizing in teams. It offers a lens through which targeted interventions can be designed to improve the functioning of work teams.

I close the chapter by laying out four prescriptions and opportunities for future teams/groups research: 1) Discrete to Intertwined; 2) Understanding the Implications of Team Formation Tendencies; 3) Understanding the Likelihood of Needed Team Processes and Properties; 4) Expanding the Methodological Repertoire.

Theme 1: Discrete to Intertwined. Although work to date on teams and groups has been pursued in parallel sequences by scholars who study team formation tendencies and those who focus on team performance needs, future work ought to pursue both paths simultaneously, by intertwining studies on team formation with those on team performance. By intertwining the "pessimistic" view with the "optimistic" view on teams, scholars adopt an a priori understanding of the antecedents that drive team member behavior, absent of incentives and awareness to perform effectively. Moreover, a simultaneous consideration of both streams can facilitate the design of more useful interventions that account for both the team's natural formation tendencies and their performance potential.

Theme 2: Understanding the Implications of Team Formation Tendencies. The literature reviewed in this chapter revealed that some of the work on teams explores important dynamics of how individuals respond in teams. Notable examples are work that explores inter-group relations and status processes (e.g., Halevy, Chou, & Galinsky, 2010; Magee & Galinsky, 2008). Hierarchy – both power and status – are such defining and pervasive features of organizations that they are often taken for granted (Magee & Galinsky, 2008). Also, this work is largely at the individual level. Though teams are a context, these studies are squarely rooted in individual attitudes and behavior. Future work needs to extend out this work to understand the implications for team effectiveness.

Theme 3: Understanding the Likelihood of Needed Team Processes & Properties. Another theme of the work reviewed explores factors that determine team effectiveness but does not consider the likelihood of their formation. One notable example is work on multiteam systems (e.g., Marks et al., 2005). This work focuses on understanding the between-team processes needed for performance but has paid less attention to the inter-group factors that shape the processes that arise between the different teams in a multiteam system. A second example falling in this category is research on team composition (Moreland & Levine, 2013). Much research has focused on understanding the team composition factors that affect performance – e.g., intelligence, personality, values. However, more research is needed to understand the motives that shape which compositions are more and less likely to arise in organizations (e.g., Contractor, 2013). Given the increased agency afforded in modern organizations, and by individuals who work in the gig economy, team assembly represents a valuable extension to the team composition literature.

Theme 4: Expand the Methodological Repertoire. My review of existing studies on organizational teams have revealed a consistent approach to studying team processes and effectiveness. The vast majority of studies have used traditional methodologies, such as inductive research, observations, laboratory studies, or self-reports to investigate phenomena of interest. The increasing variety of teams that interact using communication technologies is producing abundant digital trace data and server-side data. These data offer an obvious way to expand knowledge about team formation tendencies and team performance needs in organizations. Data extracted from servers that host team member behaviors on social media platforms, project management tools, 3D virtual environments and the like (Gilson et al., 2015) offer unprecedented ways to examine both the structure and the content of team members' actual behaviors and discourse. Data conducted by surveys can be limited in that they may be affected by distortion in recall and bias on the part of the survey taker. Moreover, tracking members' actual behaviors provide fine-grained data that lend themselves well to new social network methodologies that examine the structural patterns of interactions over time, i.e., stochastic actor-oriented models (Snijders, Van de Bunt, & Steglich, 2010), or derive meaning from the sequences of events that evolve through time, i.e., relational event models (Leenders, Contractor & DeChurch, 2016). Such methods augment the traditional toolkit available for studies on teams and calls for the use of mixed method approaches to progress the current state of research on teams.

5. DISCUSSION AND CONCLUSION

In organizations today, self-managing teams are being attributed with increased autonomy and scope to recruit teammates, interact with external team members, and set the

direction and tone of the team. In traditional organizations, the marked shift towards a network of teams – whereby individuals are part of teams with overlapping memberships (Mortensen et al., 2011) and goals (Marks et al., 2005) – suggests that teams not only have increased autonomy for what they work on but also who they work with and who they invite onto their teams. In addition, new forms of organizations are emerging; for instance, flash teams are a framework for dynamically assembling and managing crowdsourced expert teams (Retelny et al., 2014). They are a sequence of modular tasks that draw on paid experts from the crowd to sequence their workflow by linking the modular tasks together to pass each task's output as input to the next task.

In this chapter, I set out to provide a useful lens for examining the significance and practicality of the vast literature on team effectiveness: the *team form-perform paradox*. The team form-perform paradox refers to the team formation tendencies or "default behaviors" that counter what they need to be effective. To facilitate understanding of the team form-perform paradox, I synthesize the literature and identify ten team processes for which this paradox exists. These team processes are: 1) diverse composition, 2) managing external interdependence, 3) goal specification and prioritization, 4) information sharing, 5) coordination, 6) transactive memory, 7) motivation, 8) cohesion, 9) conflict, and 10) leadership. The team form-perform paradox offers a way of joining the two distinct and often disparate streams of research on teams together, while shedding light on the discrepancy or gap between team tendencies and their normative recommendations. I propose that future research on teams benefits from viewing team formation tendencies and team performance needs in tandem, through the lens of the team form-perform paradox and outline four themes for future research. Although one might argue that the benefits

of such a theoretical approach may depend on the type of team in question, I submit that these paradoxes exist irrespective of team types and provide meta-analytic evidence that supports this conclusion. Rather, a more fruitful approach would be to structure studies around the task, where important factors to consider include the degree of interdependence, complexity, and coordination that are required to accomplish team goals.

In this proposed research, an important trade-off is the multi-dimensional construct of team effectiveness. More specifically, future research needs to consider whether team performance or member viability is the ultimate objective. Often teams need both components, which suggests that the team form-perform paradox itself may be a multidimensional construct that is dynamic over time. In addition, it seems that the team processes described in this chapter may have natural proclivities towards performance outcomes or member satisfaction. The team processes highlighted in this chapter fall into the higher order dimensions of transition and action processes, interpersonal processes, and assembly processes. In the Marks et al. (2001) framework, transition and action processes facilitate the accomplishment of taskwork, while interpersonal processes facilitate management of interpersonal relationships. Hence, it is logical that the transition and action processes are more closely associated with team performance, whereas the interpersonal processes, which occur in tandem with transition and action processes, are more closely associated with team viability and satisfaction (Hackman, 1987). The team assembly processes of functional diversity and managing interdependence are also associated with trade-offs: functionally diverse teams may have better performance outcomes, but they may lack the member familiarity of social homophily that drives team member satisfaction. Also, teams that manage their external interdependence may be less cohesive than teams that focus

primarily on their internal processes. Ultimately, it is likely that teams benefit from a combination of both effectiveness criteria, and that further research is needed to examine the nature of the trade-offs involved with assessing team effectiveness.

Overall, this chapter proposes an alternative lens for viewing research on team effectiveness. Meanwhile, it sparks a new appreciation and connection between the two distinctive streams of research on teams. In doing so, it offers four themes for advancing research that seeks to bridge the disconnect highlighted by the team form-perform paradox. To summarize, these themes are: 1) creating a perspective on teams that views formation tendencies and performance needs as mutually intertwined, rather than distinct; 2) understanding the implications of team formation tendencies; 3) understanding the likelihood of needed team processes and performance; 4) expanding the methodological repertoire.

The next three chapters of my dissertation build upon the four themes introduced in this chapter to better understand how teams naturally organize, the discrepancy between these natural tendencies and their performance needs, and how technologies may enable teams to overcome these self-formation tendencies to achieve their team needs. More specifically, in Chapter 2, I examine the communication networks of online discussion groups to understand how team networks naturally form. Then, I propose that *formal interventions* that focus on the improvement of group process can improve how team members communicate and share information with each other.

Next, to extend the applicability of these findings to contemporary work teams, I examine the impact of social media use in teams. Towards this end, I begin by presenting a conceptual model in Chapter 3 that describes how enterprise social media provides new opportunities for

organizing in teams. I propose that these unprecedented opportunities potentially afford teams the ability to overcome some of their self-formation tendencies to better achieve their team needs. I develop nine propositions that describe how social media may aid with bridging the team form-perform paradox. In Chapter 4, I take a multilevel and multitheoretical approach to examine how communication networks form on social media and the extent to which they perform. Chapter 4 reveals that social media may alter the nature of communication networks while enhancing worker outcomes. I close with Chapter 5, which discusses takeaways, insights, and future directions with respect to the research presented in this dissertation.

CHAPTER 2. HOW TEAM COMMUNICATION NETWORKS FORM AND WHY THEY PERFORM

1. INTRODUCTION

Communication and teamwork are essential components of team effectiveness and yet communication failures repeatedly occur in everyday incidents. These communication failures can have tragic consequences, such as job stress and burnout (Miller, Ellis, Zook, & Lyles, 1990), flight accidents (Helmreich, Merritt, & Wilhelm, 1999), and even patient harm or death (Leonard, Graham, & Bonacum, 2004). A notable and particularly publicized example of communication breakdown in recent history was the Challenger space shuttle's fatal launch that claimed seven lives, for which "an element of good judgment and common sense" in communicating safety concerns could have prevented this tragic incident (Sanger 1986).

Research on virtual teams finds that communication breakdown and information sharing problems can be further magnified by factors that contribute to virtuality, including electronic dependence, geographic dispersion, dynamic structure, and national diversity (Gibson & Cohen, 2003; Gilson et al., 2015; Jarvenpaa & Leidner, 1998; Staples & Webster, 2008). Virtual teams, because of the geographical distance separating their members, rely more heavily on communication technologies to facilitate interaction and coordinate their work. Communication technologies, such as email, chat, discussion forums, and telephones help members of virtual teams communicate and share information. However, these technologies can fail to provide the same richness as face to face communication because they offer fewer visual and nonverbal cues

(Daft & Lengel, 1984), and opportunities for feedback that can result in misunderstanding and misinterpretation (Gibson & Cohen, 2003).

Given the potential detrimental effects of communication failure, coupled with the increasing prevalence of virtual teams (Gilson et al., 2015), it is not surprising that scholars across fields – management, organizational psychology, medicine and communication, have shown keen interest in examining the conditions or processes that lead to more effective communication in the workplace. A review of the literature shows that effective communication provides the opportunity for team members to talk through problems, share perspectives, get feedback, and resolve questions (Gibson & Cohen, 2003), and can lead to improved information flow (Leenders, Engelen, & Kratzer, 2003), improved safety (Leonard et al., 2004), enhanced employee morale and satisfaction (Kirkman, Rosen, Gibson, Tesluk & McPherson, 2002; Piccoli, Powell, & Blake, 2004), as well as more effective team performance (Bowers, Jentsch, Sales, & Braun, 199; Maznevski & Chudoba, 2000).

Although the link between effective team communication and team effectiveness is clear (e.g., see Marlow, Lacerenza, Paoletti, Burke, & Salas, 2018), much of our knowledge stems from a *content* rather than *structural* perspective. I argue that a structural perspective on team communication should complement the content-focused perspective to identify the causal mechanisms that lead to *suboptimal* versus *optimal* team communication patterns that subsequently impact the quality of teamwork processes and task performance. The purpose of this chapter is to understand how team communication networks *form* by identifying the communication patterns or structures that characterize optimal (and suboptimal) team communication. This chapter illustrates the natural communication patterns that form and uses

interventions to examine how communication patterns change when teams are provided with guidance on how to structure how they process information. In doing so, this research provides clarity on how the micro-level interactions among individuals affect the team's communication – a basic and fundamental component of many teamwork processes.

Two common barriers to effective communication are *hierarchies* and *subgrouping*. Hierarchies occur when a few individuals dominate the discussion – often because of the formal organizational structure (O'Daniel & Rosenstein, 2008; Sutcliffe, Lewton, & Rosenthal, 2004) or the informal communication structure that emerges in the group (Bales, Strodtbeck, Mills & Roseborough, 1951; Hiltz & Turoff, 1985; Leenders et al., 2003). Subgrouping occurs when information tends to be exchanged within a small set of individuals – i.e., dyads, limiting the amount of information flow and integration that occurs between these subgroups (Bales et al., 1951; Cramton & Hinds, 2005; Molm, 1994). An implication of subgrouping is that it tends to exclude or neglect third parties from the communication. Both hierarchy (Becker & Blaloff, 1969; Berdahl & Anderson, 2005; Nicol & Farrell, 1963; Torrance, 1955) and subgrouping (Armstrong & Cole, 2002; Cramton & Hinds, 2005; Lau & Murnighan, 1998; Nicol & Farrell, 1963; Torrance, 1955) have been found to reduce team effectiveness in a variety of contexts.

Prior research shows that team communication is affected by how members process information (Henry, 1995; Jehn & Shah, 1997; Salas, Cooke, & Rosen, 2008). Accordingly, I leverage information processing theory to examine how team communication is affected by how group members processes information. A recent meta-analysis (Mesmer-Magnus & DeChurch, 2009) found three factors improve group information processing: viewing the task as having a demonstrably correct or best solution (demonstrability), interacting in a cooperative manner

(cooperativeness), and structuring team discussions (structure). These factors may improve team communication by organizing how information is processed within the team. Demonstrability, cooperativeness, and structure improve members' in-depth processing and elaboration of information (Mesmer-Magnus & DeChurch, 2009), thereby affecting the ability of teams to achieve their goals, coordinate effectively and advance task progress. I conduct an experiment to examine how formal interventions promoting demonstrability, cooperativeness, and structured process alter team communication patterns during online team discussions. These formal interventions provide explicit instructions for the team to follow and help guide the team discussion (Okhuysen & Eisenhardt, 2002). Taking a structural or network approach, I examine the effects of information processing interventions on three important structural aspects of group discussion: participation (Figure 2a), social exchange (Figure 2b), and integration (Figure 2c). Participation refers to the extent of hierarchy in the group, where a hierarchical structure suggests that member participation is concentrated on a few central individuals. Social exchange refers to the extent of subgrouping or reciprocal exchanges in the group, where a reciprocal structure suggests that communication exchanges occur mutually between dyads. Integration refers to the extent of group-level communication, where transitivity or transitive closure suggests that team members communicate as a collective group.

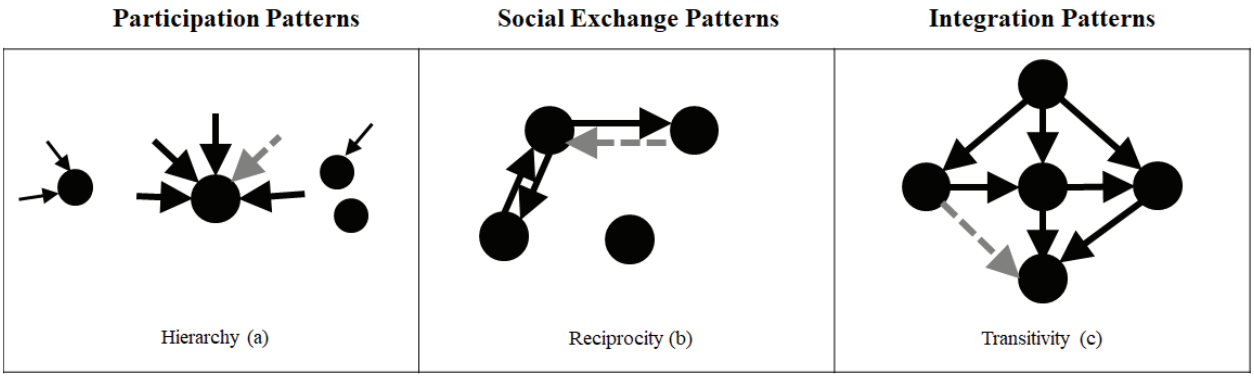


Figure 2. Communication structures in small group discussions. Grey arrow represents a likely communication act given prior communication acts among group members.

Figure 3 presents an overview of our conceptual framework. I investigate the effects of three functional information processing factors on the emergent communication patterns in online discussion teams: participation, social exchange, and integration. I posit that suboptimal communication patterns are characterized by hierarchy, reciprocity and the absence of transitivity, and that optimal communication patterns are characterized by the absence of hierarchy and reciprocity, and the presence of transitivity.

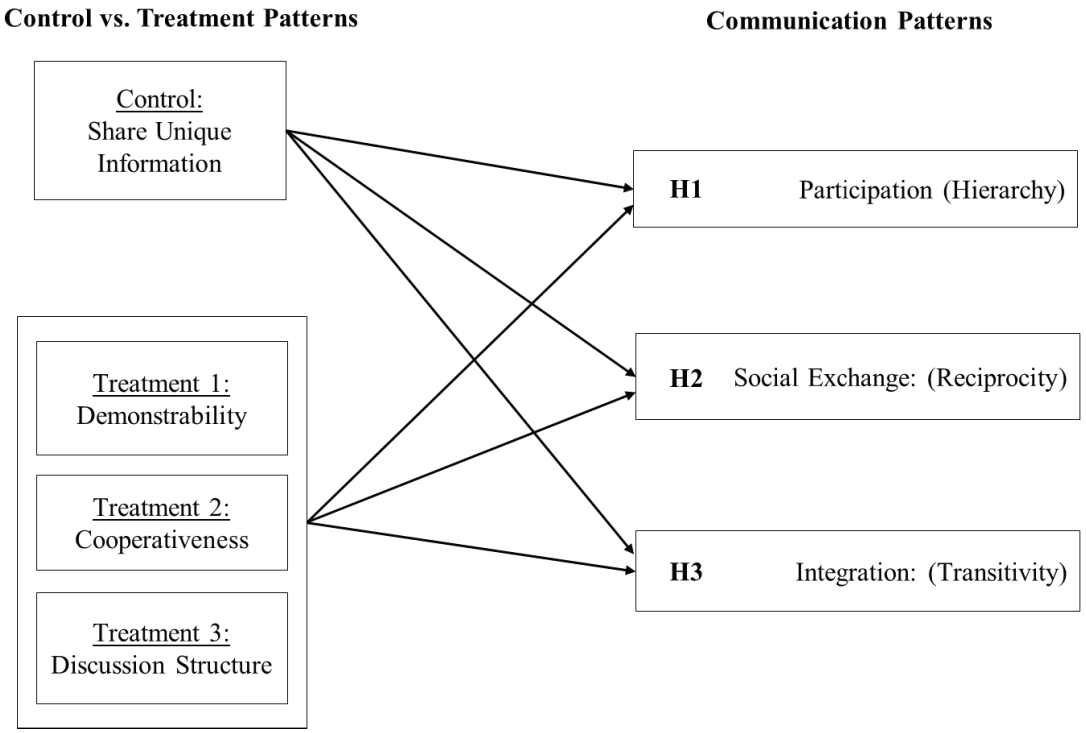


Figure 3. Impact of Formal Interventions on Team Communication Patterns

2. THEORY & HYPOTHESIS

2.1 Team Communication

Team communication enables members to exchange information so that the team has a larger pool of information than any one person acting alone (McNamara, Dennis, & Carte, 2008; Steiner, 1972). It is essential to the timely availability of information required by team members. The strategies or processes members use to communicate with each other affect how information is shared (de Vries, van den Hooff, & Ridder, 2006) and the development of shared understanding and meaning or team cognition (Brown & Eisenhardt, 1995; DeChurch & Mesmer-Magnus, 2010; Gibson & Cohen, 2003; Marlow, Lacerenza, & Salas, 2017). Frequent

and internal team communication provides the opportunity to problem solve, share perspectives, and solicit feedback from team members (Gibson & Cohen, 2003), and leads to greater team success (Allen 1977; Ancona & Caldwell, 1992; Piccoli, Powell, & Blake, 2004). Without communication, misunderstandings occur more frequently, and can lead to poor team performance and reduced member satisfaction.

Effective team communication can be more difficult in virtual teams because their members are distributed and rely more heavily on communication technologies to facilitate interaction than teams whose members share a common physical environment (Jarvenpaa & Leidner, 1999; Maznevski & Chudoba, 2000; Martins, Gilson, & Maynard, 2004). These technologies differ in their extent of media richness as communication channels (Daft & Lengel, 1984), and in the extent to which they enable synchronous collaboration (Bell & Kozlowski, 2002). Technology usage has been associated with diminished non-verbal and visual cues, and greater human and technical errors in information distribution (Cramton, 2002). These factors have been cited as reasons why virtual teams fail to communicate and remember contextual information, are subject to more frequent misunderstandings, take longer to make decisions, and are less able to make inferences about their members' knowledge or anticipate other members' responses (Cramton, 2002; Gibson & Cohen, 2003; Hollingshead, 1998; Martins et al., 2004).

To facilitate understanding of team communication patterns, it is useful to characterize team communication from three perspectives: (a) an individual perspective that focuses on the communication patterns of each person on the team, (b) a dyadic perspective that focuses on the specific patterns of communication between two individuals; (c) a group perspective that focuses on the communication patterns of the group as a whole (de Vries et al., 2006). Each of these

perspectives can be used to examine the effectiveness with which the group processes information. The individual perspective enables understanding of member *participation* in the discussion. It refers to the extent to which member contributions tend to concentrate on a few central individuals, as opposed to being evenly distributed across the different members of the team. The dyadic perspective refers to the dynamics of *social exchange* relations on the team and reveals whether members are developing intimate reciprocal-based relations with specific members, as opposed to communicating with all members equally. Lastly, the group perspective refers to the level of communication *integration* among team members and denotes the extent to which the team is integrating, elaborating, and building upon the ideas of the team to arrive at a complete analysis of the task, as opposed to only partially considering others' ideas and perspectives.

2.2 Group Information Processing

The quality of team communication (Gonzalez-Roma & Hernandez, 2014) is affected by the relevant and available information that teams discuss and process to perform cognitive tasks (Hinsz, Tindale, & Vollrath, 1997; Laughlin & Ellis, 1986). Group information processing refers to the depth and extent that information, ideas, and cognitive processes are shared and elaborated upon (Hinsz et al., 1997). Each member of a team possesses resources, such as knowledge, skills, and abilities) that are used to develop ideas, solutions, preferences and judgments. During discussions, team members can contribute these ideas, solutions, and preferences to the available information-processing space of the team. Once this information has been contributed, it is available to other team members and is subsequently processed to facilitate the team's response (De Dreu, Nijstad, & van Knippenberg, 2008). Members may differ in the information they

possess, the ideas that are most accessible or salient in their minds, and their preferences for alternative decisions (Nijstad & Paulus, 2003). The information that is contributed (and withheld) during discussions affects the team's eventual response (Stasser & Titus, 1985, 1987). Much research has suggested that despite having a greater potential pool of information, groups often fail to make use of their expanded knowledge pool when they communicate and share information with their teammates (e.g., Gigone & Hastie, 1993; Faulmüller, Mojzisch, Kerschreiter, & Schulz-Hardt, 2012). Accordingly, recent research has shifted to the notion of team members as *motivated* communicators whose discussion goals determine what and how information is shared, as well as with whom they decide to communicate (De Dreu et al., 2008; Wittenbaum et al., 2004).

An important aspect of effective team communication is information sharing. To promote more effective information sharing, Mesmer-Magnus and DeChurch (2009) found three information processing factors positively predict team information sharing: cooperativeness, task demonstrability and discussion structure. Specifically, meta-analytic evidence shows that each of these factors increases the depth of information processing and information elaboration (Mesmer-Magnus & DeChurch, 2009) by promoting ways that encourage members to communicate and utilize the knowledge of their members.

Task demonstrability. Task demonstrability is the degree to which a team task is perceived as having a correct solution (Laughlin, 1980). Teams who perceive their work as having a correct solution typically engage in more depth information processing than teams who believe their task is more judgmental in nature.

Cooperativeness. Teams emphasizing cooperativeness perceive their goals as being interdependently linked (De Dreu, 2007; Greenhalgh & Chapman, 1998). When teams draw upon their cooperative goals, they focus on their shared pursuits and commonalities, rather than their individual interests (De Dreu, Nijstad, & van Knippenberg, 2008). Members develop greater trust in each other, experience psychological safety, and are better equipped to handle conflict constructively (Gibson & Gibbs, 2006). Hence, cooperativeness encourages frequent, informal communication, speaking up, risk taking and openness to new ideas and perspectives that jointly promote information sharing (Gibson & Gibbs, 2006).

Discussion structure. Teams who engage in structured group discussions have systematic rules that organize the group's retrieval, recall and recombination procedures (Stasser, Taylor, & Hanna, 1989). By using specific rules and procedures, structured discussions promote information sharing and assist with equalizing participation and influence among members (Desanctis & Gallupe, 1987; McLeod & Liker, 1992). In addition, past research has shown that technology-mediated systems (e.g., GDSS) can reduce process loss by organizing activity to promote the exchange of ideas, opinions, and preferences (Watson, DeSanctis, & Poole, 1988).

Thus, teams that view tasks as being highly demonstrable, create cooperative norms, and/or structure their process, interact in ways have that promote more in-depth information processing and effective communication and information sharing. In this study, I use formal interventions to promote the use of these functional information processing factors. Formal interventions are group process interventions that provide explicit instructions for teams to follow, and help guide the discussion among members (Okhuysen, 2001; Okhuysen & Eisenhardt, 2002). They have been productive in improving group process in prior research and

can range from simple guidelines to share information (Okhuysen & Eisenhardt, 2002) to avoid premature closure (Larson, Christensen, Franz, & Abbott, 1997), to more complex interventions, such as the Nominal Group Technique (Bartunek & Murnighan, 1984).

I now turn to investigate the team communication patterns that are likely to emerge from online team discussions and make hypotheses about how information processing factors alter the structure of communication networks.

2.3 Structural Patterns of Team Communication Networks

Participation & Hierarchy. Team communication tends to be centralized, with a few individuals dominating the discussion. These individuals may dominate because vertical hierarchical differences or formal role structures grant higher status individuals more influence (Bonito & Hollingshead, 1997; Sutcliffe et al., 2004), such as in healthcare environments where physicians are at the top of the medical care team hierarchy (Larson, Jr., Franz, Christensen, & Abbott, 1998) or in typical supervisor-subordinate relationships (Burris, 2012). Alternatively, central individuals may appear emergently due to the rank order with which team members enter the discussion, whereby the first person to contribute to a discussion typically exerts influence on the type and amount of information discussed, and eventually emerges as the group leader (Bales et al., 1951; Hoffman, 1978; Kirchler & Davis, 1986). In particular, the number of contributions a person makes to the discussion is highly correlated with the number of responses he or she receives (Bales, 1953). In both of these situations, team members form expectations about themselves and their interactants, whereby central members often have more control over group decisions (Bavelas, 1950; Shaw, 1954), limiting less central members' contributions (Bonito & Hollingshead, 1997). From a structural perspective, these processes result in communication

centralizing on a few individuals (e.g., high status individuals, group leaders), and an emergent hierarchical structure of central (core) and non-central (periphery) members.

Communication is likely to be distorted or withheld in situations where there are hierarchical differences between members and can have detrimental consequences on both the central and non-central members. Core members who dominate the discussion are prone to information overload and cannot effectively process and disseminate information to the other team members (Oldroyd & Morris, 2012; Simon, 1971). This may lead to information distortion, bias (Stasser, 1985, 1987), and more decision errors (Shaw, 1964). Peripheral members have less autonomy, which may reduce their motivation and commitment to the discussion (Crawford & Lepine, 2013; Karau & Williams, 1993), as well as their overall satisfaction with the team (Shaw, 1964). Also, peripheral members may find it difficult to communicate diverse ideas or speak up, particularly if they are concerned about appearing incompetent to their teammates, do not want to offend others, or perceive that others are not open to communication (O'Daniel & Rosenstein, 2008). The lack of participation from non-central members can be especially detrimental for complex tasks, where distributed participation tends to create faster solutions and fewer errors (Shaw, 1964).

Further, when discussions take place online, the text-based and persistent nature of these discussions may increase the salience of the central or dominant person: since all messages are visible to participants, individuals can easily associate and evaluate other group members' behaviors, contributions, and preferences. These biases can limit the number of unique perspectives that are discussed, resulting in a few central members in the group being evaluated as possessing accurate and relevant information, and attracting the majority of responses.

On the other hand, teams who view their task as having a demonstrably correct solution, emphasize cooperativeness, and/or structure their discussions engage in more in-depth information processing and elaboration of information (Mesmer-Magnus & DeChurch, 2009) than teams without these factors. In particular, when team members view tasks as having a demonstrably correct solution (e.g., a math problem, verbal analogy or hidden profile) rather than judgmental and not having a correct answer (e.g., choosing one of three stocks to invest in), team members will be more likely to consider new facts and diverse viewpoints as part of the overall information set (Parks & Cowlin, 1996). To arrive at the correct solution, members will be more likely to communicate their ideas, opinions and perspectives to others. Similarly, when team members emphasize cooperativeness, the team becomes a "safe" environment that encourages members to engage in interpersonal risk taking by speaking up and offer dissenting viewpoints (Edmondson, 1999, p. 354), regardless of their formal or informal rank (Edmondson, Bohmer & Pisano, 2001). Lastly, when teams structure their discussions, members follow rules that systematically direct the pattern, timing or content of communication. Accordingly, these rules encourage member participation in ways that circumvent the tendency for a few individuals to dominate the discussion, for instance, by enforcing sequential turn-taking mechanisms (Dabbs & Ruback, 1987) that promote more equalized participation. During group discussions, use of these functional information processing factors suggest that all members will be more willing to contribute unique facts to the team's information processing space. As a result, participation is more evenly represented by all team members, and the communication structure tends to be less hierarchical. Thus, I posit:

Hypothesis 1. Online teams exposed to interventions promoting demonstrability (H1a), cooperativeness (H1b) or discussion structure (H1c) are less likely to exhibit hierarchical discussions than online teams not exposed to these interventions.

Social Exchange & Reciprocity. Team members tend to subgroup into dyads and develop intimate social relations with specific members of the group (Brewer & Gardner, 1996; Molm, 1994). During group discussions, individuals may prefer to exchange messages with other members who have previously responded to them, due to an obligation or normative expectation to respond back to people (Blau, 1964; Emerson, 1974). Over time, these communication exchanges can evolve into intimate dyadic relationships characterized by trust, affect, and commitment (Blau, 1964; Molm, 2010; Molm, Takahashi & Peterson, 2000).

Although reciprocity promotes intimate social relations among some pairs within the group, it suggests that information is not being shared collectively with the group. From a structural perspective, it can create discrepancies with respect to who is connected to whom (Molm, 1994), and result in third party members being ignored or excluded from the discussion (Bales et al., 1951). Reciprocity can also create a pecking order, whereby certain pairs of speakers control the discussion in that a particular member's contribution makes another member's contribution in the next turn more or less likely (Dabbs & Ruback, 1987). Accordingly, information exchange is censored, has difficulty traveling between subgroups, and is seldom able to be fully integrated. Moreover, reciprocity can lead to greater communication misunderstandings as knowledge becomes more distributed among members and individuals hold different information, ideas and perspectives.

It is also possible that the persistent record and visibility of member interactions in online team discussions may only reinforce reciprocity by creating a visual scorecard of reciprocated and unreciprocated messages. For example, virtual tools, such as discussion forums, are arranged according to a hierarchical structure of posts and comments that depict who said what and who responded to whom. The visibility of these exchanges makes unreciprocated messages salient to all participants and may further motivate members to reciprocate.

In contrast, when teams are provided with guidance on how to process information emphasizing demonstrability, cooperativeness or structure, team members are less likely to subgroup into dyads. When teams view a task as having a demonstrably correct solution, turn-taking is less likely to be censored based on who said what previously in the discussion (Dabbs & Ruback, 1987). Rather, discussants are more likely to enter the discussion when they have a relevant contribution. Similarly, teams emphasizing cooperativeness are more likely to emphasize a psychologically safe environment where the group as a whole develops a collective identity, rather than subgroup into dyads with highly relational orientations (Flynn, 2005). Also, structured discussions create procedures that regulate how, what, and when people communicate; for example, members may be told to recall and review all relevant information before indicating their preferences (Stasser et al., 1989). Such tactics can shift members' focus away from developing dyadic relationships towards communicating with the group collectively so that all relevant information can be disclosed, before members come to a decision. Based on these arguments about group discussions and reciprocal relationships, I hypothesize:

Hypothesis 2. Online teams exposed to interventions promoting demonstrability beliefs (H2a), cooperativeness (H2b), and/or discussion structure (H2c) are less likely to exhibit reciprocal discussions than teams not exposed to these interventions.

***Integration and Transitivity*.** The functional information processing factors of demonstrability, cooperativeness, and structure help focus the content and direction of the discussion on the completeness of information exchange (Johnson, Hollenbeck, Humphrey, Ilgen, Jundt & Meyer, 2006; van Ginkel & van Knippenberg, 2008). In particular, when members view discussions as having a demonstrably correct solution, they are more likely to value the need to process and elaborate on the information and ideas communicated by team members in order to achieve a superior decision or outcome. Moreover, when the team emphasizes cooperativeness, team members value the need for exchanging, considering, and integrating member's perspectives into the discussion to foster a psychologically safe environment. Lastly, when teams use a structured process, members have rules that systematically guide their discussions to promote greater integration and consideration of each idea, perspective or opinion put forth in the discussion. As a result, people's contributions are more likely to become integrated into the group discussion, with members leveraging each other's ideas to arrive at a complete analysis of the task.

From a structural perspective, integrative patterns suggest that team members communicate as a group, communication exchanges occur interdependently among three or more members or "triads" (Burt, 2000; Coleman, 1988; Simmel, 1950). Social network theory suggests that a key advantage of triadic structures is that they enable third parties to integrate information exchanges (Simmel, 1950), resolve conflicts among other members (Krackhardt,

1998), and maintain balance in exchanges (Heider, 1946). Triads also improve team members' access to information by increasing the number of direct connections between participants (Coleman, 1988), reducing the need for information to move through intermediaries (Burt, 2000). A particular type of triad, the transitive triad, suggests that when a common third party or "broker" connects two unconnected individuals together, transitivity or "closure" predicts that a connection will likely form between the remaining two members of the triad (Wasserman & Faust, 1994). Transitive triads have particular value for communication networks because they imply that the team is operating efficiently by coordinating their exchanges (Lee, Banrach & Lewis, 2014) facilitating communication (Obstfeld, 2005), and integrating their knowledge by joining disconnected parties together (Baker & Obstfeld, 1999). As a result, information can be efficiently incorporated into the discussion for a more complete analysis of the task. This integrative process is also referred to as closed-loop communication, whereby the recipient of an initial communicative act interprets and acknowledges its receipt, and the original communicator later follows up on the exchanged information (Marlow et al., 2017). These complex processes are associated with improved communication quality that have also been shown to mitigate miscommunication errors in virtual settings and improve performance (Marlow et al., 2017). Therefore, I propose:

> *Hypothesis 3. Online teams exposed to interventions promoting demonstrability beliefs (H3a), cooperativeness (H3b), and/or discussion structure (H3c) are more likely to exhibit transitive discussions than teams not exposed to these interventions.*

3. METHOD

To test these hypotheses about information processing factors and the structure of group discussions, I conducted a within-subjects experiment on 38 teams. Each team was exposed to a total of four interventions, a control condition and three treatment conditions targeting a different information processing factor. The order of presentation of the treatments was counterbalanced, so that an equal number of teams received each treatment as their first, second, third, or fourth treatment, hence canceling any potential order effect. Each intervention lasted for 2 weeks during which time the communication network was observed.

3.1 Participants & Procedure

Participants included student teams in one of three courses at a large Midwestern university: an undergraduate (class 1) and professional masters course (class 2) on social network analysis, and an undergraduate class on operations management (class 3). Participants were randomly assigned to online discussion teams with either 6 or 7 members. In all, 185 out of 223 students consented to have their data used in this study. Our sample was comprised of 130 undergraduate and 55 masters students (45 percent female).

The teams worked on weekly decision-making tasks (McGrath, 1984) in their discussion teams for 8 weeks of the 10-week quarter. The decision-making tasks consisted of different topics varying from designing and leveraging networks for team and organizational effectiveness to workforce planning to revenue management and dynamic pricing. Decision-making tasks were selected due to the longstanding issues, such as pre-discussion bias or confirmation bias that lead to suboptimal team decision outcomes (Larson Jr. et al., 1997; Mesmer-Magnus & DeChurch,

2009; Minas, Potter, Dennis, Bartelt, & Bae, 2014). All online discussions took place on a discussion forum that was available on the university's learning management system.

All teams within a course completed the same weekly discussion tasks. The assignments were complex, requiring students to process a relatively large amount of information from cases, textbooks, and articles, as well as to contribute their own insights from work experience or other courses. An example of a typical weekly discussion task consisted of the following prompt: "As you read the articles this week and the teaming mini-cases, think about how networks have impacted how you assembled or were assigned into teams? How did these networks help or hinder your contributions to the teams? And, how did the networks impact the outcomes of the teams?" These online discussions were graded by teaching assistants for the course, who were unfamiliar with the hypotheses of this study. The discussions were worth 10-35% of the course grade.

3.2 Experimental Design

Team discussion behaviors were manipulated using a within-subjects design. Each team was exposed to four interventions, the order of administration of which was counterbalanced. The four interventions consisted of a) a control condition prompting members to share unique information, and b) three interventions corresponding to the three focal, functional information processing factors: task demonstrability, cooperativeness, and discussion structure. I selected sharing unique information as a baseline comparison to understand how functional information processing factors altered the nature of group information sharing patterns when teams were given specific instructions explaining how unique information should be leveraged during their discussions. Unique information refers to uncommon or differentiated information that each

member is capable to contributing to the information set in the discussion. The content of the discussion guidelines was based on the coding system presented by Mesmer-Magnus and DeChurch (2009).

Manipulations were introduced through online instructions presented along with the weekly discussion task within the online discussion tool. Instructions were incorporated below each discussion task prompt in blue, italicized text, and were visible to all team members. Teams were exposed to new instruction prompts every two weeks and received all four interventions by the end of the 8-week experimental observation period.

In the task demonstrability condition (D), team members read the following instructions: "Your group members have unique information, different perspectives, and diverse experiences. The goal of this discussion activity is to leverage these to arrive at a complete analysis of the issue/topic."

In the cooperativeness (C) condition, team members read the following instructions: "This week, your group needs to focus on developing a psychologically safe environment where each of you is comfortable and willing to share different ideas and perspectives. These diverse ideas are the key to your group's success. For example, you can create a positive supportive climate in the group by encouraging others, being open to new ideas, and praising members who suggest new ideas."

In the discussion structure (S) condition, team members read the following instructions: "This week your group should follow a structured discussion process. First, each member should post their ideas and perspectives BEFORE reading others' posts. Second, each member should

read their teammates' posts, and reply to each of them in a way that adds new information and/or extends the discussion to consider new information and perspectives."

Lastly, in the control (N), team members read instructions that asked them to fully consider the topic or issue but not how information should be shared: "This week, your group needs to focus on sharing unique information, different perspectives, and diverse experiences in order to allow you and your group members to more fully understand the issue/topic."

3.3 Manipulation Checks

I assessed participants' perceptions of the importance of their weekly discussion activity using 4 items developed for this study. The 4 items were selected such that they emphasized the significance of each instruction prompt. Specifically, participants were asked to rank the importance of each of the following activities in their weekly discussion: (1) share unique information with my group (control), (2) follow a structured discussion process (structure), (3) arrive at a complete analysis of the topic (task demonstrability), (4) develop a psychologically safe environment in my group (cooperativeness). A ranking of "1" meant that the activity was most important to the discussion, and a ranking of "4" meant that the activity was least important to the discussion. I expected participants to rank an activity as more important if they were currently exposed to the corresponding instruction prompt condition.

Table 3 summarizes manipulation check results for the 70 subjects who completed the manipulation check after the first week's discussion. The *t*-test results indicate that the interventions were perceived as intended. Specifically, subjects rated "sharing unique information" as significantly more important when exposed to the control condition compared to

one of the non-control conditions ($M = 1.29$, $SD = 0.13$ vs. $M = 2.25$, $SD = 0.14$ for the control vs. non-control conditions; $t(68) = 3.29$, $p < 0.01$); subjects rated "arrive at a complete analysis of the topic" as significantly more important when exposed to the demonstrability condition compared to one of the non-demonstrability conditions ($M = 2.00$, $SD = 0.15$ vs. $M = 2.55$, $SD = 0.16$ for the task demonstrability, vs. non-demonstrability conditions; $t(68) = 2.38$, $p < 0.05$); subjects rated "develop a psychologically safe environment" as significantly more important when exposed to the cooperativeness condition compared to one of the non-cooperativeness conditions ($M = 1.94$, $SD = 0.21$ vs. $M = 3.52$, $SD = 0.12$ for the cooperativeness vs. non-cooperativeness conditions; $t(68) = 6.45$, $p < 0.001$); and finally, subjects rated "follow a structured discussion process" as significantly more important when exposed to the structure condition compared to one of the non-structure conditions ($M = 1.67$, $SD = 0.26$ vs. $M = 2.62$, $SD = 0.13$ for the structure, vs. the non-structure conditions; $t(69) = 3.00$, $p < 0.01$).

Table 3. Descriptive Statistics for Manipulation Check Rankings

	In Ranking		Out Ranking		
Condition	*n*	*M (SD)*	*n*	*M (SD)*	*t*-test[a]
Control	14	1.29 (0.13)	56	2.25 (0.14)	3.29**
Demonstrability	28	2.00 (0.15)	42	2.55 (0.16)	2.38*
Cooperativeness	16	1.94 (0.21)	54	3.52 (0.12)	6.45***
Structure	12	1.67 (0.26)	58	2.62 (0.13)	3.00**

Note. In Ranking corresponds to ordinal rank (1-4) when subjects were exposed to condition and Out Ranking corresponds to ordinal rank (1-4) when subjects were not exposed to the condition.
[a]Two-tailed *t*-test to compare the difference in means between In Ranking and Out Ranking ordinal ranks.
*$p < .05$. **$p < .01$. ***$p < .001$.

3.4 Communication Patterns

I observed the communication patterns resulting from the sequence of threaded replies that emerged from team members commenting on each other's messages. A communication link was defined as a directed relation (e.g., dyadic tie) between two team members, created when one individual responded to another member's message. This definition aligns with prior research (Faraj & Johnson, 2011; Wasko & Faraj, 2005).

For each of the four observed networks (demonstrability, cooperativeness, structure, and control) the relations were recorded in a square, 185 by 185 binary matrix such that a "1" was placed in a cell if at least one reply linked the two team members together. A "0" was placed in the cell if the two team members were not linked. Figure 4 presents a graphical representation of each structural parameter used in the model to test a hypothesis or to control for structural effects. Three structural parameters were used to test for hierarchy (H1), reciprocity (H2) and transitive triad closure (H3).

Concept	**Network Parameter**	**Visual Motif**	**Description**
Information sharing	Edge (Control)		Baseline tendency for information exchange to occur

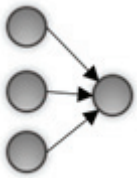
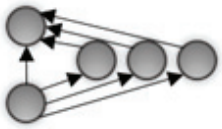
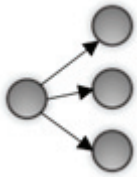
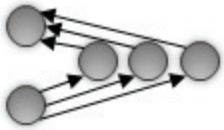
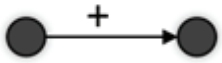
Hierarchy or centralization of indegree communication	Preferential Attachment (H1)		Tendency for variability in the degree to which team members receive information flows from others
Reciprocity (social exchange)	Reciprocity (H2)		Tendency for information exchange to be reciprocated
Transitive triad closure (group-level integration)	Transitivity (H3)		Tendency for transitive path closure to occur in the information exchange network
Centralization of outdegree communication	Expansiveness (Control)		Tendency for variability in the degree to which team members send information flows to others
Unconnected dyads	Non-edgewise partner distribution (Control)		Tendency for a team member to be excluded from information sharing
Differential interconnectedness of team members with greater discussion activity	Additive team member attributes (Control)		Tendency for information exchange to occur between team members with greater discussion activity
Differential interconnectedness of teams with shared traits	Discrete team member attributes (Control)		Tendency for information exchange to occur between teams sharing the same categorical attribute

Figure 4. Summary of Network Statistics Included in Each Statistical Model

***Participation & Hierarchy* (H1).** To test Hypothesis 1, I used the structural term, preferential attachment (Barabási & Albert, 1999) to measure the degree of hierarchy in each network. Preferential attachment captures the tendency that a few group members receive disproportionately more responses than others, resulting in an uneven indegree distribution among group members.

***Social Exchange & Reciprocity* (H2).** To test Hypothesis 2, I used the structural term, reciprocity, to measure the degree of reciprocal dependence in each network. Reciprocity captures the tendency that team member *j* will reply to team member *i* because team member *i* had previously responded to team member *j*. In other words, it corresponds to the tendency for group members to reply to others who have previously responded to them.

***Integration & Transitivity* (H3).** To test Hypothesis 3, I used the structural term, transitivity or triad closure, to measure the degree of group social exchange among team members in the network. Transitivity refers to the likelihood that a tie will form between two team members, *i* and *j,* when they both have existing ties with a third team member, *k* (Wasserman & Faust, 1994). Thus, it refers to the extent that members are contributing collectively to the discussion for a complete analysis of the task.

***Controls*.** I controlled for network density (edge term), the outdegree distribution (expansiveness term), and the unconnected dyads distribution, i.e., all dyads that do not have an edge (non-edgewise shared partners distribution term; see Figure 4) to properly capture our structural features of interest, while controlling for expected network properties. Moreover, I controlled for class effects using a categorical control variable, and the number of posts using a continuous control variable.

3.5 Statistical Network Analysis: Exponential Random Graph Model (ERGM)

I tested the focal hypotheses by estimating the extent to which the structural tendencies implied by these hypotheses influence the probabilities of observing specific realizations of each network. Since network data are relational, non-independent observations, the endogenous nature of statistical relationships between network structure and the presence or absence of specific ties in the network makes traditional statistical methods inappropriate for testing my hypotheses. Hence, I used Exponential Random Graph Models (ERGM, also known as p^*) to simultaneously test my hypotheses (Robins & Lusher, 2013). ERGMs estimate the likelihood of the observed network structures emerging out of all possible network configurations of that size generated by random assignment of the observed number of links. A key feature of ERGMs is that it allows us to obtain reliable estimates of a particular effect, while accounting for all other parameters that might also affect that probability (Contractor, Wasserman, & Faust, 2006). Like logistic regressions, positive and significant coefficients indicate that the corresponding network structures are more likely to occur than random chance, whereas negative and significant coefficients indicate that structures are less likely to occur than random chance. Also, the effect size of each additional network structure can be interpreted using the odds ratio, which equals the exponential function of the particular coefficient of interest (e.g., e^{β}). Thus, a value of 1.0 for suggests that the parameter has no effect on the probability of tie formation.

Below I explain how I specified each model to properly distinguish between plausible ties within teams and implausible ties between teams, and how I validated the goodness-of-fit (GOF) for each model.

Structural Zeros. A structural zero matrix properly specifies my models for ERGM analysis by denoting which ties are plausible and implausible in the discussion network. I specified a structural zero matrix for each model by creating a square 185 by 185 binary matrix, where a zero was placed in a cell if the relation was a feasible tie between members on the same team and a one was placed in the cell if the relation was an infeasible tie between members on different teams.

***Goodness-of-fit evaluation*.** Once the ERGM coefficients were estimated, it defines a probability distribution across all networks of this size. If the model is a good fit to the observed data, then the networks drawn from this distribution will be more likely to resemble the observed data (Robins & Lusher, 2013). I assessed the goodness-of-fit of my fitted model by comparing the observed graph statistics (i.e., indegree and outdegree distribution) with the values of these statistics for a sizeable number of networks that are simulated based on each fitted ERGM (Hunter, Handcock, Butts, Goodreau, & Morris, 2008).

Lastly, I used statnet for estimation purposes (Hunter et al., 2008).

4. RESULTS

4.1 Descriptive Statistics: Online Team Discussions

Table 4 provides descriptive statistics for the average number of posts, comments, and thread length for groups in each condition, as well as *t*-test results comparing the corresponding means. The descriptives in Table 2 show groups made significantly fewer posts when they were exposed to the demonstrability condition (M_{posts} = 0.78; F = 2.28, df = 3) than when they were exposed to the control (M_{posts} = 0.87), structure (M_{posts} = 0.86) or cooperativeness conditions (*M*

= 0.85). Groups made the most comments ($M_{comments}$ = 0.67; F = 2.93, df = 3) and had the longest discussion threads ($M_{thread\ length}$ = 1.77; F = 2.08, df = 3) when they were in the structure condition, compared to the control ($M_{comments}$= 0.48; $M_{thread\ length}$ = 1.57), demonstrability ($M_{comments}$= 0.55; $M_{thread\ length}$ = 1.75), or cooperativeness ($M_{comments}$= 0.47; $M_{thread\ length}$ = 1.60) conditions.

Table 4. Descriptive Statistics on Team Discussion Metrics

	Control			Demonstrability			Cooperativeness			Structure		
Metric	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Posts	282	0.87[a]	0.53	256	0.78[b]	0.58	275	0.85[a]	0.43	275	0.86[a]	0.43
Comments	154	0.48[a]	0.98	179	0.55[a]	0.90	152	0.47[a]	0.85	215	0.67[b]	1.19
Thread Length	282	1.57[a]	1.12	256	1.75[a]	1.47	275	1.60[a]	1.16	275	1.77[b]	1.28

Note. The sample size is 38 teams and 185 individuals.
[a]*t*-tests denote no significant difference in means, i.e., $p > 0.05$.
[b]*t*-tests denote significant difference at $p < 0.05$ level of significance for at least one comparison of means.

4.2 Descriptive Statistics: Team Communication Patterns

To examine the impact of information processing factors on team communication patterns, I computed descriptive network statistics to examine how the interventions altered the emergent participation, social exchange, and integration patterns for each network.

Participation Patterns. I computed the count of edge and isolated network statistics for each corresponding network to determine the extent that participants interacted with others, versus being excluded or isolated from the discussion due to hierarchy or subgrouping. Table 5 shows that all intervention processing conditions led to more interactions (edges) and fewer isolated individuals (isolates), compared to the control condition. In other words, when teams were exposed to the information processing interventions, they were more likely to extend each other's posts, such that more members were actively part of the discussion.

Table 5. Descriptive Network Statistics on Participation Patterns

Network Statistics	Control	Demonstrability	Cooperativeness	Structure
No. of Edges	77	115	93	129
No. of Isolates	105	73	85	63

Note. The sample size is 38 teams and 185 individuals. Network statistics are counts of edges and isolates, which correspond to the number of times a post was extended by another team member, and the number of people whose posts were not extended by others, respectively.

Social Exchange Patterns. I examined the nature of social exchange patterns by computing the total count of reciprocated (dyadic) statistics for each network. The network statistics in Table 6 show that the number of dyadic interactions remained similar across all conditions.

Integration Patterns. Lastly, I examined integration patterns capturing the extent of group-level communication by computing the total count of transitive triad statistics for each network. Table 6 shows that the number of closed triadic structures was higher in the conditions treated with information processing interventions than the control condition.

Table 6. Descriptive Network Statistics on Social Exchange Patterns

Network Statistics	Control	Demonstrability	Cooperativeness	Structure
Reciprocity	13	17	12	21
Transitivity	20	44	34	49

Note. The sample size is 38 teams and 185 individuals. Network statistics are counts of reciprocated interactions and transitive interactions, which correspond to the count of dyadic social exchanges and the count of triadic (group) social exchanges, respectively.

4.3 Hypothesis Tests: ERGM Results

Although descriptives provide an overview of how the interventions altered team communication patterns, a limitation of examining simple counts is that they do not capture the interdependencies between relational data that comprise my various network structures of interest. As a result, it does not enable simultaneous testing of my hypotheses to determine the relative contribution of the participation, social exchange, and integration communication patterns. Hence, I now present the ERGM results in Table 7 that are used to test the study's three main hypotheses.

Hypothesis 1 posited that groups in the control condition would exhibit greater hierarchical participation than groups in the treatment conditions. In Table 7, Model 1 shows the control groups and Models 2-4 show the demonstrability, cooperativeness and structure groups. As shown in Table 7, Model 1, hierarchy is significantly related to team information sharing. A negative coefficient indicates the existence of hierarchy (Model 1; Effect estimate = -1.06; $p < 0.05$). In contrast, Models 2-4 for the treatment groups show that the hierarchy terms were not significant when teams were exposed to the demonstrability (Model 2; Effect estimate = -0.37;

ns), cooperativeness (Model 3; Effect estimate = 0.04; ns), or structure prompts (Model 4; Effect estimate = -0.02; ns). The lack of hierarchy indicates that teams exposed to functional information processing factors had less hierarchy or more even participation and distributed member influence. To further evaluate this finding, I ran a post hoc analysis (reported below in Section 4.4) that enabled direct comparisons across models to show that the degree of hierarchy was significantly different between each of the information processing networks and the control network. Based on the ERGM and supplementary analysis, Hypotheses 1a (demonstrability), 1b (cooperativeness), and 1c (structure) were supported. Thus, in support of H1, the control teams showed a greater tendency towards hierarchical discussions than the treatment teams, whereby individuals were more likely to accrue additional replies if other members had already commented or responded to them.

Hypothesis 2 posited that online discussions in the control groups would be more likely to exhibit reciprocity than those in the treatment groups. Examining Table 7, Model 1 shows that when the teams were not exposed to the information processing factors, their interactions showed a strong norm of reciprocity. The odds ratio associated with reciprocity indicates that individuals were 3.78 times more likely to respond to a post by a teammate who has previously responded to their post, than to respond to a teammate who has not previously respond to their post (Model 1; Effect estimate = 1.33; $p < 0.01$). In contrast, examining Table 7, Models 2-4 show that when teams were treated with information processing factors of demonstrability (Model 2; Effect Estimate = 0.33; ns), cooperativeness (Model 3; Effect Estimate = 0.23; ns), and structure (Model 4; Effect Estimate = 0.53; ns), their interactions were less likely to exhibit reciprocity. In

addition, the results from the ERGM supplementary analysis showed that Hypothesis 2a (demonstrability), 2b (cooperativeness), and 1c (structure) were supported.

Hypothesis 3 proposed that teams exposed to functional information processing prompts would be more likely to exhibit transitivity than those in the control condition. Examining Table 7, Model 2 shows a positive and significant term for transitivity or transitive triads, suggesting that demonstrable tasks created high interconnectedness between team members during their information exchanges (Effect estimate = 0.98; $p < 0.01$). The corresponding odds ratio indicates that team members were 2.68 more likely to complete an information exchange triad than to leave it open or incomplete. Similarly, Table 7, Model 3, shows a positive and significant term for group social exchange (Effect estimate = 0.79, $p < 0.05$), as does *Table 7*, Model 4 (Effect estimate = 0.64, $p < 0.05$). The corresponding odds ratios indicate that teams with cooperative and structured group discussions were 2.19 and 1.89 times more likely to complete an information exchange triad than to leave it open or incomplete, respectively. In contrast, examining Table 7, Model 1, I find no positive, significant term for transitivity (Effect estimate = 0.35; ns). The significance of transitive triads in teams exposed to functional information processing factors indicates that team members were more likely to focus on the completeness of information exchange than those in the control teams. In addition, the results from the ERGM supplementary analysis shows that Hypothesis H3a (demonstrability), H3b (cooperativeness), and H3c (structure) were supported.

Table 7. Exponential Random Graph Models (ERGMs) of Team Communication Networks

Parameter	Model 1 Control		Model 2 Demonstrability		Model 3 Cooperativeness		Model 4 Structure	
Structural effects								
H1: Hierarchy (negative)	-1.06*	0.35	-0.37	0.69	0.04	1.04	-0.02	0.98
H2: Reciprocity	1.33**	3.78	0.33	1.39	0.23	1.26	0.53	1.70
H3: Transitivity	0.35	1.42	0.98**	2.68	0.79*	2.19	0.64*	1.89
Endogenous Control Variables								
Edge	-2.90***	0.06	-2.33***	0.10	-3.50***	0.03	-2.51***	0.08
Expansiveness	0.33	1.39	0.47	1.61	0.41	1.50	-0.30	0.74
Non-edgewise partners	0.14	1.15	-0.12	0.89	-0.09	0.91	-0.08	0.92
Exogenous Control Variables								
Personal attributes (continuous)								
Posts	0.13*	1.14	0.00	1.00	0.07	1.08	0.26***	1.29
Personal attributes (categorical; class 1 = baseline)								
Class 2	0.11	1.12	-0.08	0.93	0.22	1.25	-0.13	0.88
Class 3	0.42**	1.51	0.19	1.21	0.65***	1.91	0.09	1.09

Note. The sample size is 38 teams and 185 individuals. Each ERGM compares the observed ties to their likelihood in simulated random networks. The total possible observed ties in the 38 team, 185 person directed network is 756. Each model consists of an ERGM that was run on the team discussion networks that commenced during the two weeks immediately following the focal intervention (i.e., control, demonstrability, cooperativeness, or structure). A negative parameter estimate for the hierarchy term indicates the presence of hierarchy.

*$p < .05$. **$p < .01$. ***$p < .001$.

***Goodness-of-Fit (GOF) Evaluation*.** I examined the goodness of fit of each ERGM by comparing the structural statistics of interest in the observed networks to a sample of networks simulated from the fitted model. For each network, I simulated 100 sample networks. The GOF evaluation showed that models replicated the selected statistics well, indicating that the fitted models sufficiently capture the features of my original network.

4.4 Post Hoc Analysis: Comparing Coefficients Across Models

Because the fitted coefficients computed from ERGM compare the significance of each parameter to a random network, these coefficients cannot be directly compared across models. I present an alternative approach using simulation to compare the degree of hierarchy, reciprocity, and transitivity across models.

***Participation Patterns*.** To further interpret how information processing altered the distribution of participation patterns, I used simulation to directly compare whether the degree of hierarchy was significantly different between each of the information processing factor networks and the control network. Specifically, I simulated the indegree distributions from the fitted preferential attachment term for each model and used a) *t*-tests to compare the equality of mean indegree and b) Kolmogorov-Smirnov tests to compare the equality of indegree distributions between each of the fitted information processing networks and the control network. In accordance with hierarchy, I expected the control network to have both a lower average indegree and a more highly right-skewed indegree distribution.

Table 8 displays the results from simulation. First, I compared the observed indegree from each of the observed networks to the mean indegree simulated from the fitted models to examine the goodness-of-fit of the indegree distributions for each network. The non-significant *t*-tests indicate that there are no differences between any of the observed and fitted models: Control ($t(499) = -0.59$, $p = 0.56$); Demonstrability ($t(499) = 0.25$, $p = 0.81$); Cooperativeness ($t(499) = 0.59$, $p = 0.56$); and Structure ($t(499) = 1.12$, $p = 0.27$). The lack of significant differences indicates that the indegrees simulated from the fitted models replicate the observed indegrees well.

Then, examining Table 8 for the *t*-test results for equality of means, each simulated mean indegree from the fitted information processing factor networks is significantly different from the simulated control network. Specifically, I find a significant difference between Model 2 vs. Model 1 ($t(998) = -46.90$, $p < 0.001$), a significant difference between Model 3 vs. Model 1 ($t(998) = -28.66$, $p < 0.001$), and a significant difference between Model 4 vs. Model 1 ($t(998) = -76.07$, $p < 0.001$). The results from these *t*-tests indicate that the degree of hierarchy was significantly higher in the control network, than any of the information processing networks.

Next, examining Table 8 for the Kolmogorov-Smirnov test results for equality of distributions, each of the simulated indegree distributions in the information processing networks is significantly different from the control indegree distribution. In particular, I find a significant difference between Model 2 vs. Model 1 ($D = 0.87$, $p < 0.001$), a significant difference between Model 3 vs. Model 1 ($D = 0.64$, $p < 0.001$), and a significant difference between Model 4 vs. Model 1 ($D = 0.99$, $p < 0.001$). Accordingly, the Kolmogorov-Smirnov test results confirm that participation was more even in the information processing networks than the control network.

Table 8. Simulation Analysis for Hierarchy vs. Even Participation

	Within condition indegree comparison			Between condition indegree comparison	
Condition	Observed *M*	Simulated *M (SD)*	*t*-test[a]	*t*-test[b]	K-S test[c]
N	56.63	56.45 (6.92)	-0.59	--	--
C	77.89	77.98 (7.58)	0.25	-46.90***	0.87***
S	68.36	68.53 (6.39)	0.59	-28.66***	0.64***
D	91.21	91.59 (7.67)	1.12	-76.07***	0.99***

Note. Table statistics correspond to results from 500 simulations.
[a]Corresponds to a two-tailed, one sample *t*-test.
[b]Corresponds to a two-tailed, two sample *t*-test.
[c]Corresponds to a two sample Kolmogorov-Smirnov test.
*$p < .05$. **$p < .01$. ***$p < .001$.

Social Exchange & Integration Patterns. I performed similar analyses for H2 (reciprocity) and H3 (transitivity) and the results of the post hoc analyses find support for both hypotheses H2 and H3. For conciseness, I do not report them here.

5. DISCUSSION

Team communication is an important group process affecting organizational decision making and is central to organizational success. As information communication technologies continue to advance, digital-mediated communication is rapidly becoming the new norm, with virtualness being a matter of degree rather than a distinct binary variable. Despite the need for effective communication, teams often fail to share information, knowledge, opinions and ideas, often manifesting as hierarchy or subgrouping, with both tendencies often leading to *suboptimal*

patterns of interaction among members. A key question to the management of online teams is: how do team communication networks form? Further, what communication structures depict *optimal* interaction patterns? I conducted an experiment to explore these questions and identify the structure of optimal team communication patterns. The findings show interventions rooted in group information processing can improve the quality of team information sharing. I report causal evidence showing that interventions based on three information processing factors (demonstrability, cooperativeness, and structure) lead to more even participation, less subgrouping, and more integrative, group-level communication in online team discussions. Thus, this research contributes to group information processing theory and our understanding of team processes. It also has practical implications supporting the use of interventions that emphasize how information should be processed during online team discussions, particularly in the context of team learning (Edmondson, Bohmer, & Pisano, 2001).

To address these issues, I tested how different group information processing factors alter members' communication patterns, with respect to participation, social exchange, and integration of communication. Specifically, I tested the effects of three interventions based on replicable evidence designed to improve how online discussion groups process information. These interventions included: task demonstrability, cooperativeness, and discussion structure. Taking a social network approach, I compared team communication patterns when teams were informed to share unique information but not given explicit instructions on how they should leverage their diverse information during discussions.

These results suggest that in the absence of functional information processing strategies, small groups tend to be characterized by hierarchical participation and subgrouping. In other

words, communication tends to concentrate on the first few participants in the discussion, and members tend to segregate into two-person subgroups or dyadic, due to the natural tendency or social norm for individuals to respond to others who have previously responded to them. Although these communication patterns promote efficiency and intimate relationships, they indicate that teams are not taking advantage of their diverse informational sets and incorporating them in the discussion.

In contrast, I find that groups with functional information processing factors exhibit communication patterns that suggest less hierarchical participation, fewer mutual or back and forth exchanges between members, and greater integration of information flows. Thus, members are more likely to contribute evenly to the discussion and communicate interdependently as a group, providing more opportunities for the team to engage in a complete analysis of the task.

5.1 Theoretical Implications

This research makes several contributions to the understanding of how team communication networks form. First, I contribute to theory and understanding of team communication - a process critical to how teams carry out teamwork processes, such as goal setting, planning, information sharing and coordination (Lepine et al., 2008; Marks et al., 2001). I contribute to theory on team processes by identifying the causal mechanisms that explain how group information processing factors can enable more effective team communication, by promoting more integrative information exchange among all members.

Second, this study advances the understanding of the structure of team processes. Although theories of team processes have focused primarily on content and temporal

implications, they have largely ignored the implications of structure. In this study, I characterize communication structures associated with optimal team interaction. In examining the structure of team communication, this study reveals the trade-offs (Crawford & Levine, 2013) between efficiency, vulnerability, and coordination (Malone, 1988). By tracing the microstructures of team communication patterns, we gain insight into the vulnerability costs associated with disruption of an *inflexible* hierarchical structure. Although hierarchy may promote efficiency, it is also exposes a team to vulnerability. For instance, the level of disruption is likely to be high if a central person is removed from a hierarchical communication. In contrast, a less hierarchical structure may mitigate the disruption cost because members participate more evenly, and their roles are more interchangeable. In other words, the discussion is not dependent on a central individual that is responsible for coordinating, synthesizing, and interpreting the team's communication.

Third, this work casts demonstrable, cooperative, and structured discussions as being equally productive to effective team communication. More specifically, I found that all three functional information processing factors lead to reduced hierarchy and subgrouping, along with greater integration of communication in the group as a whole. This result is novel in the literature because demonstrability, cooperativeness, and structure each targets a different dimension of basic human capacities; that is, demonstrability is a cognitive intervention, cooperativeness is an affective intervention, and structure is a behavioral intervention. Yet these targeted interventions all result in more optimal communication patterns, whereby teams are better equipped to overcome their hierarchical and subgrouping tendencies to achieve greater group-level communication. These findings provide an alternative perspective to the view that structured

discussions are generally more productive than unstructured ones (Desanctis & Gallupe, 1987; Guzzo & Dickson, 1996). Instead, I suggest that a broad range of small interventions can be successful as long as they encourage members to use their diverse resources effectively.

5.2 Practical Implications

These findings have practical implications for improving the effectiveness of team communication. I show that interventions promoting functional information processing strategies can be a potential way to improve how members' diverse informational resources are processed. More specifically, I provide three specific strategies that managers can use to promote even participation and interdependent, group-level communication during online group discussions. These strategies can be easily implemented by team leaders or discussion moderators at the onset of team discussions. First, moderators should provide explicit instructions to the team that frame the task as having a demonstrably correct solution, as opposed to being a matter of personal judgement. Second, moderators should open discussions with remarks that set the stage for constructive conversations that promote a psychologically safe environment. Third, moderators should provide structure to the discussion process. Since these interventions are more effective on teams without established norms (Okhuysen, 2001), I recommend that managers use these interventions on newly formed teams to guide how members exchange ideas and perspectives during the planning, monitoring, and evaluation of different team processes.

5.3 Limitations and Future Research

Although this research provides important contributions, it has several limitations that point toward possible future research. First, this experiment has limited external validity, which

is rooted in the use of student samples and learning tasks. One direction for future research is to test the external validity of the findings by replicating them in non-student samples and longer duration, project-based tasks, such as organizational work teams.

Second, I did not examine the relationship between the emergence of certain structural configurations and team effectiveness. Transitive triad closure has received much attention in the literature but has yielded inconsistent results. In particular, it is possible that increasing interdependence is not necessarily positively related to decision outcomes, as it may prevent team members from achieving consensus (Watson et al., 1988). Past researchers have posited that the relationship between group interdependence and effectiveness is U-shaped, with moderate levels of closure enhancing team effectiveness (Crawford & Lepine, 2013; Oh, Chung, & Labianca, 2004; Stewart & Barrick, 2000). Hence, further research could investigate the relationship between information interdependence and team performance.

Third, I observed the structure of discussions for only two weeks following the intervention. It may be the case that the effects of these interventions wear off quickly and need to be reiterated over time as the team continues to work together. In addition, it is possible that team members engage in discussions differently over time, especially as they gain greater familiarity of their teammates' preferences, competence and expertise. Future research is needed to explore the "shelf-life" of these interventions, and also the ability for subsequent "refresher interventions" to have their intended effects.

6. CONCLUSION

This study enriches understanding of team communication networks and provides actionable guidance for improving communication in online team discussions. I advance theory on team processes and team effectiveness by adopting a structural approach that examines the communication patterns that emerge during online team discussions. I demonstrate that teams benefit from guidance explaining how members should leverage and process unique information. This guidance can be provided through the use of simple instructions or interventions that enable teams to focus on in-depth processing and information elaboration. These strategies shift communication patterns from hierarchy and reciprocity to greater integration of communication and interdependence among members. Lastly, managers can easily adopt these practical instructions to improve the effectiveness of team communication in online team discussions.

CHAPTER 3. SOCIAL MEDIA AND THEIR AFFORDANCES FOR EFFECTIVE TEAMWORK

1. INTRODUCTION

Teamwork is an essential component of effective organizations. Over the past few decades, organizations have faced stronger global competition, consolidation, and more innovative competitors. These pressures necessitate increased flexibility and adaptability. To adapt to the increasing demands of the workplace, individuals are teaming up in new ways. Contemporary teams are no longer bounded, stable entities (Mathieu, Hollenbeck, van Knippenberg, & Ilgen, 2017). People are joining more teams (multiteam membership; Mortensen, Woolley, & O'Leary, 2007), and working in larger teams (project networks; Brzozowski, 2009), diversified teams (cross-functional teams; Daspit, Justice Tillman, Boyd, & Mckee, 2013), distributed teams (virtual teams; Hinds & Mortensen, 2005; Maznevski & Chudoba, 2000), and systems of teams (multiteam systems; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; Zaccaro, Marks, & DeChurch, 2012).

Despite the prevalence of work teams, and their importance to organizational effectiveness, teams are often unsuccessful in producing high quality outcomes. Repeated studies across varied contexts find teams have natural organizing tendencies that counter what research would suggest is optimal for their performance. For example, with respect to diversity, research based on similarity-attraction (Byrne, 1971) and social homophily (Lazarsfeld & Merton, 1954) theories demonstrate that individuals tend to form teams with similar others, the consequence of

which is to limit diversity (Hinds, Carley, Krackhardt, & Wholey, 2000). However, research finds that teams are more innovative (Taylor & Greve, 2006) and productive (Ancona & Caldwell, 1992) when they are composed of functionally diverse individuals.

Enterprise social media (ESM) offer an unprecedented way for teams to engage in more effective team processes. Organizations are increasingly using social media for internal communication and social interaction within the organization (McFarland & Ployhart, 2015). A 2016 study conducted by Margolis Group found that 66 percent of companies surveyed currently use an ESM platform, and that the percentage using these tools continue to grow (Shaw, 2016). Unlike external uses of social media that cross multiple public platforms, most organizations use an integrated social media platform for internal communications (Leonardi & Vaast, 2017).

ESM offer workers several new capabilities, making it possible for anyone to create, circulate, share and exchange information in a variety of formats and with multiple communities. For instance, workers can communicate messages with specific coworkers or broadcast messages to everyone in the organization, post, edit and sort files linked to themselves or others, and view the messages, connections, text and files communicated by anyone else in the organization at the time of their choosing (Leonardi et al., 2013). Although traditional communication technologies offer some of these capabilities, social media offer all these activities simultaneously. Moreover, the openness of ESM contrasts the closed nature of interactions of traditional communication technologies that typically occurs among subgroups that rarely share their information with others (Majchrzak, Faraj, Kane, & Azad, 2013). Thus, rather than functioning as a *channel* through which communication travels, ESM operate as a *platform* for public communication that expand the range of people, groups, networks, and texts from whom people and teams can learn

and share knowledge with across the organization (DiMicco, Geyer, Millen, Dugan, & Brownholtz, 2009; McAfee, 2009). Although ESM is gaining widespread adoption in organizations, there has been limited theory building on the effects of social media use on organizational phenomena, particularly at the team and inter-team level (Leonardi & Vaast, 2017). Much of the work on teams and technology continues to be rooted in virtual teams using traditional communication technologies (Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015), where organizing in teams and technology are largely viewed as *discrete entities* rather than being *mutually dependent* (Orlikowski & Scott, 2008).

In this chapter, I aim to understand how ESM enable work teams to organize differently. This chapter focuses on self-managing teams, where members take responsibility for their own work, monitor their own performance as well as alter their performance strategies based on situational demands to solve problems and adapt to changing conditions (Hackman, 1986; Wageman, 1997). The autonomy that self-managing teams have in setting their direction, structure, performance and executing their work offers the most potential in theorizing the potential effects of social media use on team functioning. I begin by reviewing studies on ESM use within organizations that have examined how social media has offered organizational workers novel approaches to accomplish their work tasks. Based on this review, I identify a distinct set of social media affordances that are relevant to teams. I then integrate past research on conceptual models of team effectiveness to identify eight illustrative team processes, or enabling conditions (Hackman, 2012), that increase the odds that a team will be effective. To demonstrate how social media use may impact teams, I consider how social media may have countervailing (desired and undesired) influences on team processes. The use of social media by

teams introduces both *affordances* and *constraints* on team members' behaviors. These can either enable teams to overcome some of their perennial challenges or accentuate suboptimal self-organizing tendencies. Lastly, I explain how team task and socioemotional motives serve an important role in determining how affordances are enacted by teams, and their ultimate consequences on team processes.

2. TOWARDS AN AFFORDANCE LENS ON SOCIAL MEDIA USE AND TEAMS

Research on teams and technology or "virtual teams" is prevalent across management research. A Web of Science search for "virtual teams" returned a total of 582 articles published in management and business journals over the past decade. This research tends to focus on technology and teams as discrete entities, with three core themes. First, research tends to compare virtual teams to face to face teams. This view is disconnected from how teams function, as contemporary teams consistently leverage technologically enabled communication to accomplish their work. Yet given the long history of scholarly research on work teams (Mathieu, Hollenbeck, van Knippenberg, & Ilgen, 2017), the bulk of our understanding of teams is still based on "traditional" teams where members are collocated and communicate face to face (Bell & Kozlowski, 2002; Hinds & Bailey, 2003). Accordingly, scholars have largely viewed face to face interaction as the gold standard and have drawn conclusions about virtuality as a context for organizing in teams. Second, the underlying assumption is that virtual tools have fixed properties that are static across team needs and context. Recent conceptions of this line of thinking have portrayed virtuality along key scaling dimensions, such as the richness of informational value offered or the degree of synchronicity that team members interact using the technology (Kirkman & Mathieu, 2005). Team virtuality then emanates from a combination of these antecedent

conditions (e.g., Jarvenpaa & Leidner, 1999; Kirkman & Mathieu, 2005). Third, virtual teams research continues to focus on conventional technologies, such as email, chat, or discussion forums, despite the rapid uptake of newer technologies, such as social media within organizations as either complementary modes of communication or supplanting these conventional technologies.

The bulk of the existing research on virtual teams points to a discrepancy between how scholars have conceptualized virtuality and contemporary work practices, where technology is everywhere to be found in organizing (Orlikowski & Scott, 2008). Traditional virtual teams research has for the most part viewed technology as an exogenous force or as an obdurate piece of hardware that is distinct from humans and organizations (Orlikowski, 2010). For example, virtuality is often conceptualized as an "input" or "moderator" in models of team effectiveness (e.g., input-processes-output or IPO model; see Hackman & Morris, 1975), where the objective is to determine the relationships, effects or tendencies that extend generally and hold broadly across technologies. When viewed in this light, the roles of human agency and social context in shaping technology use are largely ignored, and technology is assumed to be stable and predictable (Orlikowski, 2010). However, the theoretical image of fixed or inflexible technologies does not adequately represent the empirical reality of current work trends (Leonardi, 2011). Rather, workers have different opportunities to make material changes to the technologies that they work with; hence, technologies are no longer fixed but flexible. Together, these factors pose a need to question whether teams and their engagement with new technologies should still be examined as discrete entities, or if in fact, mutually dependent ensembles (Orlikowski & Scott, 2008).

I address this question by proposing that teams research adopt a sociomaterial perspective on technology use. This perspective suggests that a technology's social uses and materiality are entangled, and that human action shape the material attributes as does the material in shaping human action (Orlikowski, 2007). Specifically, I introduce an affordance lens to develop theory on how teams use the material features of social media technologies to overcome their teaming challenges. An affordance lens accounts for the relationship between materiality and social action. The term "affordance" refers to the potential for action that new technologies provide to users and is useful in explaining how human and material agencies become imbricated, or function interdependently to enable people to attain their goals (Leonardi, 2011). All technologies are constructed out of material features that have properties that transcend their context of use that permit certain actions and limit others. When individuals perceive that those features allow them to perform certain actions, the technology can be said to provide an "affordance" (Treem & Leonardi, 2012).

Affordances are not exclusively properties of people or of objects. Rather, they are constituted in the relationships between actors and the materiality of the things with which they come in contact (Gibson, 1986). Hutchby (2001) argues that an object's affordances can change across different contexts even though its materiality does not. By focusing jointly on objects' materiality and on people's perceptions of affordance, an affordance lens is useful for developing theories that help explain why, how, and when new technologies become enrolled in and affect organizational action (Faraj & Azad, 2012). This approach asks what combinations of material features allow people to do things they could not do before, or to do things that were previously difficult to do without the technology. Also, as Leonardi (2011) suggests, people may perceive

that an object offers no affordances for action, perceiving instead that it *constrains* their ability to carry out their goals. Thus, people's goals guide and shape their interactions with a new technology, leading them to perceive a technology as offering distinct possibilities or constraints for action. In short, objects can be used in myriad ways and have multiple effects on the organization of work (Fayard and Weeks, 2007; Zamutto, Griffith, Majchrzak, Dougherty, & Faraj, 2007).

Although the literature has advanced understanding of social media for organizing, there has been little theorizing at the team and inter-team level (Leonardi & Vaast, 2017). This gap in understanding is problematic because perceptions of social media affordances are dependent on the specific actor or group of actors that interacts with these technologies (Faraj & Azad, 2012; Leonardi, 2013). Factors such as the contextual needs for collaboration and interdependence, physical and temporal proximity, number of interaction partners, commonness of activities, and formal reporting relationships influence how affordances are perceived (Rice, Evans, Pearce, Sivunen, Vitak & Treem, 2017). This suggests that teams may perceive a technology's affordances differently than those communicating over social media at the interpersonal or the organizational level.

To advance understanding of how teams enact affordances, I propose that team motives direct and energize teamwork towards accomplishing a team's goals. Team motives have two dimensions: task and socioemotional (Bales, 1950; 1970; Cartwright & Zander, 1968). When task motives are activated, team members engage in work aimed at accomplishing the team's desired end product or objective. When team socioemotional motives are activated, team members engage in relationship building activities that promote group solidarity and attraction

between members (Zaccaro, 1991; Zaccaro & Lowe, 1988). Although teams pursue both task and socioemotional motives, teams vary on their strength and relative emphasis of these motives temporally over time. For example, when a team evaluates the feasibility of a new idea, it may exhibit a strong task orientation. However, when disagreement emerges, the dominant motive may switch to socioemotional-oriented to manage and resolve conflict. A team's orientation towards their task or socioemotional motives is shaped by the material features of the technologies they use and the social context of their environment. By social context, I draw upon Zack and Kenny (1995)'s definition of social context as the culture, distribution of power, and the social norms, habits, practices, expectations, and preferences held by team members regarding their present and past patterns of interaction.

Team task and socioemotional motives provide a useful frame for understanding the basic forces that shape how team members perceive the material features of technology, and their accompanying potentials. When team members encounter technologies, their orientation toward task or socioemotional needs affects how they view material features of technology. This motivated perception of technology that results from a combination of team motives, social context, and technological features, sparks the imbrication or interlocking of human and material agencies to facilitate goal accomplishment (Leonardi, 2011). Based on this conceptualization of team motives, I develop a conceptual framework for understanding how teams actualize affordances to achieve their immediate and concrete outcomes. This approach provides more specificity to the relationship between goals and affordances, which has for the most part been left ambiguous by organizational scholars studying technology practices (Anderson & Robey, 2017; Faraj & Azad, 2012; Leonardi, 2011; Strong et al., 2014).

2.1. Affordances for Team Processes

Organizational scholars have identified dozens of affordances across a range of contexts and using varied methodologies (e.g., see Evans et al. 2016; Flyverbom et al. 2016; Majchrzak et al., 2013; Rice et al., 2017; Treem & Leonardi, 2012). The review of the literature suggests that four primary affordances are consistently identified across social media platforms: visibility, persistence, association, and editability (Clark & Brennan, 1991; Treem & Leonardi, 2012). These affordances have been shown to accommodate a large degree of variability in user perceptions depending on the context in which they are used (Evans et al., 2016). The potential range of outcomes largely motivated their inclusion as the four primary affordances in the taxonomy shown in Table 9. Nested within each of the primary affordances are related secondary affordances that have the potential to emerge as a consequence of the primary affordance that supersedes them. Table 9 provides a summary description of the primary affordances and their related secondary affordances. Due to their broad array of potential outcomes associated with the primary affordances, I propose relationships between the four primary affordances and team processes. The remainder of this section provides a detailed description of these affordances.

Table 9. Taxonomy of Primary and Secondary Social Media Affordances

Affordance	**Definition**	**Previous Research/Citations**
Visibility	Information about someone's network, activities, skills, and knowledge that is easily accessible	Treem & Leonardi (2012)
Triggered attending	Subscribing to topics of interest to receive updates	Majchrzak et al. (2013)
Pervasiveness	Facilitating spread of one's knowledge or	Rice et al. (2017)

	opinions through multiple channels	
Awareness	Awareness of information, opinions, activities, and location of others	Rice et al. (2017)
Self-presentation	Crafting one's image	Rice et al. (2017)
Generative Role-Taking	Spontaneous moderation of discussions	Majchrzak et al. (2013)
Persistence	Shared information persists for others to review at any time	Treem & Leonardi (2012); Rice et al. (2017)
Searchability	Easy to search for association and content	Rice et al. (2017)
Reviewability	Ability to view and manage content over time	Faraj et al. (2011); West & Lakhani, (2008)
Replicability	Ease of duplication	Ellison et al. (2015)
Recombinability	Ability to build on own and other's prior contributions	Faraj et al. (2011)
Editability	Information can be edited before or after it is shared with others	Gibbs et al. (2013); Rice et al. (2017);
Self-presentation	Crafting one's image	Rice et al. (2017)
Shaping	Publicly modifying and reorganizing content	Faraj et al. (2011)
Association	People are associated with content they share and with other people in their network	Treem & Leonardi, (2012);
Network informed associating	Visibility of association facilitated by network transparency	Ellison et al. (2015); Majchrzak et al. (2013)
Metavoicing	Sharing and engaging with someone else's posts, knowledge or opinions	Majchrzak et al. (2013)

Visibility. Social media afford users the ability to make their behaviors, knowledge, preferences, and communication network connections that were once invisible, or difficult to see, visible to others (Treem & Leonardi, 2012). Visibility is related to the amount of effort people need to expend to locate information: if information is difficult to locate or people are unaware of its existence, then it is unlikely that they will seek it out (Brown & Duguid, 2001). Often, the private communication acts between colleagues or subgroups are invisible to others and difficult to attend to (Leonardi et al., 2013). Social media offers a means to overcome these challenges by enabling others to easily see the work of others and the emergent conversations about their work (Treem & Leonardi, 2012). In other words, visibility can lead to the development of more accurate organizational metaknowledge, which refers to knowledge about who knows what and who knows whom within the organization (Leonardi, 2014; Leonardi, 2015).

Persistence. A communicative act is persistent if it affords users the ability to access it in the same form as the original display at any time after the actor has finished his or her presentation (Bregman & Haythornthwaite, 2003). Social media enables communal conversations to persist past their initial point of presentation, and in a manner that does not expire or disappear (Treem & Leonardi, 2012). According to Erickson and Kellogg (2000), "persistence opens the door to a variety of new uses and practices: persistent conversations may be searched, browsed, replayed, and annotated, visualized, restructured, and re-contextualized with what are likely to be profound impacts on personal, social and institutional practices." Thus, the ability to view past interactions and information affords individuals the ability to learn from the experiences of their predecessors, despite not being present to witness the actual interactions between the original communicators (Leonardi et al., 2013).

Association. Association refers to established connections between individuals, between individuals and content, or between content and content (Treem & Leonardi, 2012). Although traditional communication technologies make individuals' personal connections visible, social media makes others' communication public, and provides users with the ability to see how people are connected to other people, how people are connected to content, and how content is connected to other content (Majchrzak et al., 2013). Individuals can also receive updates to changes in their associations by subscribing to notifications that alert them for instance, when a connection has a new role or adds a new tag to his or her public profile. In other words, social media enables users to articulate and make their social networks visible to others (Ellison, 2007).

Editability. Editability refers to the ability for individuals to spend a great deal of time and effort crafting and recrafting a communicative act before others view it (Treem & Leonardi, 2012; Walther, 1993). It is largely a function of two aspects of interaction: communication that is formed in isolation from others and asynchronicity (Dennis, Fuller, & Valacich, 2008). Due to these features, individuals can engage in more purposeful communication, by focusing on the content of the message they would like to convey, rather than how nonverbal cues may be perceived by others (Treem & Leonardi, 2012). In addition, editability enables individuals to modify or revise content after it has been initially communicated and affords communicators the flexibility to take into consideration the context in which their messages will be viewed by others and adapt them accordingly.

Teams can enact the social media affordances of visibility, persistence, association, and editability in a myriad of ways. How these affordances are enacted may have important consequences for team processes. The next section begins by presenting the conceptual model

illustrating the relationship between social media affordances and team processes. The conceptual model builds upon eight specific team processes identified in Chapter 1 on the team form-perform paradox (see Table 2) and examines how the four primary affordances can enhance and constrain these team processes.

3. THE EFFECTS OF SOCIAL MEDIA AFFORDANCES ON TEAM PROCESSES

The conceptual model linking social media use to team processes is presented in Figure 5. The teaming environment is comprised of team motives, the features of the social context and the material features of social media. Team motives towards task- and socioemotional-orientations motivate members to form teams, and to enact transition, action, and interpersonal team processes. Although teams have both motives, their activated orientations influence how they perceive the material features of technologies in their social context. This process takes place in the teaming environment, where the features of the social context and the social media become imbricated to determine how teams enacts technological affordances. Put another way, the teaming environment leads to various ways of using the technology. Those uses of the technology affect the way that teams carry out a number of important team processes. Members engage in behaviors that affect the team's assembly, transition, action, and interpersonal processes. Changes in these behaviors have a reverberating effect on the teaming environment in that they can reinforce or alter social processes and material features of the social media that exist or are used. Such reinforcement or alteration will then lead to stasis or change in the teaming environment.

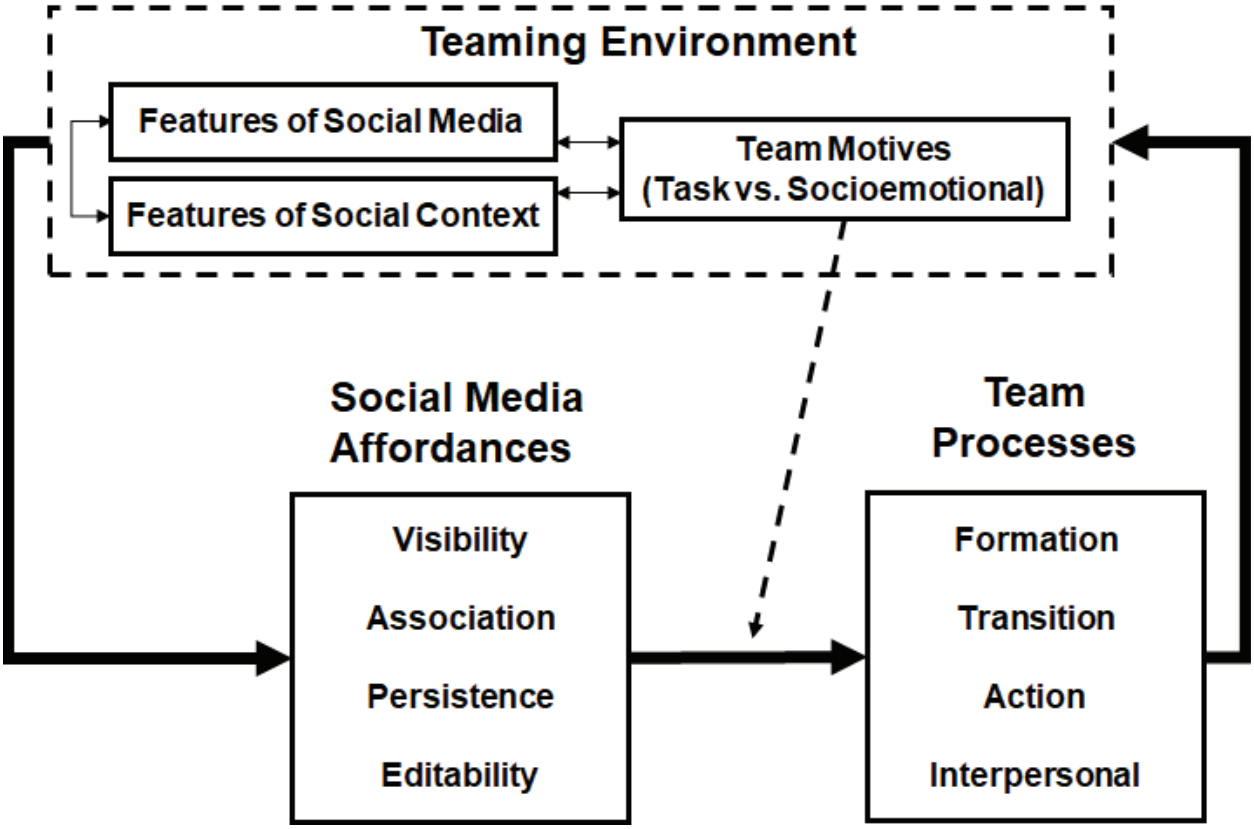


Figure 5. A Conceptual Model of Social Media Affordances & Team Processes

As described in the conceptual model, teams can enact affordances in a myriad of ways that have important consequences for how team processes are carried out. The imbrication of human and material agencies at the team level occur in a teaming environment that simultaneously shapes and is shaped by team members' motives and their perceptions of the social context and the features of social media.

Proposition 1. The teaming environment is shaped by the imbrication of the social context and material features of technology to influence how teams enact social media affordances to carry out team processes.

Next, I examine in greater detail, how the teaming environment provides affordances for accomplishing team processes. In particular, I propose that social media provides affordances that may enable teams to overcome eight of the 10 team processes for which a team form-perform paradox exists (see Table 2). The remainder of this section provides a more detailed explanation of team processes and effectiveness and proposes specific relationships between the identified social media affordances and team processes.

3.1. Team Effectiveness

As previously mentioned in Chapter 1, team effectiveness refers to the criteria used to assess the outputs of team activity and processes (Kozlowski & Bell, 2013). It is widely agreed upon to have two components: (1) task performance, the degree to which the team's product or service meets the needs of those who use it (Sundstrom, De Meuse, & Futrell, 1990); (2) team viability, the degree to which the group experience is more satisfying than frustrating to team members (Hackman, 1990). Although the literature has examined a range of outcomes (e.g., quality, performance, creativity, productivity, member satisfaction) on a range of team types (e.g., top-management teams, product design teams, decision-making teams, multiteam systems, cross-functional teams), the meta-analytic findings relating team processes to team effectiveness have not demonstrated differences across team types. Specifically, Lepine and colleagues (2008) conducted a meta-analysis relating the Marks et al. (2001) taxonomy of team processes to team effectiveness. The meta-analytic findings show support for the taxonomy, as well as strong, consistent relationships of team processes with team performance and member satisfaction across team types. More recently, Hollenbeck, Beersma, & Schouten (2012) propose that there is greater consensus on the underlying dimensions differentiating teams than how to use the

dimensions to categorize them into team types. Building on existing research, they propose that a dimensional scaling approach with three underlying constructs of skill differentiation, authority differentiation, and temporal stability can improve accuracy and consensus for describing teams.

3.2. Team Processes

Team processes describe "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals" (Marks et al., 2001, p. 357). Team processes, such as goal specification, coordination, and motivation, play an integral role in promoting team effectiveness because they are the vehicles that transform team inputs into outcomes (Hackman & Morris, 1975; Kozlowski & Bell, 2013; Kozlowski & Ilgen, 2006).

Drawing upon Marks et al. (2001) taxonomy of team processes, I identify eight illustrative team processes in Table 10 (Column 1) that are representative of team assembly, transition, action, and interpersonal processes that draw upon the processes previously described in

Table 2. *Team assembly processes* refer to the factors that individuals use to select and manage their team composition (Team process #1) and external interdependence (Team process #2). Team assembly processes are influenced by the antecedent factors of individual demographic and psychological characteristics, skills, ideas, resources, and external member relations that form the foundation of team assembly mechanisms (Contractor, 2013; Guimera, Uzzi, Spiro, & Amaral, 2005; Kozlowski & Bell, 2013). Team assembly processes create the foundation of a good team design that in turn supports the effectiveness of transition and action

team processes (Kozlowski and Ilgen, 2006; Hackman 2012). After the team has assembled, *transition* and *action processes* describe the different types of interactions members use to accomplish team goals. Teams generally cycle through two recurring phases of activity (Marks et al., 2001). The first, *transition* phase, involves planning, analysis, goal setting, and reflecting on feedback and prior events. The second, *action* phase, involves coordinating, sharing information, actively monitoring goal progress, and backing up teammates. The transition process of goal specification (Team Process #3), and the action processes of scaffolding team information sharing (Team Process #4) and facilitating member coordination (Team Process #5) are three important processes that are directly related to task accomplishment.

Lastly, team interpersonal processes regulate motivation and emotions within the team. They occur during both transition and action processes to regulate member emotions, confront conflict, and sustain motivation (Marks et al., 2001). Three interpersonal processes that have been shown to increase the odds of an effective team are to generate member motivation (Team Process #6), build cohesion and identity (Team Process #7), and manage conflict (Team Process #8).

Table 10. Team Process Recommendations and Team Self-Formation Tendencies

Team Process Recommendations	**Discrepancies Between Team Self-Formation Tendencies and Requirements for Team Effectiveness**
TEAM ASSEMBLY PROCESSES	
Team Process #1: Enable **Diverse Team Composition**	Self-forming teams generally avoid diversity and seek out prior teammates to reduce uncertainty (Lungeanu,

Recommendation: Teams need functional diversity and a balance of incumbents and newcomers **Evidence**: Cummings, 2004; Cummings, Kiesler, Zadeh, & Balakrishnan, 2013; Horwitz & Horwitz 2007; Guimera, Uzzi, Spiro, Nunes & Amaral, 2005; Jehn, Northcraft, & Neale, 1999; Perretti & Negro, 2007; Ruef, Aldrich, & Carter, 2003; Uzzi & Spiro, 2005	Huang and Contractor, 2014; Zhu, Huang, and Contractor, 2013); People's networks tend to be homophilous, and it is difficult to reach across network cliques to recruit diverse teammates (Ruef, Aldrich, & Carter, 2003); Also, there is a startup cost to socializing newcomers into the team once it has formed (Hinds, Carley, Krackhardt, & Wholey, 2000)
Team Process #2: Manage **External Interdependence** **Recommendation:** Teams need to boundary span in order to promote the team, gather information from outside the team, and coordinate with teams who share superordinate goals **Evidence**: Ancona, 1990; Hinds & Kiesler, 1995; Heath & Luff, 1992; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; Mortensen, Woolley, & O'Leary, 2007	Teams tend to view other teams competitively, and do not effectively span their boundaries (Ancona & Caldwell, 1992)
TRANSITION & ACTION PROCESSES	
Team Process #3: Identify & Prioritize **Specific Goals** **Recommendation:** Teams need to identify and prioritize specific, challenging yet attainable team-oriented goals **Evidence:** Bell & Kozlowski, 2002; Hertel, Konradt & Orlikowski, 2004; Kozlowski & Ilgen, 2006; LePine, 2005; O'Leary-Kelly, Martocchio, & Frink, 1994	Teams set poorly conceptualized goals that are overly general, conflicting, ambiguous, unattainable, and not necessarily valued by team members (Kleingeld, van Mierlo, & Arends, 2011)
Team Process #4: Scaffold Team **Information Sharing** **Recommendation:** Teams need to explore members' unique information	Teams spend more time discussing common information, and are less likely to consider unique information

Evidence: Mesmer-Magnus & DeChurch, 2009; Rentsch, Delise, Mellow, & Staniewicz, 2014; Robert Jr., Dennis, & Ahuja, 2008; Stasser, Taylor, & Hanna, 1989	(Mesmer-Magnus & DeChurch, 2009; Wittenbaum et al., 2004)
Team Process #5: Facilitate Member **Coordination** **Recommendation:** Team members need to coordinate their activities with one another **Evidence**: Fussell, Kraut, Lerch, Schertis, McNally, & Cadiz, 1998; Heath & Luff, 1992; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; Marks, Mathieu, & Zaccaro, 2001	Teams often suffer from "process loss" whereby members are less productive when working together because of coordination costs than the same individuals working alone (Marks, Mathieu, & Zaccaro, 2001; Steiner, 1972)
INTERPERSONAL PROCESSES	
Team Process #6: Generate Member **Motivation** **Recommendation:** Team members are more motivated when provided with feedback on work processes and performance **Evidence**: Dencheva, Prause, & Prinz, 2011; Geister, Konradt, & Hertel, 2006; Kluger & DeNisi, 1996	Teams without sufficient feedback on individual contributions suffer from "social loafing" wherein each individual contributes less effort than they would if working alone (Karau & Williams, 1993; Latané et al., 1979)
Team Process #7: Develop and Maintain **Cohesion** **Recommendation:** Team members need to identify strongly with the team and its purpose, and avoid forming subgroups within the team **Evidence**: Festinger, 1950; Ren, Kraut, & Kiesler, 2007; Tajfel, 1974, 1981; Tasa, Taggar, & Seijts, 2007; Wiggins & Crowston, 2011	Teams, especially diverse teams, tend to form subgroups (Carton & Cummings, 2013; Lau & Murnighan, 1998)
Team Process #8: Manage **Conflict** **Recommendation:** Teams need to use cooperative conflict management to resolve	Teams often use ineffective conflict management including individualistic strategies (competing, avoiding), or openly discussing rather than avoiding relationship issues (Alper, Tjosvold &

task-based conflicts and generally avoid discussing relationship-based conflict **Evidence**: DeChurch et al., 2013; DeDreu & Van Vianen, 2001; Marks, Mathieu, & Zaccaro, 2001; Mesmer-Magnus, DeChurch, & Doty, 2013; Tekleab, Quigley, & Tesluk, 2009	Law, 2000; Montoya-Weiss, Massey, & Song, 2001)

Although theory and research on team effectiveness have provided normative recommendations to guide and enhance team processes, empirical evidence suggests that teams have natural self-formation tendencies that counter the recommendations prescribed by research. Table 10 (Column 2) presents a summary of these tendencies, and illustrate that, left to their own devices, teams may not engage effectively in team processes. The conceptual model (Figure 5) proposes that social media provides unprecedented opportunities for facilitating more effective team processes that can enable teams to achieve their normative recommendations. These capabilities are rooted in the potential affordances and constraints that social media provide teams.

3.3. Social Media Affordances & Team Processes: Eight Illustrative Cases

In the remainder of this section, I illustrate how social media may have positive and negative consequences on specific team processes by theorizing the relationship between the primary social media affordances (Table 9) and the eight illustrative team processes in Table 4. I posit that team members' orientations towards task versus socioemotional motives are the levers that shape how teams use technologies and develop eight propositions describing these relationships.

Social Media Affordances and Team Process #1: Enable Diverse Team Composition. Team composition is the configuration of member attributes in a team (Levine & Moreland,

1990), and includes factors such as personality, abilities, demographics, and skills of team members (Bell, 2007; Ruef, Aldrich, & Carter, 2003). Teams tend to be more effective when their members are functionally diverse with respect to member training, development and development (Bell, Villado, Lukasik, Belau, & Briggs, 2011; Cummings, Kiesler, Zadeh, & Balakrishnan, 2013; Eisenhardt & Tabrizi, 1995; Griffin & Hauser, 1992; Horwitz & Horwitz, 2007) and when they balance incumbents with newcomers who bring new ideas to the team (Guimera et al., 2005; Uzzi, Mukherjee, Stringer, & Jones, 2013).

Despite normative recommendations to diversify, individuals generally seek out similar and prior teammates to reduce uncertainty. Research finds that teams tend to be homophilous (Hinds et al., 2000), often because members are simply unaware of who other people are and what they might know (Carlile, 2004). Moreover, newcomers present a potential challenge to the existing social structures (e.g., norms, status) established within a team, and therefore undermine the security that most individuals feel when working with incumbents. Table 11 summarizes these potential positive and negative effects.

The affordances of visibility and association can facilitate more diverse team composition in three ways. First, social media presents content communally so that individuals' contributions are visible and can be easily located and viewed by others. Visibility has the potential to provide greater message transparency into the work behaviors of others and can improve communication visibility into the type of people in the organization and their potential areas of expertise (Leonardi, 2014; 2015). Second, features, such as rankings and recommendations afford emergent forms of associations by suggesting ways for individuals to form new associations with new people outside their proximal surroundings (Brzozowski, 2009). For example, these

associations can enable individuals to reach across their networks to identify new teammates with diverse knowledge, skills and abilities (DiMicco et al., 2009). Third, visibility and association can aid with assimilating newcomers into the team. Visibility enables incumbents to learn about the background, interests, and activities of newcomers, and for newcomers to learn about the norms, role expectations and other informal structures in the team. Furthermore, incumbents can form explicit associations with newcomers to facilitate their assimilation into the team.

Although visibility enables people to encounter diverse content, absent explicit incentives, teams may restrict their view to people and material in their own networks (Farzan, DiMicco & Brownholtz, 2009). The association affordance can further propel these challenges by providing multiple avenues to connect with like-minded individuals. Recommender systems typically facilitate connections by presenting individuals with results that are based on their past behavior and interests (Pariser, 2011). Thus, visibility and association may lead to even less exposure to new people and ideas, and further promote the formation of homogeneous teams by making it even easier to routinize existing biases in seeking out teammates.

Team motives likely determine the ways in which technology will be used. Teams with activated task motives are more likely to focus on forming diverse teams to facilitate accomplishment of their task goals. Thus, they are more likely to perceive visibility and association affordances as facilitating access to potential teammates with functionally diverse skillsets and to newcomers offering new perspectives to the team. In contrast, teams with activated socioemotional motives are more likely to emphasize the need for member attraction and harmonious working relationships. These needs may prompt team members to enact

visibility and association affordances to seek out others who have similar ascriptive characteristics to existing members, thereby promoting the formation of more homophilous teams.

Proposition 2. Teams with activated task motives enact visibility and association affordances to form more diverse teams than teams with activated socioemotional motives that enact visibility and association affordances to form more homophilous teams.

Table 11. The Effects of Social Media Affordances on Diverse Composition

Team Process #1: Enable Diverse Composition		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges
Visibility	• Provides **greater transparency** into others' work behaviors to identify diverse team members • Incumbents and newcomers can **review and learn** from the each other's profiles, background, interests and activities to facilitate **easier socialization**	• Visibility may restrict activities to own networks, leading to greater encounters between like-minded individuals that create **more homogeneous teams**
Association	• Facilitates **emergent connections** to help members connect with unfamiliar others to enable diverse composition • Allows incumbents to articulate their associations with newcomers explicitly, **promoting assimilation and affiliation**	• Recommender systems facilitate connections between like-minded individuals, further **promoting team homogeneity**
Motive	• Task	• Socioemotional

Citation(s)	Brzozowski, 2009; DiMicco et al., 2009; Leonardi, 2014; Leonardi, 2015	Farzan et al., 2009; Pariser, 2011; Leonardi et al. 2013; Treem & Leonardi, 2012

Social Media Affordances and Team Process #2: Manage External Interdependence. External interdependence involves gathering information from external contacts, representing the team to outsiders, coordinating work with others in the organization, and negotiating intergroup actions to expand the team's network and connect with important external actors (Ancona, 1990; Marrone, 2010). Yet teams often view other groups competitively and do not always engage effectively in boundary spanning, external activities (Ancona & Caldwell, 1992).

Social media features affording visibility and association can facilitate effective team boundary activities. First, visibility provides team members with insight into what people are doing in other groups, departments, or locations. The ability to see more communicative acts, interactions, and connections afford team members the ability to develop a common understanding with other groups. This can facilitate boundary spanning activities, such as "talking up" to create favorable impressions with senior management (Ancona & Caldwell, 1992; Van Osch & Steinfield, 2016) and ease of coordinating and soliciting feedback from other teams. Second, social media supports connection across boundaries, including emergent connections with other individuals and groups that team members may otherwise know very little about. For instance, teams can use recommender algorithms and profile information to evaluate the potential value of connecting with other teams with relevant resources or external stakeholders (Majchrzak et al., 2013).

At the same time, visibility and association may create new constraints on teams' external activities by highlighting differences and reinforcing team boundaries. Also, teams may avoid forming connections with other teams to protect their social capital and proprietary knowledge (Gibbs et al., 2013). As a result, team members may focus their activities inwardly, adopting an isolationist strategy (Ancona & Caldwell, 1992). Table 12 summarizes these potential positive and negative effects.

Teams with activated task motives tend to focus on furthering the task at hand to promote effective outcomes. As a result, they are more likely to enact visibility and association affordances to promote the team externally to others. In contrast, teams with activated socioemotional motives are more likely to focus on internal activities that reduce their propensity to communicate with external team members. These inward activities promote greater group cohesion and team satisfaction but undermine team performance.

Proposition 3. Teams with activated task motives enact visibility and association affordances to more effectively manage their external interdependence than teams with activated socioemotional motives.

Table 12. The Effects of Social Media Affordances on External Interdependence

Team Process #2: Manage External Interdependence		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges
Visibility	• **Visibility** into others' activities & interactions facilitates desire to cross more knowledge boundaries **to coordinate activities with other teams** and team **representational activities** with senior management	• Ability to see others' activities and preferences may **reinforce team boundaries** and promote internal focused activities

Association	• Supports **emergent connections, interactions and informal communications** to external teams through use of recommendation algorithms & profile or keyword searches, **promoting similarity and interdependence of goals**	• Teams may avoid external activities to protect their **proprietary information** and **social capital**
Motive	• Task	• Socioemotional
Citation(s)	Van Osch & Steinfield, 2016	Gibbs et al., 2013

Social Media Affordances and Team Process #3: Identify & Prioritize Specific Goals.

Goal specification refers to the identification and prioritization of goals and subgoals for task accomplishment (Marks et al., 2001). During goal specification, teams develop, assign, and prioritize goals and subgoals that indicate what needs to be accomplished within a certain time frame and within a threshold standard of quality (O'Leary-Kelly, Martocchio, & Frink, 1994). Teams that set specific, challenging yet attainable goals with collective-oriented strategies, tend to be more effective than those who set more general goals (Kozlowski & Bell, 2006). However, teams often set ineffective goals that are poorly conceptualized, conflicting or ambiguous, as well as individual- rather than group-oriented (Kleingeld, van Mierlo, & Arends, 2011).

Visibility, editability, and persistence afford teams the ability to identify and prioritize specific goals for task accomplishment. First, visibility makes other individuals' activities easy to see. This enables team members to monitor and hold each other accountable for accomplishing their goals and subgoals. In particular, teammates can use notification features on social media to stay up to date on each other's activities and track progress on task accomplishment (Treem & Leonardi, 2012). Second, editability enables goals to be continuously updated, as team members

encounter unforeseen situational contingencies that force them to reevaluate their ability to attain their goals as they were previously set. Third, persistence creates a permanent record of team goals that can be referenced at any time in the future. This means team members can view past records to clarify content to develop a clearer understanding of how to accomplish team goals.

Yet visibility, editability and persistence can also inhibit goal specification. First, team members may be unwilling to set specific goals due to its visible nature to others. Alternatively, they may set individual- rather than team-oriented goals for strategic presentation purposes (Rice et al., 2017). Second, editability may encourage goal respecification that masks inefficiencies and productivity loss. Lastly, persistence may lead to inefficiencies or difficulty monitoring progress towards goal accomplishment if team members do not periodically update the status of their goals. Table 13 summarizes these potential positive and negative effects.

Teams with activated task motives are more likely to use social media to set specific, challenging goals. The need for task-goal attainment prompt members to hold each other accountable for prioritizing and accomplishing their goals and subgoals, while discouraging vague or misspecified goals. In contrast, teams with activated socioemotional motives may deprioritize the need to set and achieve challenging goals due to their focus on maintaining stable relationships and group harmony.

Proposition 4. Teams with activated task motives enact visibility, editability, and persistence affordances to set more specific and challenging goals than teams with activated socioemotional motives.

Table 13. The Effects of Social Media Affordances on Goal Identification & Prioritization

Team Process #3: Identify & Prioritize Specific Goals		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges
Visibility	• Makes **others' activities easy to see and navigate**, enabling teammates to monitor and hold each other accountable for attaining goals & subgoals • **Notifications** help teammates stay up to date on each other's activities and track progress on task accomplishment	• May **avoid setting specific goals** due to increased accountability • May encourage goals that reflect **strategic self-presentation** rather than team's purpose
Editability	• Enables goals to be **specified and respecified** enabling flexibility to situational contingencies	• Editability resulting in goal respecification may **hide inefficiencies and productivity loss**
Persistence	• Provides **permanent record** of team goals to be referenced at any time in the future	• Creates **inefficiencies monitoring progress towards goal accomplishment** if goals are not updated to reflect their current status
Motive	• Task	• Socioemotional
Citation(s)	Treem & Leonardi, 2012	Rice et al., 2017

Social Media Affordances and Team Process #4: Scaffold Information Sharing.

Information sharing is the primary means through which team members utilize their informational resources to arrive at a decision or outcome. Teams need to leverage their informational resources to explore their members' unique information and to discuss all available pertinent task information to engender better performance (Mesmer-Magnus & DeChurch, 2009; Robert Jr., Dennis, & Ahuja, 2008) and higher quality solutions (Rentsch et al., 2014). Yet,

despite normative recommendations for sharing unique information, teams spend more time discussing and oversampling shared information—i.e., common information that is known to all group members (Stasser & Titus, 1985; Wittenbaum, Hollingshead, & Botero, 2004). This bias towards discussing already shared information limits the team's ability to fully exchange unique information and reach optimal decisions.

The association affordance can help teams share more unique information and arrive at superior decision outcomes in two ways. First, team members can identify unique information by searching for keywords or tags on entries to find explicit connections among projects and their authors. To verify its accuracy, team members can examine the types of comments and direction of votes generated on the original communication. Second, team members can react to each other's posts and activities, by commenting, voting, polling or tagging each other's content to promote alternative opinions (Di Gangi, Wasko, & Hooker, 2010).

However, associations may unintentionally reinforce the sharing of common rather than unique information. For instance, team members may form associations with like-minded individuals who share similar information and promote self-reinforcing tendencies (Leonardi et al., 2013). Further, certain communicators may enact *strategic opacity* to increase the availability and accessibility of unimportant information to prevent others from accessing the central information (Stohl, Stohl, & Leonardi, 2016). This can increase the risk of team members contributing irrelevant information to their team discussions. Table 14 summarizes these potential positive and negative effects.

Teams with activated task motives are more likely to enact the association affordance to seek out diverse information from dissimilar others to improve the quality of their solutions.

Conversely, teams with activated socioemotional motives may avoid discussing conflicting information (Von Glinow, Shapiro, & Brett, 2004) to maintain positive group relations. As a result, such teams enact the association affordance to seek out common information from like-minded individuals who reinforce the team's existing views.

Proposition 5. Teams with activated task motives enact the association affordance to share and discuss more unique information than teams with activated socioemotional motives.

Table 14. The Effects of Social Media Affordances on Information Sharing

Team Process #4: Scaffold Information Sharing		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges
Association	• Identify unique information using searches for **keywords or tags** and verify accuracy by **reviewing comments and votes** • **React** to each other's posts and activities to promote **alternative opinions**	• Information may represent a **biased view** of organizational knowledge from **self-reinforcing groups**, resulting in more common information • Information may be **irrelevant** due to strategic opacity
Motive	• Task	• Socioemotional
Citation(s)	Di Gangi et al., 2010; Leonardi & Vaast, 2017	Leonardi et al., 2013; Stohl et al., 2016

Social Media Affordances and Team Process #5: Facilitate Member Coordination. Coordination refers to the activities required for managing the interdependencies of the team workflow, where the correct and timely contribution of each member is often an important

correlate of team effectiveness (Marks et al., 2001). However, coordination is difficult to achieve due to the costs associated with integrating disparate actions together and attaining temporal pacing of member contributions (Argote & McGrath, 1993). Thus, teams often suffer from "process loss", whereby team members working together fall below their potential productivity level (Steiner, 1972).

Persistence and editability facilitate team coordination by allowing team members to retrieve, revise, and edit each other's content and contributions at any time and from any place. First, persistence enables team members to refer back to previous communications to clarify responsibilities and improve workflow processes. Because the entire history of the conversation is stored, ordered and retrievable, team members can join the conversation at any time and become relevant contributors (Treem & Leonardi, 2012). Second, the change control feature on social media reduces coordination effort by allowing members to edit each other's content asynchronously, while maintaining a history of revisions and the option of restoring prior versions (Arazy, Gellatly, Jang, & Patterson, 2009).

However, persistence and editability can also create unexpected challenges. One potential negative consequence of persistence is that it creates a growing amount of content over time. If left unmanaged, this content can become unwieldy and poorly organized (Leonardi et al., 2013), with outdated information undermining team members' abilities to coordinate workflow processes. Another negative implication is that while editability affords team members the ability to craft and revise content asynchronously, these same capabilities can be used to reinforce personal preferences and perspectives. In particular, individuals can reverse and restore previous

editions to reflect their preferred views, thereby heightening process loss. Table 15 summarizes these potential positive and negative effects.

Teams with activated task motives are more likely to enact persistence and editability to improve team coordination. These affordances provide new ways for team members to stay up to date on each other's progress on tasks, and to revise and improve each other's contributions in an asynchronous and efficient manner. On the other hand, teams with activated socioemotional motives are more likely to focus on their relational activities, which may come at the expense of enacting persistence and editability to aid with coordinating the team's activities.

Proposition 6. Teams with activated task motives enact persistence and editability affordances to exhibit better coordination and less process loss than teams with activated socioemotional motives.

Table 15. The Effects of Social Media Affordances on Coordination

Team Process #5: Facilitate Member Coordination		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges
Persistence	• Permits **review of original communication** at any time, enabling team members to clarify responsibilities • Enables anyone to join at any point and become a **relevant contributor**	• **Growing content** can become **unwieldy** and **poorly organized** • Persistence of **outdated information** can **undermine coordination** of workflow processes
Editability	• **Change control** enables **asynchronous editing** of content after the initial communication, and the ability to track revision history & restore prior versions,	• Ability to edit team members' content after they have posted it can **reinforce personal opinions and objectives**, limiting its collaborative potential

	facilitating ease of coordination	
Motive	• Task	• Socioemotional
Citation(s)	Arazy et al., 2009; Treem & Leonardi, 2012;	Leonardi et al., 2013

Social Media Affordances and Team Process #6: Generate Member Motivation. Team motivation is the direction, intensity, and persistence of effort that team members exert towards work processes and tasks. Teams that promote their task competency and provide feedback to their members on work processes are typically more effective (Dencheva, Prause, & Prinz, 2011; Geister, Konradt, & Hertel, 2006; Kluger & DeNisi, 1996). That said, teams often engage in behaviors that are demotivating, such as providing insufficient feedback on individual contributions. These tendencies lead to productivity loss or social loafing, whereby individuals exert less effort when their efforts are combined (Karau & Williams, 1993; Latané, Williams, & Harkins, 1979).

The visibility and association affordances afforded by social media use can facilitate team motivation in two ways. First, the visibility affordance makes individual contributions (or the lack thereof) visible to others. The identifiability of member contributions has been shown to improve team motivation (Price, Harrison, & Gavin, 2006). Second, the association affordance makes it easier to solicit and provide feedback among members in a variety of formats. A team member can increase the odds of receiving feedback by pushing out content to teammates and

other subscribers (Fulk & Yuan, 2013). In response, others can easily provide feedback with a vote, comment, "like", or tag.

That said, the visibility affordance can undermine motivation if members use their knowledge of others' contributions to enable them to reduce their effort, as occurs with social loafing (Karau & Williams, 1993). Moreover, although the explicit associations tend to elicit more varied feedback, they may unexpectedly encourage "lurking" activities (Gibbs et al., 2013), whereby team members enact association to keep up with ongoing activities, instead of interacting directly with other teammates. If team members refrain from expressing their opinions, it can reduce the amount of feedback provided to team members and contribute to groupthink (Janis, 1982). Table 16 summarizes these potential positive and negative effects.

Teams with activated socioemotional motives are more likely to perceive that the visibility and association affordances promote feedback behaviors to maintain team motivation. On the other hand, teams with activated task motives are more likely to focus on accomplishing the task at hand, which jeopardizes the amount of time and effort team members expend on providing each other with quality feedback needed to sustain member motivation.

Proposition 7. Teams with activated socioemotional motives enact visibility and association affordances to exhibit greater member motivation and less social loafing than teams with activated task motives.

Table 16. The Effects of Social Media Affordances on Motivation

Team Process #6: Generate Member Motivation		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges

Visibility	• Ability to **make member contributions identifiable** can improve team motivation	• Members may use knowledge of others' contributions to reduce own effort, **increasing social loafing**
Association	• Ability to **"push"** knowledge contributions to team members and subscribers can facilitate two-way interactivity	• Team members may shy away from expressing their opposing views and/or opinions due to **normative pressure for conformity** and potential to be associated with it in the future, thereby facilitating **lurking behavior**
Motive	• Socioemotional	• Task
Citation(s)	Fulk & Yuan, 2013	Gibbs et al., 2013

Social Media Affordances and Team Process #7: Build Cohesion and Identity. Team cohesion is the "resultant of all forces acting on members to remain in the group" (Festinger, 1950). Cohesion has three main components: task, social, and group pride (Beal, Cohen, Burke, & McLendon, 2003). Teams need to develop and maintain cohesion by identifying strongly with the team and its purpose (Tajfel & Turner, 1986; Wiggins & Crowston, 2011). However, teams tend to form identity-based subgroups with configurations that highlight ingroup-outgroup tensions (Carton & Cummings, 2013) and negatively affect group dynamics and performance (Lau & Murnighan, 1998).

Social media tools affording association can support team cohesion and identity by facilitating social connections that allow team members to articulate their associations with each other and their content (Thom-Santelli, Muller, & Millen, 2008). For instance, individuals can

signal their relationships with other members by "friending" them or joining a group page. Similarly, members can react to the profiles, preferences, content, and activities of other team members, by "liking", tagging, voting, or commenting. These associations support communication creation and bonding (Jackson, Yates, & Orlikowski, 2007), leading to increasing bridging and bonding social capital, as well as stronger network ties, particularly in distributed teams (Fulk & Yuan, 2013).

That said, a potential constraint is that social media associations may create disingenuous relationships that can give false impressions that close or strong ties exist, when they are in fact, non-existent (Leonardi et al., 2013). This can negatively impact group cohesion, with members identifying weakly with the team and its purpose. Table 17 summarizes these potential positive and negative effects.

Teams with activated socioemotional motives are more likely to enact the association affordance to enhance member cohesion and identity to foster close relationships with each other. Consequently, team members are likely to perceive associations as affording new opportunities to connect, engage, and form stronger bonds with other teammates. In contrast, teams with activated task motives tend to focus on advancing the task at hand and are therefore less likely to enact the association affordance to build cohesion and identity.

Proposition 8. Teams with activated socioemotional motives enact the association affordance to exhibit stronger cohesion and team identification than teams with activated task motives.

Table 17. The Effects of Social Media Affordances on Cohesion

Team Process #7: Build Cohesion and Identity		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges
Association	• Ability to form social connections with teammates and initiate interactive communication facilitates **interactions and affiliation**, promoting **community and identity formation**	• Potential to **stimulate disingenuous relationships** to give false impression that close ties exist when they are in fact non-existent
Motive	• Socioemotional	• Task
Citation(s)	Fulk & Yuan, 2013; Gibbs et al., 2013; Jackson et al., 2007; Thom-Santelli et al., 2008	Leonardi et al., 2013

Social Media Affordances and Team Process #8: Manage Conflict. Team conflict refers to disagreement that arises from team members' natural attempts to cooperate and coordinate their efforts (Jehn, 1997; Jehn, Chadwick, & Thatcher, 1997). Although conflict can promote different perspectives, and contribute to team effectiveness, teams need to use cooperative conflict management to resolve task-based conflicts and generally avoid discussing relationship-based conflict (DeChurch, Mesmer-Magnus, & Doty, 2013; De Dreu & Van Vianen, 2001; Tekleab, Quigley, & Tesluk, 2009). Teams can either establish preemptive conditions to prevent, control or guide team conflict before it occurs or develop reactive strategies to effectively work through conflict and member disagreements (Marks et al., 2001). However, teams often use individualistic strategies and openly discuss relationship issues (Alper, Tjosvold, & Law, 2000; Montoya-Weiss, Massey, & Song, 2001).

The affordances of persistence and editability can aid with cooperative conflict management by regulating personal expressions and targeting content. First, the permanence of social media content may deter team members from employing individualistic strategies or openly discussing relationship issues because others can retrieve, review, and report it at any time. Second, editability enables team members to spend an unlimited amount of time designing and recrafting a communicative act before it is viewed by others (Walther, 1993), meaning that they can manipulate how and when information is shared (Barley, Leonardi, & Bailey, 2012). In addition, members can reshape, modify or delete their messages based on others' responses, thereby facilitating cooperative strategies.

However, persistence and editability may heighten interpersonal conflict if team members miscommunicate or misinterpret content on social media. The permanence and reviewability of content may also highlight differences between members. Moreover, the reduction in social cues in asynchronous text-based environments can facilitate depersonalization of the other that may provoke team members to craft conflictual messages or "flames" that can promote greater conflict (McGuire, Kiesler & Siegel, 1987; Turnage, 2007). *Table 18* summarizes these potential positive and negative effects.

Teams with activated socioemotional motives are more likely to perceive persistence and editability as affording ways to guide and manage team conflict, due to their need to maintain harmonious group relations. On the other hand, teams with activated task motives are more likely to prioritize advancing task goals, therefore undermining the potential that persistence and editability afford for promoting cooperative conflict management strategies.

Proposition 9. Teams with activated socioemotional motives enact persistence and editability affordances to exhibit greater use of cooperative conflict management and express less relationship conflict than teams with activated task motives.

Table 18. The Effects of Social Media Affordances on Conflict

Team Process #8: Manage Conflict		
Affordance	Positive Intentional Benefits	Negative Unanticipated Challenges
Persistence	• **Permanence and reviewability** of social media may **deter members from using individualistic strategies** or openly discussing relationship conflict	• May **provoke interpersonal conflic**t if content is miscommunicated or misinterpreted • Ability to access & review communication history may **highlight differences**
Editability	• Ability to craft and recraft messages can help team members **target content** appropriately for the audience and **revise content** based on their **reactions**	• Reduction in social cues can facilitate depersonalization of the other, leading members to craft conflictual messages or **"flames"** that promote conflict
Motive	• Socioemotional	• Task
Citation(s)	Barley et al., 2012; Walther, 1993	Gibbs et al., 2013; McGuire et al., 1987; Landry, 2000; Turnage, 2007

Thus far, this section has described the links between social media affordances and team processes and explained how team motivational orientations moderate how teams perceive ESM affordances. At the same time, team members can assess how effectively they carry out team processes. This feedback serves as either impetus for change or stasis in team motives in the

teaming environment. In the remainder of this section, I describe how this recurrent feedback promotes more effective team processes.

3.4. The Continuous Improvement of Team Processes

As teams interact, collaborate and communicate to carry out team processes, they continuously monitor their environment to determine whether their goals and needs are being adequately achieved. This is represented in Figure 5 by the feedback arrows between the teaming environment and social media affordances, between social media affordances and team processes, and between team processes and the teaming environment.

Given their current configurations, teams assess their ability to accomplish goals by monitoring how effectively they carry out essential team processes. Informed by the prior outcomes of their behaviors, teams can either continue with their existing routines, or alter them (Leonardi, 2011). If team members are satisfied with their capabilities, they may not perceive the need to reconfigure their routines. However, if they perceive a gap between their goals and capabilities for effectively carrying out team processes, they can either alter their routines or their technologies. Through these recurrent actions (Orlikowski, 2000), teams may find new ways of organizing their social interactions that lead to new ways of enacting human agency (i.e., reconfigure their routines), or they may make changes to the features of the technologies to better accomplish their goals (i.e., reconfigure their technologies). Both reconfigurations ultimately take place in the teaming environment. Further, as a result of recursive evaluation and subsequent changes to their teaming environment, members will enact different affordances and behaviors that enable them to better accomplish their goals.

An important aspect of this continuous reassessment process is that each subsequent reconfiguration of the social context or technological features becomes intertwined or imbricated in overlapping sequences that depend largely upon their prior imbrications. Over time, these imbrications will provide affordances that enable teams to effectively carry out team processes and accomplish their goals.

4. DISCUSSION & CONCLUSIONS

In this chapter, I set out to explore how social media affordances shape team processes in ways that can enable teams to more effectively accomplish their goals and objectives. Social media has the potential to bring about significant changes to our conceptualization of organizational self-managing teams, and how they leverage new technologies to accomplish their teaming goals. Through tools like SNS, blogs, micro-blogs and wikis, people can organize across boundaries and time in space like never before. Much of this organization is emergent, in the fashion of self-organizing systems. Through algorithms, such as recommender systems, people have increased autonomy to self-select into entities that can create and define their own boundaries. This chapter introduces an affordance lens as an alternative perspective to the research on virtual teams and theorizes how social media affordances can enhance or hinder important team processes.

My conceptual model linking social media use to team processes reveals that four primary technological affordances have profound implications on how teams self-organize. Specifically, visibility makes team member behavior visible to a broad audience, association allows team members to articulate their own social networks for others to view and interpret, persistence creates a memory or code of each conversation that is accessible long after the

original communication, and finally, editability enables team members to craft and recraft their messages depending on their audience. Although this chapter focused on the four primary affordances, I submit that teams can often enact these affordances in ways that are representative of the secondary affordances. Yet the intention of this chapter is to introduce how social media can potentially enhance team processes in a broad range of contexts; thus, the intention was to put forth plausible cases that can spark interest in future work that refines and revises these proposed relationships.

Also, a key advantage of the affordance perspective is that it enables theorizing on social media's potential positive and negative outcomes on team processes. Accordingly, it provides a pragmatic approach that acknowledges that social media can have contradictory influences on organizing at the team and inter-team level. I propose that the teaming environment shapes how affordances will be enacted, and more specifically, how the activation of task- and socioemotional-oriented motives impacts how teams enact affordances to carry out team processes. Furthermore, the conceptual model emphasizes that the relationship between social media use and team processes is a recursive process. In other words, teams continuously monitor their behaviors to assess their effectiveness, and constitute and reconstitute their teaming environment to enhance how social media affordances facilitate team processes and goal accomplishment.

The propositions linking social media affordances to team processes open up new pathways for future research to understand how ESM is transforming how individuals organize in teams. Future research would need to adopt a wide methodological perspective to help expand our knowledge of social media use in work teams. The methodological repertoire for studies on

social media and teams should encompass both qualitative and quantitative methods. Interview and case-study methods will help decode the affordances and constraints that social media use has on teams. Large scale digital trace data (Pentland, 2012), observations of social media use, and natural experiments (Salganik, 2017) will refine our conceptualization of ESM use on a team's goals and abilities to carry out team processes effectively. First, digital trace data provide evidence of both the structure and content of users' actions, interactions and transactions, enabling the use of social network methods to decode structural signatures that capture the different types of relations between users and groups of users (Contractor, Monge & Leonardi, 2011; Poole & Contractor, 2011). Second, observations of social media use crystallize understanding of why social media affords and constrains certain behaviors and will further refine our understanding of how the teaming environment, and particularly, how team motives, the features of the social context, and social media are imbricated to regulate and guide how teams perceive the possible uses of social media technologies. Finally, natural experiments create an opportune way to isolate the effects of social media use on team processes, such as information sharing, diverse composition, and team boundary spanning.

Hence, this conceptual framework ushers a new era of research on social media use in teams. Future research should refine conceptualizations of how the teaming environment shape, and are in turn shaped by, the perceptions and enactment of social media affordances that influence the effectiveness of team processes and outcomes. This research can then be extended to interventions that attempt to improve targeted team processes through revised routines, and new feature designs or technologies that lead to new perceptions of social media affordances. Such research would also provide more detail into the types of team processes for which social

media enhances and constrains, and how ESM tools fits into the broader suite of virtual tools available to organizational workers. More generally, given the fast pace of change in innovation and application of social media technologies in organizations, I advance a timely conceptual framework that invites a new stream of research on how ESM technologies can potentially change the ways that teams accomplish their goals.

CHAPTER 4. HOW DO SOCIAL MEDIA NETWORKS FORM AND PERFORM? A COMPARISON OF SOCIAL MEDIA AND FACE TO FACE COMMUNICATION NETWORKS

1. INTRODUCTION

Informal communication networks are essential to the performance of knowledge workers. These workers need to collaborate with colleagues to share and acquire information, coordinate their activities, and integrate their diverse expertise to create value and innovative solutions. Traditionally, knowledge workers developed informal networks through face-to-face interactions, such as "water cooler" conversations, hallway encounters, and staffing on ad hoc project teams (Cross, Nohria, & Parker, 2002). Many of these interactions involved physical proximity or functional similarity, which may have a constraining effect on people's access to diverse contacts and the flow of information (Davis, 1984; Pinto, Pinto, & Prescott, 1993).

In the past decade, organizations have increasingly adopted social media for internal communication, interaction and collaboration. A recent survey by the Margolis Group found that two-thirds of organizations have already adopted social media for their internal communication, and the percentage is predicted to increase further (Shaw, 2016). These technologies have revolutionized how people connect, communicate and develop relationships, providing new opportunities for knowledge workers to expand the range of their network connections (Fulk & Yuan, 2013). Social media are digital platforms that facilitate information sharing, user-created content and collaboration (McFarland & Ployhart, 2015). When used within the workplace, these

computer-mediated tools typically integrate the full variety of social media functionality onto one common platform, and include capabilities, such as blogs, wikis, microblogs, social analytics, as well as social network tools that enable people to "follow" another user (Ehrlich & Shami 2010), "like" a page (DiMicco et al. 2009), "comment" on a post or content (Brzozowski et al. 2009), "@mention" another user (Ehrlich & Shami 2010), or "hashtag" a topic (Zhang et al. 2010). In contrast to most other technologies used for internal communication in organizations, social media provides a forum for public and decentralized communication among employees about user-generated content (DiMicco, Geyer, Millen, Dugan & Brownholtz, 2009).

Research on the use of social media in organizations has suggested that these new technologies provide unprecedented opportunities for informal, peer-to-peer communication and knowledge sharing (Ellison & boyd 2007; Leonardi et al., 2013). A critical element that makes social media unique from other technologies (e.g., chat, email, discussion forums) is that dyadic communication can be seen, stored and added to by anyone in the organization. As a result, they provide the opportunity for employees to observe the experiences that are occurring amongst others through *communication visibility* (Leonardi, 2015). Such third party observation of what content workers communicate with each other and with whom they communicate that content can enable vicarious learning about others' expertise and networks (Ellison et al. 2015; Leonardi et al. 2013). Indeed, recent research has shown that communication visibility can lead to improved metaknowledge of "who knows what" and "who knows whom" in the organization (Ren & Argote 2011; Leonardi 2014).

These capabilities make social media a novel context for interaction and communication that is fundamentally different from traditional organizational contexts (McFarland & Ployhart,

2015). The implication is that these new technologies have become so ubiquitous in the workplace (Shaw, 2016) that both collocated and geographically distributed workers rely on social media for their daily work. Yet despite social media's rapid adoption by organizations, and its potential as *informal information economies* (Leonardi et al., 2013), organizational theorists have been slow to study the uses and effects of these technologies in the workplace (Leonardi & Vaast, 2017). Thus, it is not clear whether and how communication on social media differ from other forms of communication, particularly amongst collocated workers, or how workers might use social media to augment their interactions with their coworkers.

This study aims to better understand how employees communicate on social media, by examining the communication patterns that emerge from collocated employees' interactions on social media and face to face. In addition to examining which network structures form, this study also examines the implications of these structures, namely transitive triad closure, on knowledge workers' performance. To understand how these communication patterns may differ from traditional, face to face communication, I compare workers' emergent communication structures on social media to the same workers' face to face communication exchanges. I developed and tested these ideas in a field study examining how specialists coordinate their interdependent work at a high technology startup in the real estate industry. The startup is altering the generalist approach to the home purchase process by disaggregating it into modular tasks performed by teams of specialists that need to coordinate with each other to advance the home purchase process for a client. These teams of specialists include people in sales, tours, operations, and research. Although several specialists are required to complete a home purchase transaction, the roles are for the most part interchangeable and deindividualized, meaning that anyone with the

necessary training can assume the activities required of the role or position (Bechky 2006; Valentine & Edmondson 2014). These specialists often collaborate, coordinate and communicate on Slack, a commercial team-oriented social media platform to perform a variety of functions associated with the home purchase process.

A particularly useful feature for directed communication on Slack and other social media platforms is the @mention feature. By typing the "@" sign followed by a recipient's name, individuals can send directed messages to others on social media to call their attention to the contents of a specific message. From a relational perspective, the @mention feature differs from other social media features because it encourages direct interaction between people. Whereas the ability to "like", "comment" and "follow" create associations between people and objects or content, @mention's are direct connections that are being established between people. Thus, like other forms of communication modes (e.g., face to face, email, chat), they facilitate directed, dyadic communication. Yet a major difference is that this communication is visible to all third party users on the platform. Indeed, prior studies examining @mention's have suggested that this feature is successful in facilitating coherent turning-taking dyadic exchanges, managing information flow, and coordination (Honey & Herring 2009; Oostervink et al. 2016).

The findings show that workers choose different communication partners when interacting using social media and face to face communication modes. Although both communication modes lead to mutual, reciprocal exchanges, social media has a broadening effect on one's connections by encouraging more heterophilous interactions among people in dissimilar functions. In addition, social media fosters group-level communication, that is, communication that connects and integrates the information and knowledge flow of three or

more people. These integrative interactions lead to transitive triad closure. Additionally, the findings reveal that individuals who have highly transitive or clustered networks are more effective at their jobs.

This study makes three important contributions to the study of social media use for internal firm collaboration. First, it identifies how communication networks form on social media networks in the workplace. In doing so, it investigates how these networks potentially differ from traditional communication – specifically, face to face interactions, which are still largely considered the gold standard of communication in many contexts (Hinds & Bailey, 2003). By examining collocated workers' communication patterns on social media and face to face, this study reveals that social media may promote new opportunities for group-level communication and for expanding one's networks beyond individuals who share similar roles within the firm. Second, this study shows that social media promotes connectivity by introducing disconnected others and forging stronger ties between others who may already have ties with others through network closure. In addition, it investigates the implications of high connectivity and closure on individual performance and shows that people who have a tertius iungens orientation (i.e., people who promote connectivity and closure in the network) are associated with higher performance ratings. Thus, this study provides exploratory findings linking the relationship between social media use and effectiveness in the workplace. Third, this study extends the methodological repertoire used to examine social media use in the firm by incorporating server-side data, and social network analysis to understand people's actual behaviors and actions.

2. THEORY & HYPOTHESES

2.1 Face to Face and Social Media Networks

Informal communication networks at work play an important role for collaborative work and organizational success (Zhao & Rosson, 2009). These networks facilitate opportunistic conversations, or so called "water-cooler conversations" that support a number of different functions, such as sharing of work-relevant information among employees, coordination of group activities, execution of work-related tasks, joint problem solving, social bonding and social learning; activities that are essential for complex collaboration (Hardi, Whittaker, & Bradner, 2000; Whittaker, Rohlich, & Daly-Jones, 1994; Zhao & Rosson, 2009). They also play an essential role in the performance of knowledge workers (Gargiulo, Ertug, & Galunic, 2009). Knowledge workers create value by acquiring, processing and providing information to create solutions for complex problems. To accomplish tasks, they need to work interdependently with others by both acquiring information from colleagues and providing information to these or other colleagues in the organization.

Social media has opened up new avenues for informal communication that are ushering a fundamental change to the structure of social relations (Hampton, 2016). Social media platforms used for internal communication within organizations typically integrate features of many online technologies together, such as wikis, blogs, microblogs, social analytics, social network tools, and online document collaboration tools (Kane et al., 2014; Leonardi et al., 2013). A major promise of this class of technologies is their potential to facilitate decentralized, continuous, and emergent forms of communication and collaboration, where people can contribute at any time and place of their choosing (Majchrzak et al., 2013).

Against this backdrop, there are at least three ways by which social media facilitates new opportunities for communication and collaboration. First, social media allows people who do not know each other to easily see each other's communication and online activities through communication *visibility* (Leonardi, 2015). Users can see the conversational threads that their work colleagues have had with each other, as well as the documents, connections, and texts that they have shared with others (Leonardi et al., 2013). This visibility enables vicarious learning, improved metaknowledge of "who knows whom" and "who knows what" (Ren & Argote, 2011; Leonardi, 2015) and can foster new collaborations between people who share similar interests. Second, social media creates an environment that enables people to more easily form and maintain interactions with others through *persistence* of content. Social media interactions persist over time (Treem & Leonardi, 2012), which provides the capability to search, browse, and edit discussions (Erickson & Kellogg, 2000), and opens the door for ongoing knowledge conversations where people can be easily invited into discussions and activities. Often people's networks are homophilous because they are simply unaware of who might exist outside their immediate circles (Carlile, 2004). The persistence of social media interactions offers new opportunities for people to connect and develop ties to others who exist outside their homophilous networks (Leonardi et al., 2013). In other words, persistence enables low cost and low bandwidth broadcasts of information (Hampton, Lee, & Her, 2011) – i.e., person-to-network broadcasts that enable people to navigate through second and third degrees of visibility (Hampton, 2016).

Third, social media has introduced several new features to increase the likelihood of successful collaborations. These features, which includes the ability to follow, like, comment,

tag, and mention people, are important for managing, filtering, facilitating, and sustaining emergent collaborations. Often people can subscribe to alerts that notify them when a relevant party has made a new contribution on social media or engaged them in a directed interaction. One of the key features used for directed interaction is @mention's, which enables people to send and receive messages to each other on social media. By typing the '@' sign followed by the recipient's name, people can send notifications that alert the targeted user to the contents of a message. Use of this feature on social media has been shown to facilitate information sharing, coordination, and coherent, turn-taking conversations between users (Grabowicz et al., 2012; Honey & Herring, 2009). It is also useful for distinguishing between the directed, and dyadic based communication on social media from non-specific and non-targeted communication that lives and breathes on the platform.

Given these new opportunities for communicating with others on social media, it is possible that people may communicate with different people on social media than face to face. In other words, social media may have a broadening effect on people's communication networks that extend beyond face to face interactions, which tend to be constrained by physical proximity (e.g., layout of office space and seating arrangements determine who talks to whom) and people's work roles. This is in part facilitated by the visibility and persistence that social media provides into third parties' communication and activities, which provide a foundation for building a common ground with people who may have similar interests and the opportunity to learn about others' skills and expertise through their interactions and exchanges with others. Moreover, the new collaborative features that facilitate communication, as well as the asynchronous, text-based nature of social media interaction lowers the stakes (Daft & Lengel,

1987) associated with reaching out to others who may not be in one's social networks (Fiol & O'Connor, 2005; McPherson et al., 2001), which have traditionally influenced with whom people communicate. Thus, I posit:

Hypothesis 1. Knowledge workers maintain different face to face and social media communication networks.

Having posited that workers' communication networks on social media and face to face will be characterized by different relations, I now turn to developing hypotheses on the types of local network patterns or structures that emerge in these networks.

2.2 Direct Reciprocity

One network structure that may emerge in both social media and face to face networks is direct reciprocity. Direct reciprocity refers to the extent that communication is dyadic and mutual among communication partners. Direct reciprocity is a hardwired human relation (Blau, 1964) and a cultural mandate (Malinowski, 1932) that prescribes people should help others with the expectation that their help will be reciprocated, and that people should help those who have helped them. If a person supplies a benefit, the receiving party should respond in kind (Gergen, 1969). This concept is illustrated in Figure 6: if *i* communicates with *j*, then *j* will respond back to *i.* Over time, direct reciprocity provides mutually and rewarding transactions and relationships, and fosters strong interpersonal ties, affect, and trust (Cropanzano & Mitchell, 2005; Molm, 1994). Accordingly, reciprocity is common to social interactions in a variety of settings, such as small groups (Brewer & Gardner, 1996), discussion groups (Bales et al., 1951) online chat rooms (Becker, & Stamp, 2005), large scale online communities (Faraj & Johnson,

2011) and expectations for workplace behavior (Cropanzano & Mitchell, 2005). In fact, studies of reciprocity in the workplace shown that firm productivity is related to the reciprocating behavior among workers (Cropanzano & Mitchell, 2005). In addition, recent studies on social media have suggested that social media features, namely @mention's facilitate turn-taking conversations, much like face to face interactions (Honey & Herring, 2009).

Given that direct reciprocity is a strong norm in a variety of both face to face and online settings, I posit that both the face to face and social media communication networks will be characterized by reciprocal exchanges, where people tend to respond back to others who have initiated them in a communication exchange. Thus, I hypothesize:

Hypothesis 2. Both face to face (H2a) and social media (H2b) communication networks tend to exhibit mutually reciprocal ties.

2.3 Functional Homophily

Lazarsfeld and Merton (1954) coined the term "homophily" to refer to a tendency for people to be attracted to others who have similar attitudes, beliefs, and personal characteristics. According to McPherson, Smith-Lovin & Cook (2001, p. 416), homophily is the principle that a contact between similar people occurs at a higher rate than among dissimilar people. It is a basic organizing principle – as individuals automatically and unconsciously categorize others, and these categorizations form the basis of similarity or difference (Fiske, Lin & Neuberg 1999; Ridgeway 1997). Similar people want to interact with one another and join the same groups, and they tend to value each other's contribution more than contributions from dissimilar people (Lincoln & Miller, 1979; Tsui & O'Reilly, 1989).

Social homogeneity in the workplace makes communication easier, behavior more predictable and fosters relationships of trust, understanding, and reciprocity, which can lead to greater levels of social affiliation and enhance instrumental relationships (Ibarra 1992). Functional background within an organization can generate strong homophily preferences in the workplace (Figure 6). Functional background refers to work experience in specific areas, such as finance, marketing, sales, or operations - and functional diversity is often a proxy for diversity in skills, information, and expertise (Mannix & Neale, 2005). Many studies have shown that networks are shaped by ties to others who occupy the same job or role (e.g., Ibarra 1992, 1995; McPherson et al. 2001). This is in part due to the fact that diverse groups tend to have more formal and less frequent communication compared to homogenous groups, lower member satisfaction (Bunderson & Sutcliffe, 2002), and cohesion (van Knippenberg & Schippers, 2007), while engendering greater creativity and problem solving skills when certain conditions are in place (Mannix & Neale, 2005). Moreover, the layout of office space and seating arrangements tend to be based on people's functional role and may promote homophilous interactions (Cross & Cummings, 2004; Davis, 1984) – particularly as proximity facilitates familiarity and attraction (McPherson et al., 2001).

Social media may offer conditions that enable people to communicate with dissimilar others, outside their immediate functional backgrounds – that allow workers to overcome their homophilous tendencies for functionally similar others. Social media makes people's communication, interests and expertise visible to others, creating access to diverse identity information on others that can help people locate others in the organization with the specific kids of expertise or skills that they need (Ellison, Gibbs, & Weber, 2015). The personal information

shared on social media may spark conversations that replicate the spontaneous conversations that have traditionally occurred due to proximity (Kraut, Fussell, Brennan, & Siegal, 2002). For example, profile information can serve as a social lubricant (Ellison, Steinfield, & Lampe, 2011) that creates common ground between people from different functional backgrounds, and enhance mutual understanding and connection (Lampe, Ellison, & Steinfield, 2007). Together the identity information about people's expertise enable workers to locate others with the relevant expertise with ease, and the inclusion of personal or social information about them makes these interactions less artificial (Ellison et al., 2015). Moreover, the visibility that social media offers into people's connections to others and content can allow workers to strategically diversify their networks to improve knowledge sharing and access to information (Kane, 2015). Based on these arguments, I hypothesize:

> *Hypothesis 3. Social media communication networks are less likely to exhibit functionally homophilous ties than face to face communication networks.*

2.4 Transitive Triad Closure

Another communication structure that is likely to emerge on social media is transitive triad closure, which captures how communication and information is being retrieved, coordinated and exchanged among members of the social group. Transitive triads are a triadic structure that is characterized by a third party *k* that receives information from *j* and sends information to *i* (Figure 6). Based on the transitivity argument, this local structure should facilitate the emergence of trust and awareness between *i* and *j,* such that *j* is more likely to send information to *i* (Sosa, Gargiulo, & Rowles, 2015). The common third party *k* understands the information provided by the source *j*, and also understands the needs of the recipient *i*, and

therefore coordinates the transfer of information from *j* to *i* (Reagans & McEvily, 2003, Tortoriello et al., 2012) to close the triad. According to social network theory, coordinating information flow enables third parties or "brokers" to facilitate the activity of the other members (Obstfeld 2014), share and integrate information exchanges (Simmel 1950), resolve conflicts (Krackhardt 1998), encourage efficiency (Lee, Bachrach, & Lewis, 2014) and maintain balance in transactions and exchanges (Heider 1946). The high connectivity enables members to consult and gain complex information from one another through established ties and connections. In addition, it also allows members to validate information (Coleman, 1988; Obstfeld, 2005) and monitor each other (Burt, 1992).

The visibility and persistence of people's interactions, activities, and behavior on social may increase the tendency for transitive triad closure. On social media, people can *see* others' activities and communication (Leonardi, 2015), read or reread messages at any time, copy them, edit them and pass them along to others (Sproull & Kiesler, 1995). The visibility of content on social media makes the needs of the dialogue more salient and may facilitate generative role taking (Majchrzak et al., 2013) whereby a common third party emergently takes on a coordinative role to facilitate the transfer of information between the other workers. In essence, communication visibility enables workers to bring people together in collaboration by introducing disconnected others and forging ties between them, and also building stronger ties between people who may already have ties with one another (Obstfeld, 2005). Moreover, the persistence of communication means that workers can review others' content on social media to improve their metaknowledge of who knows whom and who knows what and encourage people with complementary skills and expertise to coordinate. Persistence can also enable people to

revisit the communication to monitor people's behaviors, follow up on task progress, and encourage the relevant parties to coordinate if something has been missed. Based on these arguments, I hypothesize:

Hypothesis 4. Social media communication networks are more likely to exhibit transitive triad closure than face to face communication networks.

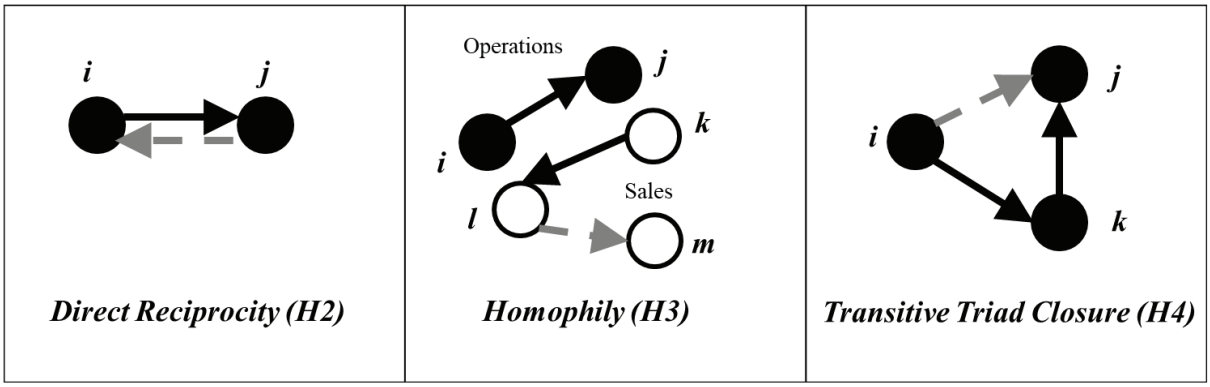


Figure 6. Emergent Structural Patterns in Communication Networks

2.5 Local Transitivity (Closure) and Performance

Given the new opportunities for communication afforded by the visibility and persistence provided by social media, it suggests that knowledge workers who make greater use of social media over face to face communication to connect with others, and coordinate their activities and actions are more likely to be effective at their work. Visibility and persistence provide the ability to see, interpret, review, and monitor coworkers' activities, creating improved awareness into their behaviors and progress on tasks. This awareness afforded by the visibility and persistence of others' communicative acts can facilitate improved coordination and connectivity among workers. Moreover, the use of social media tools, such as @mention's, can also help with knowledge flow with multiple people by facilitating timely transmission and access to critical

and relevant information. In particular, @mention's target the intended recipients of information by using notifications to indicate that their attention is required.

Individuals have different orientations or predispositions towards bringing people together in collaboration. Often, this involves acting as the common third party who introduces disconnected others and forging stronger ties between people who are already connected by finding a common ground between people who may have different perspectives on an issue (Obstfeld, 2005). Network research suggests that in triadic relationships, the common third party is typically instrumental in balancing, integrating and coordinating information flow (Lee et al., 2014). As this common third party (i.e., "tertius") brings people together, these individuals may begin to communicate directly with each other, leading to triadic closure in the network (Granovetter, 1973; Obstfeld, 2005). Triadic closure (see Figure 6. *Emergent Structural Patterns in Communication Networks*Figure 6) suggests that the members of the triad are collaborating and coordinating as a group and working towards accomplishing their common goals (Lee et al., 2014). Transitive triad closure can improve the speed with which workers receive information because communication no longer needs to travel through intermediaries. This direct access to information is particularly relevant for knowledge workers who have distributed expertise and need to coordinate and integrate their information and activities with one another in order to accomplish their tasks.

Moreover, the visibility and persistence of social media communication can aid with more effective coordination and integration because workers can see and refer back to others' communication at any time. These capabilities can facilitate greater ease in monitoring others' progress on tasks, backing up coworkers, providing feedback and reducing errors (Marks et al.,

2001), which can be difficult to perform effectively in face to face settings (Alonso et al., 2006; Wilson, Salas, Priest, & Andrews, 2007). Thus, I propose that individuals who occupy highly clustered or locally transitive positions in the social media network are more likely to be associated with better performance ratings

Hypothesis 5. Greater local transitivity in the social media network is more positively related to performance in the social media network than in the face to face network.

3. METHODS

3.1 Field Site and Research Design

To test these hypotheses, I studied how specialists at a high technology real estate startup Technology Realty (a pseudonym) coordinate their interdependent activities to complete home purchase transaction for clients. Technology Realty is a full-service brokerage firm that augments the traditional generalist real estate agent with a team of specialists that interact with clients at different touch points throughout the home purchase process. Technology Realty employs a total of 45 employees, who are distributed across three primary functional teams – sales, support and product, and five locations, 2 in the US West, 1 in the US Midwest, 1 in the US East, and 1 in India. The workers at Technology Realty use Slack, a commercial team-oriented social media platform to communicate, coordinate, and collaborate on the different segments of the client home purchase process. Slack is a social media platform that connects teams with apps, services, and resources they need to accomplish their work. It currently has 9 million weekly active users, including from 43 companies on the Fortune 100 list, in over 100 countries (http://www.slack.com).

Because Technology Realty is comprised of specialists, these specialists need to update, inform, and share information about the client with each other. Sometimes these interactions occur face to face, especially if specialists are collocated and are present at their desks. Other times, the specialists coordinate on social media to create a visible record of the communication that others can follow up on, or if a specialist is either not at his or her desk, is out of the office, but is on their mobile phone. To facilitate social media communication, the firm has created public team channels that correspond to different parts of the home purchase process. For instance, there are channels for home tours, comps (i.e., market research on comparable home prices), and offers.

To address the hypotheses in this study, which investigates the similarities and differences in the communication networks of social media and face to face directed interactions, I needed to examine both the social media and face to face communication of the employees at Technology Realty. To this end, I collected and extracted data on the social media and face to face interactions of 15 collocated workers at the firm's headquarters, which was one of the US West Coast offices. Below I describe how the data were collected.

3.2 Data Collection and Analysis

As shown in Table 19, I collected data on 15 employees, which included the two co-founders, as well as 13 specialists distributed into 3 functional roles at the firm's headquarters.

Table 19. Demographic Information for Technology Realty Employees

Employee	**Functional Role**	**Gender**	**Tenure (months)[a]**
CEO/Co-Founder	Product	Male	27

VP Sales/Co-Founder	Sales	Male	24
Specialist 1	Sales	Female	13
Specialist 2	Sales	Female	3
Specialist 3	Sales	Female	2
Specialist 4	Sales	Female	1
Specialist 5	Sales	Male	1
Specialist 6	Sales	Male	4
Specialist 7	Operations	Male	4
Specialist 8	Operations	Male	5
Specialist 9	Operations	Male	3
Specialist 10	Operations	Male	7
Specialist 11	Product	Female	2
Specialist 12	Product	Male	3
Specialist 13	Product	Male	3

[a] Tenure is as of August 2017

3.3 Communication Networks

Social Media Communication Network. I collected server-side data of the workers' interactions for seven months between January and July 2017. Using the server-side data I extracted all directed communication that included @mention's. On social media, an @mention is used by a person to send a directed message to another individual. By using the @mention feature, the recipient gets an alert on their social media platform that notifies them that their attention is needed. On Slack, sending an @mention is the only way for someone to notify another user. Typical examples of use include information requests or coordination requests to

someone with the relevant expertise, information broadcasts, monitoring, or following up. Below I provide a few excerpts from the Slack communication data of how @mention's are used by the employees at Technology Realty.

Example 1: Information/coordination request

> **Specialist 1 (Sales) 6:15 pm:** @Specialist 1 URGENT: 1254422
>
> **Specialist 7 (Operations) 6:16 pm:** Just wrapping up another comp, will prioritize this one right after
>
> **Specialist 1 (Sales) 6:16 pm:** @Specialist 7 Thanks! Making offer ASAP I believe.
>
> **Specialist 7 (Operations) 6:18 pm:** Alright I'll get it done ASAP
>
> **Specialist 7 (Operations) 6:18pm:** @Specialist 1 who's the client?
>
> **Specialist 1 (Sales) 6:20 pm:** [first name last name]

Example 2: Information/coordination request, information broadcast, following up

> **Specialist 8 (Operations) 3:41 pm:** @Specialist 1 @Specialist 2 @Specialist 3 @Specialist 4 [This client] just signed up and requested a tour. Does anybody know who this is?
>
> **Specialist 8 (Operations) 3:42 pm:** Her phone # is [xxx-xxx-xxxx].
>
> **Specialist 1 (Sales) 3:44 pm:** @Specialist 8 I don't recognize the name
>
> **Specialist 8 (Operations) 3:46 pm:** She's requesting to tour a vacant house at 5:45pm. Anybody able to take this tour with her as it's her first one?
>
> **Specialist 4 (Sales) 3:52 pm:** @Specialist 8 I can meet her and give her the tour.
>
> **Specialist 8 (Operations) 3:55 pm:** Great! @Specialist 4 can you also do intro call with her? Just give her a quick ring and intro yourself, and that you will be her expert and see her there.
>
> **Specialist 4 (Sales) 3:55 pm:** Sure will do
>
> **Specialist 4 (Sales) 6:34 pm:** quick update - I've met her and showed her the house...Had a nice talk and pitch. AND SHE IS NOW WORKING WITH US. can mark as active client. @Specialist 8
>
> **Specialist 1 (Sales) 6:35 pm:** Good job @Specialist 4!

Example 3: Following up

> **Specialist 3 (Sales) 11:32 am:** [Client name] wants to tour this house at 12:30pm. She especially wants to tour with [tour agent name]
>
> **Specialist 9 (Operations) 12:05pm:** @Specialist 10 this is for that request that came [in] - what's the status?
>
> **Specialist 10 (Operations) 12:06pm:** @ Specialist 9 literally just started looking at it, working on it now.

Example 4: Information/coordination request

> **Specialist 9 (Operations) 9:00 pm:** @Specialist 3, will you be able to take [this tour]? Seems everybody's calendar is booked…
>
> **Specialist 8 (Operations) 9:01 pm:** @Specialist 9 book with me
>
> **Specialist 9 (Operations) 9:01 pm:** okay thanks

All @mention's were extracted from the server-side social media communication during the January to July 2017 observation period. There was a total of 225 @mention's that were sent between the 15 workers over the observation period. Each @mention formed a directed relation indicating who @mentioned whom. These @mention's were recorded in a 15 x 15 binary matrix, where a 1 indicated that a directed relation connected the two individuals together, and 0 otherwise.

Face to Face Communication Network. In January 2018, I sat as an observer in the headquarters of Technology Realty and observed all task-related face to face interactions between the same 15 collocated workers at Technology Realty for one month. A directed relation was formed from person *i* to person *j* if person *i* initiated *j* in a communication exchange. If person *j* later initiated a new exchange with person *i*, then a directed relation was formed from *j*

to *i*. Directed ties were coded this way for consistency with @mention interactions on Slack. Their communication exchanges were recorded in a second 15 x 15 binary matrix, where a 1 indicated a directed relation between two individuals, and 0 otherwise. To facilitate direct comparisons in the two communication channels, I observed the social media communications over a longer observation period to account for workers being hired into the firm and providing them with time to familiarize themselves with the organization and the technology. To account for the differences in observation periods, I binarized the network relations.

In addition, to compare whether the observed informal communication networks differed at all from the formal chain of command and the physical seating arrangements of the office space, I constructed a network of the formal hierarchical structure of the 15 workers as well as the seating arrangement of the office. The matrix for the formal structure included vertical ties between subordinates and their supervisors and horizontal ties between peers who occupied similar functional roles in sales, operations, and product, respectively. The matrix for the physical seating arrangement included ties between people who either sat beside or across from each other.

3.4 Other Variables and Measures

Performance. I used the year-end 2017 peer performance ratings for each individual. At the end of December, each individual was asked to peer review three other workers at the firm by assigning them a rating of 1 = Superb, 2 = Strongly exceeds expectations, 3 = Exceeds expectations, 4 = Consistently meets expectations, and 5 = Needs Improvement. The average of the three peer performance ratings for each individual were used as the dependent variable for testing H5. The performance reviews and ratings were given to the workers at the end of January

2018, after data collection on the communication networks had ended. For the purposes of the analysis, the average performance ratings were reverse coded on the same 5-point Likert scale.

Local Network Structures. To test H1, I used the edge covariate parameter. The edge covariate parameter determines the extent to which two actors engage in an activity. In this context, it refers to the extent to which two actors who communicate on social media (face to face) also communicate face to face (on social media). A positive significant parameter estimate suggests that the occurrence of the focal tie (i.e., the type of tie being modeled in the network) co-occurs with the tie described by the edge covariate term.

To test H2, I used the reciprocity parameter. The reciprocity parameter captures the tendency for *j* to respond back to *i* after *i* had previously communicated with *j* during the entire observation period for social media and face to face communications, respectively. A positive significant parameter estimate suggests that communication exchanges between workers are likely to be reciprocated.

To test H3, I used the homophily parameter to capture the tendency for people to communicate with people of the same functional background during the entire observation period for social media and face to face communications. A positive significant parameter estimate suggests that communication exchanges are likely to take place between people of the same functional background.

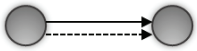
To test H4, I used the transitive triad parameter to capture the tendency for *i* to communicate with *j*, for *j* to communicate with *k*, and for *i* to close the triad by communicating with *k* during the entire observation period for social media and face to face communications,

respectively. A positive significant parameter estimate suggests that the communication exchanges are likely to exhibit transitive triad closure.

To test H5, I computed each individual's clustering coefficient to measure the density of an individual's local or ego network, as the fraction of ties among the individual's contacts over the possible number of ties between them (Watts & Strogatz, 1998). This equates to the ratio of triangles connected to the individual to the triples centered on the individual *i*:

$$C(i) = \frac{number\ of\ actual\ ties\ among\ individual\ i's contacts}{number\ of\ possible\ ties\ among\ individual\ i's\ contacts}$$

Control Variables. Control variables were included to account for basic structural effects: the number of directed network ties in the network, the outdegree distribution and cyclic triad closure using the edge and geometrically outdegree parameter and gwesp parameter, respectively. Individual level control variables were also used to control for hierarchical level (1 = manager; 0 = otherwise), gender (1 = female; 0 otherwise) and tenure (in years). I used the term, nodefactor to control for categorical personal attributes, namely hierarchical level and gender, and the term, nodecov to control for continuous personal attributes, namely tenure. Figure 7, below, illustrates each parameter that was used to test the hypotheses.

Concept	**Network Parameter**	**Visual Motif**	**Description**
Communication Tie	Edge (Control)		Baseline tendency for communication to occur
Communication Tie Co-Occurrence	Edge Covariate (H1)		Tendency for co-occurrence of face to face and social media ties between actors

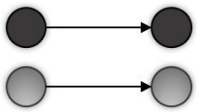
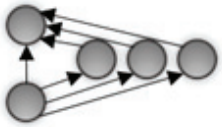
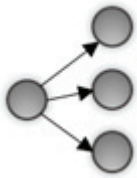
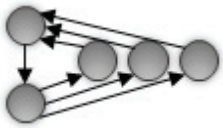
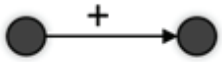
Reciprocity	Reciprocity (H2)		Tendency for information communication to be reciprocated
Functional Homophily	Homophily (H3)		Tendency for communication ties to occur between actors who share the same functional role
Transitive Triad Closure	Transitivity (H4)		Tendency for transitive path closure to occur in the communication network
Centralization of outdegree communication	Expansiveness (Control)		Tendency for variability in the degree to which workers communicate with others
Indirect Reciprocity	Cyclic Triad		Tendency for cyclic triad closure to occur in the communication network
Differential interconnectedness of people with longer tenure at firm	Additive personal attributes (Control)		Tendency for communication exchanges to be based on a worker's tenure at the firm
Differential interconnectedness of people with certain personal attributes (manager, gender)	Discrete personal attributes (Control)		Tendency for communication exchange to be based on a worker's hierarchical level or gender

Figure 7. Network parameters used for statistical analyses of communication networks

3.5 Statistical Analysis

Exponential Random Graph Model (ERGM). To test H1-H4, I used a type of statistical analysis for social networks called Exponential Random Graph Models (ERGMs) to predict network structure. ERGMs describe a probability graph distribution with an exponential form:

$$P(Y = y|n\ actors) = \frac{\exp(\sum_{k=1}^{K} \theta_k\, z_k(y)}{c}.$$

The $z_k(y)$ terms represent model covariates, which consist of any set of *K* network statistics calculated on *y* and hypothesized to affect the probability of this network forming. Examples of positive *z* statistics include the number of ties, the number of reciprocated ties, or the number of transitive triads. The θ coefficients determine the impact of these statistics on the observed data. The denominator *c* is a normalizing constant.

ERGMs are used to model how the global network structure (i.e., of the mention network) may be explained by endogenous network processes (i.e., reciprocity, transitive triad closure, homophily/heterophily) and exogenous nodal factors (i.e., gender, manager, number of mentions sent). Thus, it is a model to predict the emergence of local structural configurations of a network, in which the relationships among actors are influenced by the presence of other ties and attributes of the other actors in the network (Robins et al., 2007).

ERGM provides a superior specification to standard statistical methods (e.g., logistic regression or multiple regression) because it accounts for the dependencies in network data, for which complex and interdependent social processes explain how actors are connected within a network (Lusher, Koskinen, & Robins, 2013). That said, the parameter coefficients are interpreted similar to a logistic regression. A parameter estimate of zero indicates that the effect

being modeled occurs at a rate consistent with chance, whereas a positive parameter suggests the effect is more prevalent and a negative parameter that the effect is less prevalent than chance, given the other effects in the model. The effect size of each additional variable can be interpreted using the odds ratio, which equals the exponential function of the particular coefficient of interest (e.g., e^{β}). Thus, a value of 1.0 for suggests that the parameter has no effect on the outcome or dependent variable. Statnet was used for estimation purposes (Handcock et al. 2008).

ERGM Goodness-of-fit Evaluation. Once the ERGM coefficients were estimated, it defines a probability distribution across all networks of this size. If the model is a good fit to the observed data, then the networks drawn from this distribution will be more likely to resemble the observed data (Robins & Lusher, 2013). I assessed the goodness-of-fit of the fitted models by comparing the observed graph statistics of features that were not included in the fitted model (i.e., indegree, outdegree, edge-wise shared partners, and minimum geodesic distance) with the values of these statistics for a sizeable number of networks that are simulated based on each fitted ERGM (Hunter, Handcock, Butts, Goodreau, & Morris, 2008). I used statnet for estimation purposes (Handcock et al., 2008).

Ordinary Least Squares (OLS) Regression. Because H5 was related to an individual's local transitivity measure rather than the topology of network structures that emerged in the communication networks, I used OLS regression to examine the relationship between each individual's local transitivity on the social media and face to face networks, respectively, and their year-end performance ratings.

4. RESULTS

4.1 Descriptive Statistics

Table 20 presents network descriptive statistics of the two communication networks. The descriptives suggest that the face to face network had a higher density (0.71) than the social media network (0.22). Accordingly, there are more edges in the face to face (149) than social media network (47).

Table 20. Summary of Network Statistics in the Social Media and Face to Face Networks

Network Statistic	Social Media Network	Face to Face Network
Edge (communication tie)	47	149
Isolates	1	0
Reciprocity	14	64
Cyclic Triads	16	361
Transitive Triads	82	1122

N = 15 nodes or individuals.

Moreover, Table 21 presents the correlations between the different networks in the organization's headquarters, namely the formal hierarchical structure, the physical seating arrangements, as well as the informal face to face and the social media communication networks. The correlations between each network were computed using Quadratic Assignment Procedure (QAP; Hubert & Schultz, 1976), which performs a nonparametric test of whether the two matrices are significantly and non-spuriously correlated. QAP involves randomly permuting the rows and columns of one matrix while holding the other matrix constant and calculating the correlation between the two after each permutation. A distribution produced from each of these correlations determines its significance. This procedure has been found to be superior to ordinary

least squares for testing hypotheses based on dyadic data, like the data in social network analysis (Krackhardt, 1988) because it accounts for autocorrelations in the social network data.

The QAP correlations indicate that while the formal organizational structure and the face to face network are moderately correlated ($r = 0.38$, $p < 0.001$), there is a near zero correlation between the formal organizational structure and the social media network ($r = 0.04$, $p < 0.01$), and a modest or low correlation between the face to face and social media networks ($r = 0.17$, $p < 0.05$). Moreover, although the formal hierarchical chain of command is moderately correlated with the physical seating arrangements in the office space ($r = 0.46$, $p < 0.01$), there is only a small positive correlation between the physical seating arrangements and the informal face to face network ($r = 0.15$, $p < 0.05$) and a slight negative correlation with the informal social media network ($r = -0.06$, *ns*). These descriptive results suggest that workers' informal communication ties are not limited by their formal roles in the organization or their physical seating arrangements, and that workers maintain different face to face and social media networks.

Table 21. Correlations between Communication Networks

	Formal Network	Seating Network	Face to Face Network	Social Media Network
Formal Network	1.00			
Seating Network	0.46**	1.00		
Face to Face Network	0.38***	0.15*	1.00	
Social Media Network	0.04	-0.06	0.17*	1.00

$N = 15$ nodes or individuals. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Next, Table 22 presents the correlations between the individual level attributes. There were 5 women (33 percent), 4 managers (26 percent), and average tenure was 0.56 years. Average local transitivity for the face to face network was 0.28, compared to 0.37 for the social

media network. Also, the average performance rating was 3.49. Overall, the level of correlation between the attributes are low, except for the correlation between manager and tenure ($r = 0.61$, $p < 0.05$) and between local transitivity on the social media network and performance ($r = 0.56$, $p < 0.05$). The moderate correlation between manager and tenure is due to the early stage and flat hierarchical nature of the firm, whereby the two co-founders have the longest tenure at the firm.

Table 22. Correlations between Individual Level Attributes

		1	2	3	4	5	6
1	Gender	1.00	-0.43	-0.22	-0.05	-0.05	-0.15
2	Manager	-0.43	1.00	0.61*	0.04	0.15	0.38
3	Tenure	-0.22	0.61*	1.00	-0.32	0.23	0.41
4	Local Transitivity (Face to Face)	-0.05	0.04	-0.32	1.00	0.06	0.03
5	Local Transitivity (Social Media)	-0.05	0.04	-0.32	0.05	1.00	0.56*
6	Performance	-0.15	0.38	0.41	0.03	0.56*	1.00

$N = 15$. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

4.2 ERGM Results (H1-H4)

To test the first four hypotheses, I use ERGM. This particular statistical analysis method enables me to control for various structural differences in the two networks, such as their density.

Hypothesis H1 posited that the people would have different communication networks on social media than face to face. Examining Table 23, Model 1, the coefficient for co-occurrence between communication ties in the face to face (focal network) and social media networks is positive but not significant ($\beta = 0.56$, *ns*). This suggests that people do not have a strong tendency to have similar face to face and social media contacts. Similarity, examining Table 23, Model 2, the coefficient for similarity in communication ties in the social media network shows that the social media (focal network) and face to face networks is once again positive, but not

significant (β = 0.54, *ns*). This confirms that people do not have a strong tendency to have similar face to face and social media contacts.

Hypothesis H2 posited that both networks would exhibit direct reciprocity Examining Table 23, Model 1, the coefficient for direct reciprocity is positive and highly significant in the face to face network (β = 2.35, $p < 0.001$); thus, Hypothesis 2a is supported. Examining Table 23, Model 2, the coefficient for direct reciprocity is also positive and highly significant (β = 3.65, $p < 0.001$); thus, Hypothesis 2b is supported. This suggests that people tend to engage in mutual, dyadic exchanges, where a person tends to respond back to someone who had previously engaged them in a communication exchange. Thus, Hypothesis 2 is fully supported.

Hypothesis H3 posited that the social media communication network would be less likely to exhibit functionally homophilous ties than the face to face communication network. Examining Table 23, Model 1, the coefficient for functional background homophily is positive and significant in the face to face network (β = 1.12, $p < 0.01$). The odds ratio of 3.05 suggests that workers are three times as likely to communicate with another person from the same functional background than another person from a dissimilar functional background. In contrast, examining Table 23, Model 2, the coefficient for functional background homophily is positive but not significant in the social media network (β = -0.05, *ns*). The odds ratio of 0.95 suggests that workers are equally as likely to communicate with another person from the same functional background as another person from a different functional background, therefore indicating no particular preference for functional homophily. Moreover, a post hoc analysis using simulation and the goodness-of-fit test was conducted to show that the extent of functional homophily in the

two networks were statistically different. Based on the ERGM and post hoc analyses, Hypothesis 3 was supported.

Hypothesis H4 posited that the social media communication network would be more likely to exhibit transitive triad closure than the face to face communication network. Examining Table 23, Model 1, the coefficient for transitive triads is positive but not significant in the face to face network ($\beta = 0.59$, *ns*). In contrast, examining Table 23, Model 2, the coefficient for transitive triads is positive and highly significant in the social media network ($\beta = 1.25$, $p < 0.001$). The odds ratios of 1.80 and 3.50 for the face to face and social media networks, respectively, show that workers are approximately twice as likely to close a transitive triad on social media than face to face. Furthermore, a post hoc analysis using simulation and the goodness-of-fit test was conducted to show that the extent of transitivity in the two networks were statistically different. Based on the ERGM and post hoc analyses (See Section 4.5), Hypothesis 4 was supported.

Lastly, the control variables provide some additional insight into the nature of the communication networks. The structural control for communication tie or edge is negative and non-significant in the face to face network ($\beta = -0.88$, *ns*), but negative and highly significant in the social media network ($\beta = -4.50$, $p < 0.001$). This confirms that the people are less likely to engage in interactions with their coworkers on social media than face to face. In contrast, the structural controls for expansiveness are non-significant in both networks and suggests that activity is not likely to be dominated by a few individuals in either network. In other words, communication is non-hierarchical, and consistent with prior work showing that informal networks tend to be more distributed than formal organizational structure (Cross & Cummings,

2004; Table 21). The controls for indirect reciprocity are both negative and significant in both networks and show that while there is a strong tendency for reciprocated exchanges, this is accompanied by a strong tendency against indirect reciprocity (cyclic triad closure). Lastly, the individual level controls for gender and manager are not significant in either network. This suggests that communication is evenly distributed between males and females, and formal hierarchical levels in both network. In contrast, tenure is significant in the social media network, and suggests that workers who have been employed for a longer period are more likely to be connected to others.

Table 23. ERGM Results Predicting Communication Patterns on Social Media and Face to Face Communication Channels

		Model 1 (Face to Face)		**Model 2 (Social Media)**	
Concept	**Parameter**	**Coefficient**	**Odds Ratio**	**Coefficient**	**Odds Ratio**
Independent Variables					
Co-Occurrence of Ties (H1)	Edge Covariate	0.56	1.75	0.54	1.71
Direct Reciprocity (H2)	Reciprocity	2.35***	10.50	3.65***	38.42
Transitive Triad (H3)	Transitivity	0.59	1.80	1.25***	3.50
Homophily (H4)	Homophily	1.12**	3.05	-0.05	0.95
Controls					
Communication Tie	Edge	-0.88	0.41	-4.50***	0.01

Expansiveness	Outdegree Distribution	-0.79	0.45	1.49	4.45
Indirect Reciprocity	Cyclic Triad	-0.67***	0.51	-0.95***	0.39
Gender	Categorical Personal Attribute	-0.06	0.94	-0.50	0.61
Manager	Categorical Personal Attribute	-0.35	0.70	-0.62	0.53
Tenure	Continuous Personal Attribute	0.41	1.51	0.70*	2.01
	AIC	219.0		148.3	
	BIC	251.9		200.0	

N = 15 nodes. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Goodness-of-fit Evaluation. I examined the goodness of fit of each ERGM by comparing the structural statistics of interest (indegree, outdegree, edgewise shared partners, and minimum geodesic distance) in the observed networks to a sample of networks simulated from the fitted model. For each network, I simulated 100 sample networks. As shown in Figure 8 and Figure 9, the models replicated the selected statistics relatively well, indicating that the fitted models sufficiently capture the features of the original networks.

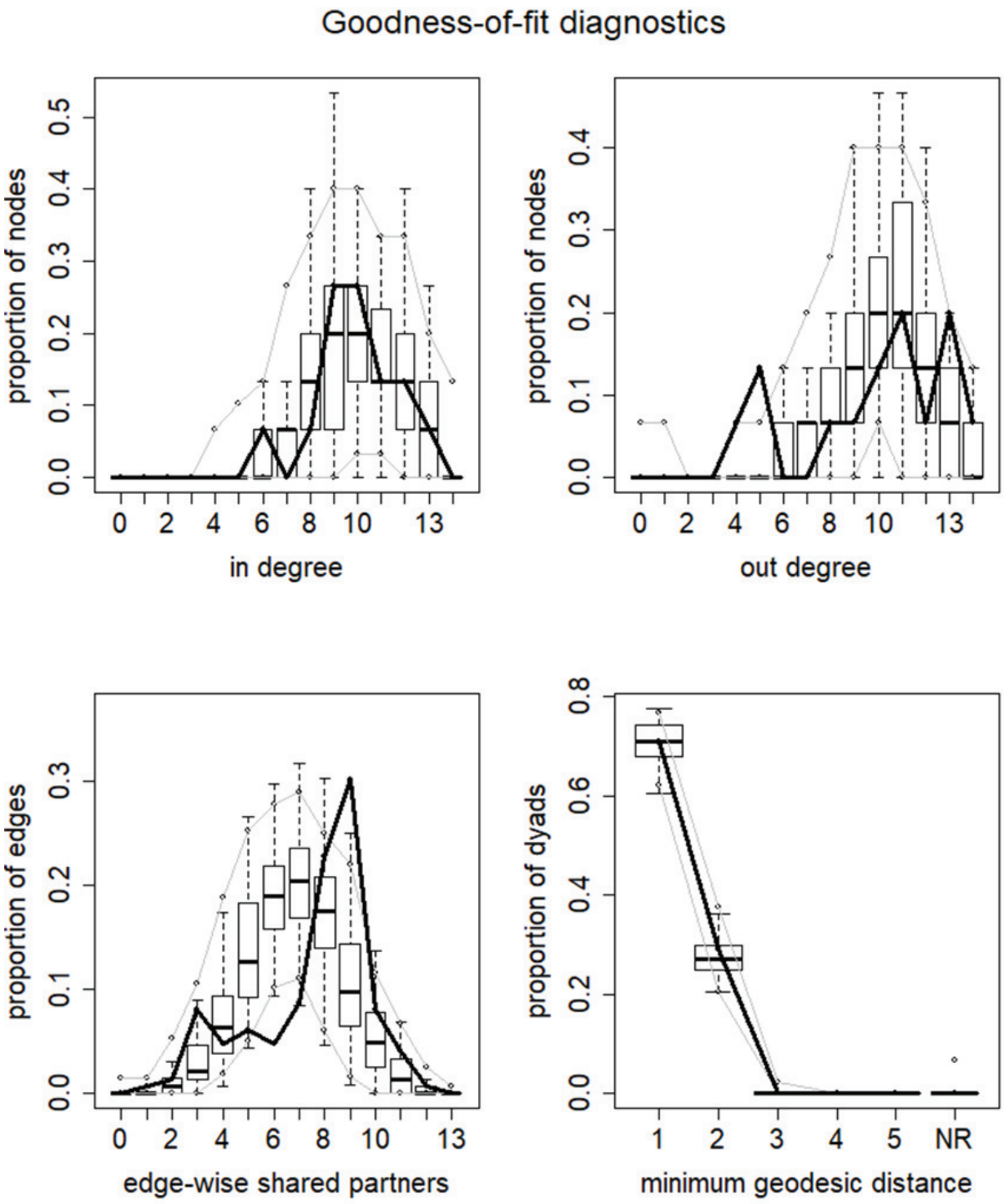


Figure 8. Goodness-of-fit diagnostics comparing fitted and observed networks for the face to face network (solid black line is the observed network).

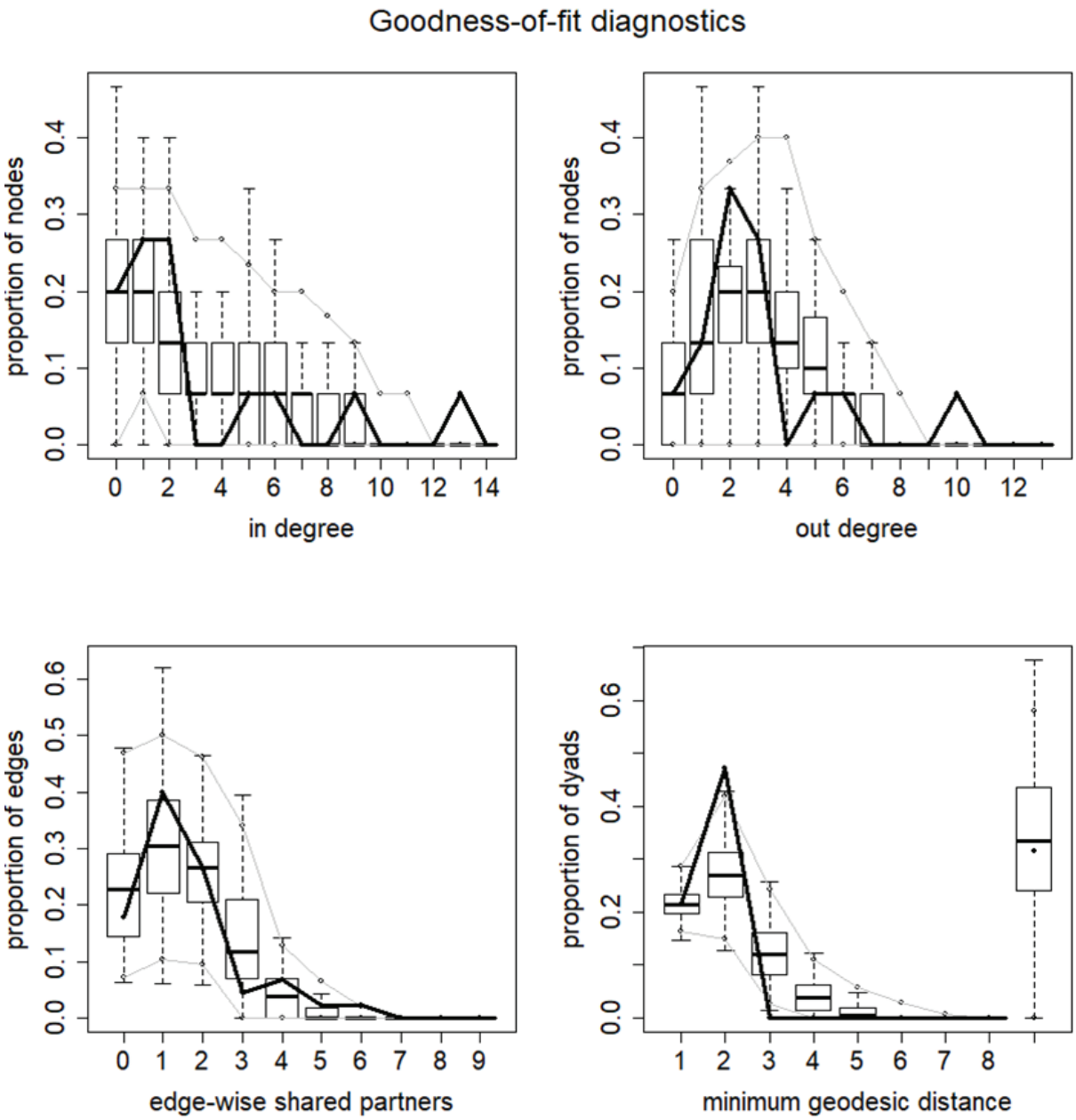


Figure 9. Goodness-of-fit diagnostics comparing fitted and observed networks for the social media network (solid black line is the observed network).

4.3 OLS Regression Results (H5)

To test H5, I use OLS regression to examine the relationship between local transitivity or clustering in the social media and face to face networks and performance. Table 24 displays the results. Examining Table 24, Model 1 shows that local transitivity or clustering coefficient in the face to face network is not significantly related to workers' performance ratings ($\beta = 0.37$, *ns*). In contrast, Model 2 shows a significant and positive relationship between an individual's local transitivity on the social media network and his or her performance ratings ($\beta = 1.76$, $p < 0.05$). Lastly, Model 3 examines the face to face and social media networks simultaneously and shows that the positive relationship between a worker's local transitivity in the social media network and performance remains significant ($\beta = 1.76$, $p < 0.05$) when both transitivity measures are included in the model together. Thus, Hypothesis H5 was supported.

Table 24. OLS Regression Results Comparing Local Transitivity to Performance

DV = Performance Ratings	Model 1	Model 2	Model 3
Local Transitivity (Face to Face)	0.37		0.00
Local Transitivity (Social Media)		1.76*	1.76*
Intercept	3.39**	2.83***	2.84**
R^2	0.00	0.31	0.31

$N = 15$. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

4.4 Robustness Check: Collocated versus Distributed Social Media Networks

Because the social media communication network was not restricted to collocated individuals, except for the purposes of this study's analysis to enable direct comparisons between the interactants in the social media and face to face networks, one might question whether the emergent communication patterns in the social media network are characteristic of the entire firm's communication exchanges on social media. As a robustness check, I ran the ERGM

analysis on the firm's entire communication network, inclusive of collocated and distributed ties. This analysis was conducted during the same observation period, and the fitted model included the same network parameters and controls, except for the edge covariate parameter, examining the overlap of face to face and social media communication.

The results are displayed in Table 25. Comparing Model 2 in Table 23 to Model 3 in Table 25, all results replicated for the entire firm's social media network except for Hypothesis 3; while the collocated social media network showed no preference for functionally homophilous ties, the entire firm's social media network shows a significant preference for functional homophily ($\beta = 0.86$, $p < 0.001$). That said, the odds ratio of 2.37 compared with 3.07 in the face to face network suggests that functional homophily is still more prevalent in face to face communication than it is for the entire firm's social media communication. Lastly, the goodness-of-fit statistics indicated that the fitted model replicated the observed model well.

Table 25. ERGM Results Predicting Communication Patterns for Firm's Social Media Network

		Model 3 (Social Media; Firm level)	
Concept	**Parameter**	**Coefficient**	**Odds Ratio**
Network Variables			
Direct Reciprocity (H2)	Reciprocity	2.58***	13.19
Homophily (H3)	Homophily	0.86***	2.37
Transitive Triad (H4)	Transitivity	0.81***	2.26
Controls			
Communication Tie	Edge	-4.29***	0.01

Expansiveness	Outdegree Distribution	-1.04*	0.35
Indirect Reciprocity	Cyclic Triad	-0.46***	0.63
Gender	Categorical Personal Attribute	-0.09	0.91
Manager	Categorical Personal Attribute	0.29*	1.33
Tenure	Continuous Personal Attribute	0.02***	1.02
	AIC	570.7	
	BIC	614.2	

$N = 31$. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

4.5 Post Hoc Analysis: Goodness-of-Fit Parameter Estimates for H3 and H4

A difficulty in interpreting the results from Hypotheses H3 and H4 is that the coefficients for functional background homophily (H3) and transitive triad closure (H4) in the face to face and social media networks are both being compared to a random network, rather than being compared directly to each other. To overcome this difficulty, I present an alternative approach using simulation to compare the degree of transitive triad closure and functional homophily in the face to face and social media networks. Specifically, I apply a post hoc goodness-of-fit test for the face to face network but replace the parameter estimate associated with the structural term of interest (i.e., transitive triad closure or functional background homophily) with the corresponding parameter estimate in the fitted model for the social media network. If the parameter estimates for each of these terms (i.e., transitive triad closure, functional background

homophily) is statistically different, then the simulated distribution of graphs would no longer be a good fit to the observed model of the face to face network.

Indeed, after running the post hoc goodness-of-fit tests, I find that the fitted model for the face to face network is no longer a good fit of the observed network when the parameter estimates for transitive triad closure (Figure 10) and functional background homophily (Figure 11) in the face to face network are replaced by the respective estimates in the social media network.

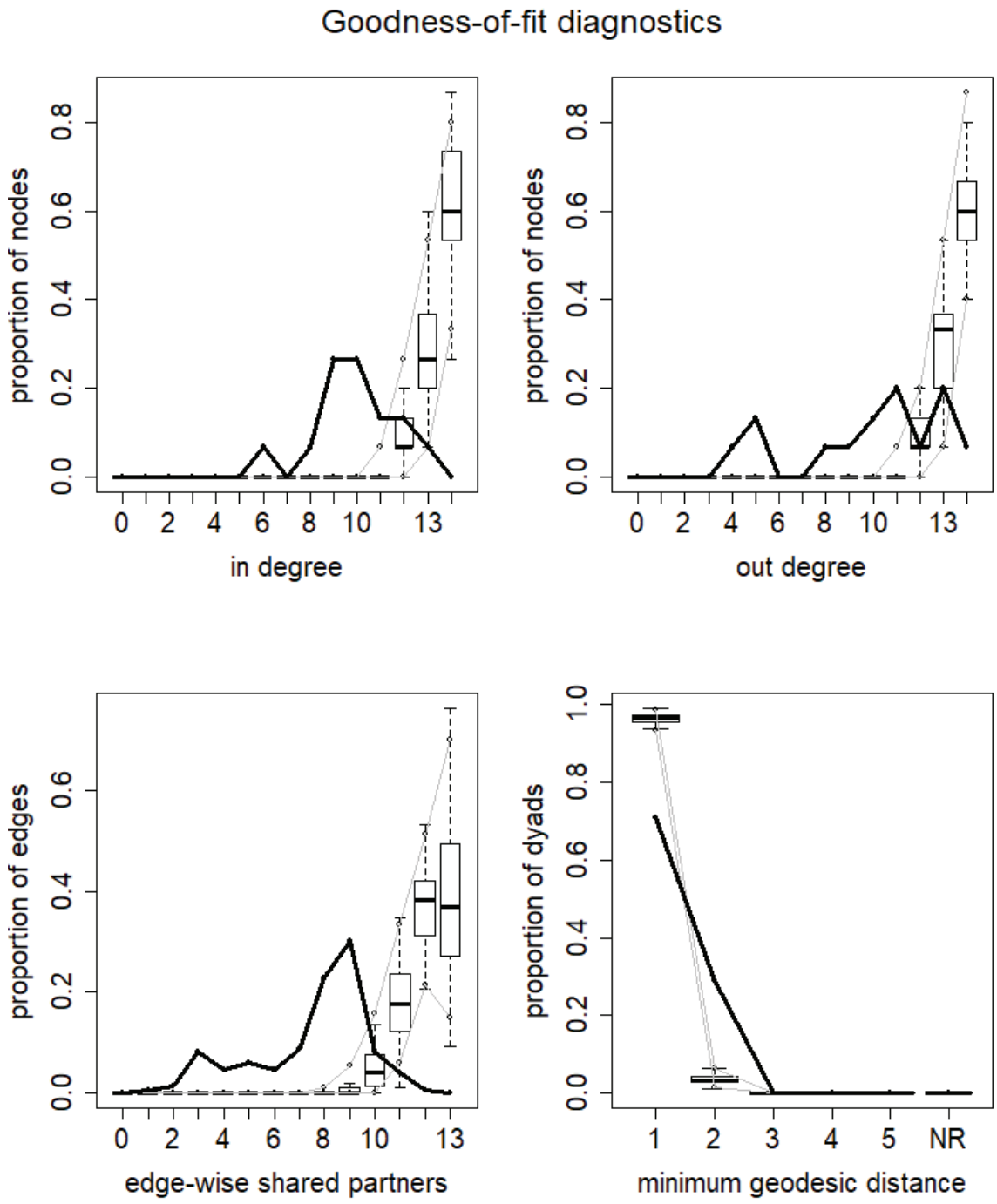


Figure 10. Post hoc goodness-of-fit test shows that the fitted model is no longer a good fit of the observed face to face network when the parameter estimate for transitive triad closure is replaced with the corresponding estimate from the social media network.

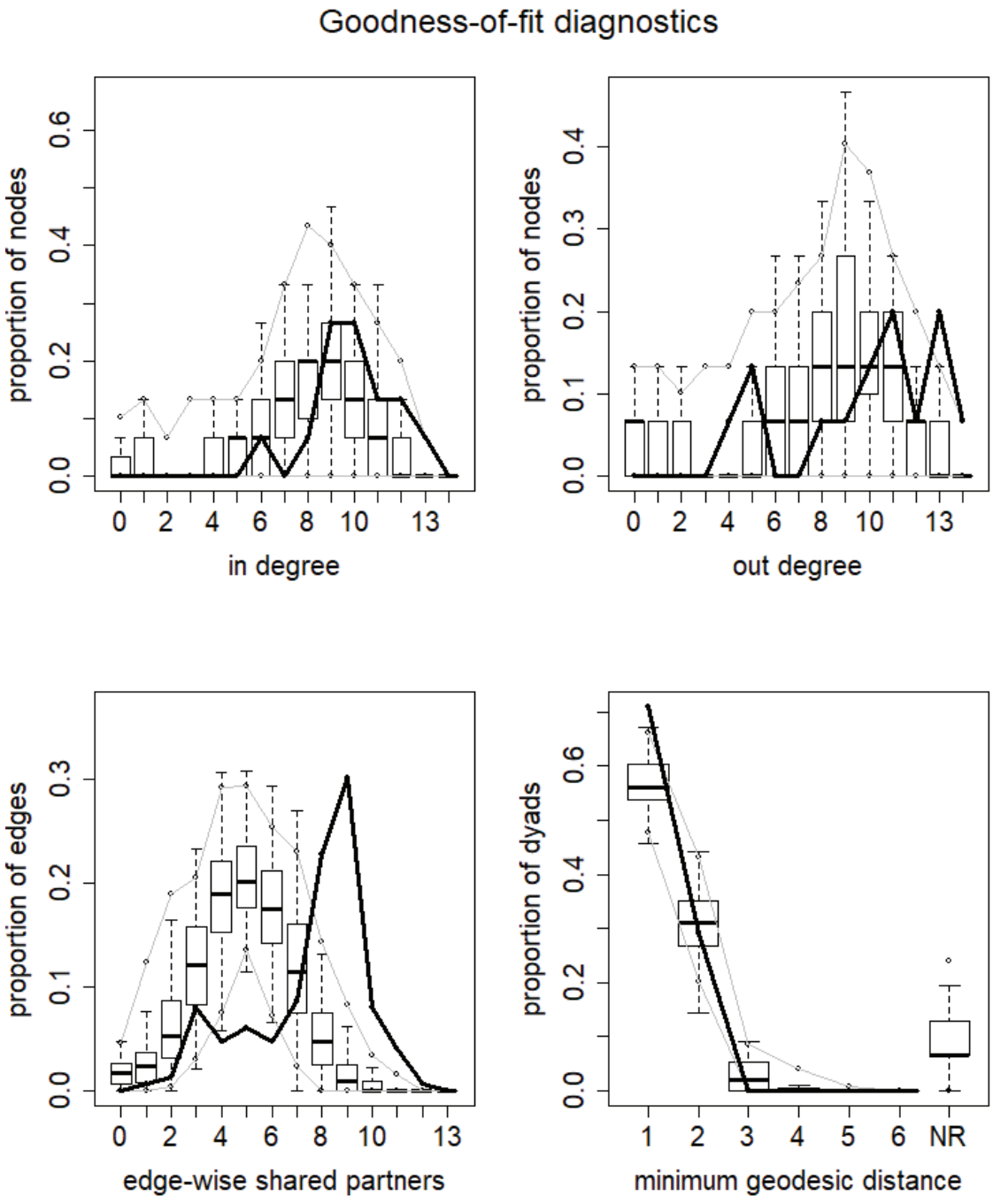


Figure 11. Post hoc goodness-of-fit test shows that the fitted model is no longer a good fit of the observed face to face network when the parameter estimate for functional background homophily is replaced with the corresponding estimate from the social media network.

5. DISCUSSION AND CONCLUSIONS

Knowledge workers in contemporary organizations have abundant choice in the communication media they choose to interact with others within the organization. In recent years, social media have gained widespread usage for internal communication within the firm. The implication is that knowledge workers have even more choice when it comes to communication media, with social media either complementing or replacing other forms of communication. Although social media are prevalent across many organizations, organizational scholars have been slow to study their adoption and the implications of their use. In this study, my primary objective was to contribute to the understanding of social media use within the enterprise by examining how communication networks on social media form, and how communication patterns on social media may differ from traditional media, namely face to face interactions. To this end, I examined the social media and face to face communication networks among collocated workers at a US based technology startup. The findings show that people tend to communicate with different people on social media than face to face. Also, they suggest that social media may offer new opportunities for communication, beyond the capabilities offered by face to face communication. In particular, while both forms of communication enable mutual, reciprocal interactions, social media potentially engenders broader, group-level communication and less functionally homophilous interactions. This communication is potentially facilitated by the design of social media technologies, which afford visibility into others' activities, behaviors, attitudes and content, persistence of past communication acts (Treem & Leonardi, 2012), as well as new features that facilitate interaction in asynchronous, text-based environments.

The lack of significant functional background homophily on the social media network suggests that workers may be more likely to reach across their networks and communicate with people who are outside their functional team; thus, social media may promote cross-functional team interaction and have a broadening impact on communication ties rather than the deepening effect (Ellison et al., 2015; Hampton, 2016; Leonardi & Meyer, 2015). Moreover, the presence of transitive triad closure in the social media network suggests that common third parties are likely to promote direct interaction between the unlinked people in the triad. It is possible that the ability to see others' communication and activities, combined with the ability to revisit past communication on social media improves coordination and facilitates information exchange, leading to increased transitive triad closure. Lastly, the positive and significant relationship between a worker's degree of local transitivity or clustering of connections and their peer performance ratings on the social media network suggests that social media use can improve workers' productivity and performance. In particular, the results suggest that knowledge workers who leverage social media for collaborating, coordinating and integrating group-based knowledge work tend to be more competent and effective at their jobs.

Accordingly, this research has implications for the understanding of social media use within organizations. This research contributes to the understanding of how informal networks emerge on social media. It also sheds light on the types of communication patterns the arise on social media – due to the capability to *see* third parties' interactions and activities, as well as the persistence of these communication exchanges that can be archived, searched and reviewed at any point in time. These new capabilities affect how communication networks form and has potential implications on how knowledge-based work is being accomplished.

Although this research contributes to the budding research on enterprise social media, it is not without limitations. First, I focused on people's relational networks on social media by examining the communication patterns that emerged from their directed messages, through the use of @mention's. Despite @mention's being integral to organizing and the formation of communication networks on social media, it does not capture the entirety of activity and relations that occur on social media. There may be important associations between people and content or between content and content (Treem & Leonardi 2012) that provide additional insight into the types of activities that knowledge workers accomplish interdependently on social media that are not possible in face to face or other forms of digital mediated interaction. Thus, an avenue for future research would be to examine how communication networks on social media differ from traditional digital mediated communication, such as email. An important next step would also be to understand the content of the exchanges that occur on different forms of communication to determine not just *how* people communicate (i.e., the structure) but also *what* people communicate (i.e., the content). Indeed, through informal interviews with the workers at Technology Realty, there seemed to be differences in perceptions among workers regarding the *immediacy* with which @mention's were recognized and responded to. Although some workers found that @mention's were equivalent to a crucial "escalation" that required an "immediate response" (Specialist 9; Operations), there were others who felt that the waiting period involved was not urgent enough and preferred in person contact or phones to get a hold of another worker urgently (Specialist 5; Sales). Text analysis and machine learning methods can be applied to the content of the social media ties to better understand how workers are using social media to accomplish important work functions, such as coordination, information sharing and monitoring.

Similarly, communication on social media is for the most part asynchronous and text-based, and therefore offers greater leeway for self-editing and self-presentation than would be available in face to face settings (Toma et al., 2008). As one specialist said, "You don't really escalate on Slack because it's online. You don't need to write things for everyone to see. You want to keep it friendly." This quote confirms that there is a general inclination for people to portray a positive image on social media (Treem & Leonardi, 2012). This suggests that there are some conversations that occur in more private settings where communication is less visible and transparent to all to see (Flyverbom et al., 2016). Further, this study did not examine tie multiplexity – that is, the tendency for different types of social ties (e.g., advice, friendship, resource) to co-occur between two individuals (Monge & Contractor, 2003). It is possible that the accomplishment of taskwork may depend on the embeddedness of social and instrumental ties (Uzzi, 1997), and that the emergent network structures in these communication networks at the dyadic, triadic and subgroup level may have different implications depending on whether the relations are uniplex or multiplex in nature (Lageza & Pattison, 1999).

Given the wide array of choice in communication technologies, workers often use multiple forms of communication modes to interact with each other. For instance, workers at IBM has multiple modes of communication (e.g., Beehive, Sametime, Connections), made possible through their ability to design and implement their own proprietary technologies (IBM, 2018), but there is also risk that too much choice is overwhelming (Iyengar & Lepper, 2000) and counterproductive to productivity (Deloitte, 2018). Accordingly, future research should address this issue and examine how different communication technologies can be managed and used more efficiently. Lastly, this study also took a cross-sectional approach, where the time periods

observed did not overlap. Although measures were taken to account for these differences – for instance, by binarizing relationships between people, and extending the observation window on social media to incorporate learning effects for newcomers into the organization – there is risk that familiarity changes the nature of communication networks.

CHAPTER 5. CONCLUSIONS, INSIGHTS, AND FUTURE DIRECTIONS

1. CONCLUSIONS AND INSIGHTS

In this dissertation, I introduced a framework for organizing in teams, through the lens of the team form-perform paradox. This paradox refers to the tendency for teams to exhibit default behaviors that counter what teams should do in order to be effective. In Chapter 1, I presented 10 illustrative cases of the team form-perform paradox in organizational teams and highlighted four themes brought to light by this paradox. These themes were: 1) viewing both team formation tendencies and team performance needs as being mutually dependent rather than discrete entities; 2) understanding the implications of team formation tendencies; 3) understanding the likelihood of needed team processes and performance; 4) expanding the methodological repertoire. In Chapters 2 through 4, I leverage this paradox lens as a framework for investigating how technologies may enable teams to organize effectively.

In Chapter 2, I examined team communication networks in the context of online discussions and used formal interventions or simple team messages to improve and better understand the discrepancies between suboptimal (i.e., naturally forming) and optimal team communication patterns. The findings indicated that interventions can promote group-level communication and information integration and reduce the tendency for hierarchy and subgrouping. This chapter illustrated how the team form-perform paradox lens can be concretely applied to examine team processes and phenomena.

Next, in Chapter 3, I turned my focus to social media and proposed that social media use within organizations may provide possibilities for the enactment of affordances that may enhance how teams carry out team processes. In this chapter, I reviewed the extant literature on social media affordances and team processes and proposed how social media affordances may enable teams to overcome their team form-perform paradoxes identified in Chapter 1. This chapter introduced a conceptual model that proposed novel relationships between the teaming environment, the enactment of affordances, and team processes. It also proposed a taxonomy for classifying the growing array of overlapping affordances that have been identified in the literature on enterprise social media and provided conceptual clarity on how people's goals influence their enactment of affordances at the team and inter-team level.

Lastly, in Chapter 4, I studied how communication networks on social media form and how they may perform. I examined the types of communication patterns that emerged in social media and face to face networks among collocated workers and showed how social media may enhance traditional modes of communication and organizing. In particular, the findings showed that social media can foster group-level communication and coordination and have a diversifying effect on one's network ties. This study advanced understanding on the types of communication patterns that are both enabled and constrained by social media – juxtaposed against face to face communication, which is often still considered as the gold standard of communication in many workplace contexts.

This dissertation reveals three key insights. First, it illustrates that despite the rich and diverse literature on teams and the enabling conditions (Hackman, 2012) that increase their odds of being effective, there is still much that is unknown about how teams function and why they

perform. This is in part due to a disconnect in the literature, whereby studies of the self-formation tendencies of teams are not necessarily connected to studies that examine team performance needs. Accordingly, this dissertation presents a systematic approach for addressing this disconnect by developing studies that examine both team formation tendencies and team performance needs in tandem. For instance, Chapter 2 compared the natural self-formation tendencies of team communication networks to the emergent communication networks that resulted when teams were provided with ways to structure group information processing. The different communication patterns that emerged in these networks provided insight into suboptimal versus optimal team communication patterns; further, it illustrated the success of formal interventions in bridging the disconnect between team self-formation tendencies and performance requirements.

Second, this dissertation provides an alternative perspective on technology and teams by proposing that technology is fundamental to organizing in contemporary teams. In essence, technology use cannot be distinguished from team phenomena, but rather, the two entities are mutually intertwined. In support of this perspective, Chapters 3 and 4 elucidated how new forms of technologies, such as social media, can augment team member interactions by reducing their likelihood that they default to their self-formation tendencies. In other words, the design features of technologies may provide new opportunities for organizing that enable teams to bridge their team form-perform paradoxes.

Third, this dissertation demonstrates the power of social networks as a tool for examining how teams organize in the digital age. Social networks are inherently relational in nature and enable multi-theoretical analysis that test multiple and multilevel hypotheses simultaneously.

Moreover, the relatively new methodological developments in social network analysis (e.g., ERGM) enables researchers to address research questions and test hypotheses that were not easily advanced before the advent of these approaches.

2. FUTURE DIRECTIONS

Although this dissertation develops important insights, it is not without its limitations that point to possible avenues for future work. The team form-perform paradox provides a useful lens to categorize the vast literature on teams into formation tendencies and performance needs. Yet as they currently stand, the paradoxes described in Chapter 1 are quite broad in nature, and greater specificity is needed to address the boundaries or limits of these paradoxes. To narrow in on how these paradoxes apply to contemporary teams, it is important to identify the team characteristics that affect the size of the discrepancy between the team formation tendencies and the team needs for effectiveness. One possible approach towards identifying key team characteristics is to leverage Hollenbeck, Beersma & Schouten (2012)'s three-dimensional scaling framework of team characteristics and examine how the team form-perform paradox varies according to the team dimensions of skill differentiation, authority differentiation, and temporal stability. Another, perhaps complementary approach would be to examine how task type affects the likelihood of a team paradox. As Table 1 demonstrated, task type was the only clear and consistent lever that affected the relationship between team processes and team effectiveness. Accordingly, it may serve as a logical starting point for investigating how team characteristics shape the size of the team form-perform paradox. To summarize, the major next step in advancing research on the team form-perform paradox is to generate conditions, bounds and limits on the applicability of the observed disconnect between team formation tendencies and team performance needs.

In Chapter 2, I identified how interventions alter how team communication networks form. There are two limitations in this research that warrant further investigation. The first is the

relatively small sample size of 38 teams. To address this limitation, I have replicated the experiment (initially conducted in Spring 2016) in four additional classes (3 identical classes in Spring 2017; 1 new class in Fall 2017). The replication provides an additional 39 teams that will increase the statistical power and validity of the findings. Future work would consist of analyzing the findings from this study replication. The second limitation is the lack of performance implications in this research. In its current form, a valid question to ask is: do these interventions lead to better performance outcomes? To address this question, I am in the process of designing a second study that uses a hidden profile task to examine whether online teams that are treated with these information processing interventions have more effective communication processes and performance (i.e., better decisions) on hidden profile tasks. A hidden profile task is a method of distributing information among members of a decision-making group and leaves the optimal alternative hidden from group members unless they thoroughly pool and integrate their unique (i.e., "unshared") knowledge together collectively as a team. This future work would help establish whether a positive relationship exists between the effectiveness of these simple interventions on team process and team performance outcomes. I believe that addressing both of these limitations would enable both greater theoretical contributions and practical implications for this work.

Next, Chapter 3 proposed eight new relationships between social media affordances and team processes that are intended to help bridge the disconnect between how teams form and what they need to perform. Yet these relationships are theoretical, and they have not yet been tested empirically. An important next step would be to conduct rigorous tests of these proposed relationships to advance understanding of social media use in teams, with specific attention to

the levers that determine when social media enhances or constrains team processes. This future work would make important strides in advancing the literature on affordances at the team and inter-team level and provide a stringent test of the posited relationship between goals, affordances and organizing that is for the most part fuzzy in the minds of organizational theorists studying technology affordances (e.g., Anderson & Robey, 2017; Faraj & Azad, 2012; Leonardi, 2011).

Lastly, Chapter 4 examined how social media alters the nature of team communication networks. However, in comparing social media use to face to face interactions, a critical, yet unanswered question is how communication on social media differs from the capabilities offered by traditional communication technologies, such as email. Affordances, such as visibility and persistence are not necessarily new to social media. Rather these affordances potentially exist on traditional communication media, but they are not necessarily provided in tandem, as they do on social media (Treem & Leonardi, 2012). An important next step would be to identify the similarities and differences in the communication networks enabled by social media and other "traditional" communication technologies.

Another question that remains unaddressed is how workers can manage the diverse array of communication technologies available to them. The digital age is associated with an increasingly diverse array of communication channels and platforms that people use regularly in their daily work. Yet workers are not necessarily more productive, despite their pervasive connectivity and ease of access to anyone else in the organization. For instance, there is a growing concern that visibility and transparency can paradoxically hinder productivity rather than improve workers' abilities to effectively carry out their work (Bernstein, 2017). Applied to a

social media context, it suggests that the presence of third parties may have unintended consequences on people's behaviors and motivations (Bernstein, 2012; Flyverbom et al., 2017). In future work, I would address these questions by more broadly examining the emergence of communication patterns across an array of communication technologies (e.g., social media, email, chat, face to face). This would help to develop an improved understanding of the types of activities that are supported by each of these technologies. I would also examine the content of these interactions to better understand what types of activities are supported (and not supported) by each of these communication media. This content-based approach would complement the structural perspective of team communication networks developed and advanced in this dissertation.

REFERENCES

Ackerman, M. S., & Palen, L. (1996). *The Zephyr Help Instance: promoting ongoing activity in a CSCW system.* Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

Allen, T. J. (1977). Managing the flow of technology: Technology transfer and the dissemination of technological information within the R & D organization(Book). *Research supported by the National Science Foundation. Cambridge, Mass., MIT Press, 1977. 329 p*.

Alonso, A., Baker, D. P., Holtzman, A., Day, R., King, H., Toomey, L., & Salas, E. (2006). Reducing medical error in the military health system: how can team training help?. *Human Resource Management Review*, *16*(3), 396-415.

Alper, S., Tjosvold, D., & Law, K. S. (2000). Conflict management, efficacy, and performance in organizational teams. *Personnel Psychology, 53*(3), 625-642.

Ambrose, M. L., & Kulik, C. T. 1999. Old friends, new faces: Motivation research in the 1990s. *Journal of Management*, *25*(3): 231-292.

Ancona, D. G. (1990). Outward Bound: Strategies for Team Survival in an Organization. *The Academy of Management Journal, 33*(2), 334-365.

Ancona, D. G., & Caldwell, D. F. (1992). Bridging the boundary: External activity and performance in organizational teams. *Administrative science quarterly*, 634-665.

Anderson, C., & Brown, C. E. (2010). The functions and dysfunctions of hierarchy. *Research in organizational behavior*, *30*, 55-89.

Arazy, O., Gellatly, I., Jang, S., & Patterson, R. (2009). Wiki deployment in corporate settings. *IEEE Technology and Society Magazine, 28*(2), 57-64.

Argote, L., & McGrath, J. E. (1993). Group processes in organizations: Continuity and change. *International review of industrial and organizational psychology, 8*(1993), 333-389.

Austin, J. R. 2003. Transactive memory in organizational groups: the effects of content, consensus, specialization, and accuracy on group performance. *Journal of Applied Psychology*, *88*(5): 866-878.

Baker, W. E., & Bulkley, N. (2014). Paying it forward vs. rewarding reputation: Mechanisms of generalized reciprocity. Organization science, 25(5), 1493-1510.

Baker, D. P., & Salas, E. (1997). Principles for measuring teamwork: A summary and look toward the future. *Team performance assessment and measurement: Theory, methods, and applications*, 331-355.

Bales, R. F. 1950. *Interaction process analysis; a method for the study of small groups*. Oxford: Addison-Wesley.

Bales, R. F. (1953). *The Equilibrium Problem in Small Groups. Teoksessa Parsons, Talcott & Bales, Robert F. & Shils*. Edward A.: Working Papers in the Theory of Action. The Free Press, New York. 111–161.

Bales, R.F., 1970. *Personality and interpersonal behavior.* New York: Holt, Rinehart and Winston.

Bales, R. F., & Borgatta, E. (1955). Size of group as a factor in interaction profile. In A. Hare, E. Borgatta, & R. Bales (Eds.), *Small Groups: Studies in Social Interaction* (495-512). New York: Knopf.

Barabási, A.-L., & Albert, R. (1999). Emergence of scaling in random networks. *science, 286*(5439), 509-512.

Barley, S. R., Bechky, B. A., & Milliken, F. J. 2017. The changing nature of work: Careers, identities, and work lives in the 21st century. *Academy of Management Discoveries*, *3*(2), 111-115.

Barley, William C., Paul M. Leonardi, and Diane E. Bailey. "Engineering objects for collaboration: Strategies of ambiguity and clarity at knowledge boundaries." *Human Communication Research* 38.3 (2012): 280-308.

Barr, A., & Serneels, P. (2009). Reciprocity in the workplace. Experimental Economics, 12(1), 99-112.

Bartol, K.M. and Srivastava, A., 2002. Encouraging knowledge sharing: The role of organizational reward systems. *Journal of Leadership & Organizational Studies*, 9(1): 64-76.

Bartunek, J. M., & Murninghan, J. K. (1984). The nominal group technique: expanding the basic procedure and underlying assumptions. *Group & Organization Studies*, *9*(3), 417-432.

Bavelas, A. (1950). Communication patterns in task-oriented groups. *The Journal of the Acoustical Society of America*, *22*(6), 725-730.

Beal, D. J., Cohen, R. R., Burke, M. J., & McLendon, C. L. (2003). Cohesion and performance in groups: a meta-analytic clarification of construct relations. *Journal of Applied Psychology, 88*(6), 989.

Becker, J. A., & Stamp, G. H. (2005). Impression management in chat rooms: A grounded theory model. *Communication studies*, *56*(3), 243-260.

Bell, B. S., & Kozlowski, S. W. 2002. A typology of virtual teams: Implications for effective leadership. *Group & Organization Management*, 27(1): 14-49.

Bell, S. T. 2007. Deep-level composition variables as predictors of team performance: a meta-analysis. *Journal of Applied Psychology,* 92(3): 595.

Bell, S. T., Villado, A. J., Lukasik, M. A., Belau, L., & Briggs, A. L. 2011. Getting specific about demographic diversity variable and team performance relationships: A meta-analysis. *Journal of Management*, 37(3): 709-743.

Bharati P., Zhang W., Chaudhury A. 2015. Better knowledge with social media? Exploring the roles of social capital and organizational knowledge management. *Journal of Knowledge Management*, 19: 456–475.

Blau, P. M. (1964). *Exchange and Power in Social Life*. New York: John Wiley & Sons, Inc.

Bonito, J. A. (2001). An information-processing approach to participation in small groups. *Communication Research, 28*(3), 275-303.

Bonito, J. A., & Hollingshead, A. B. (1997). Participation in small groups. *Annals of the International Communication Association*, *20*(1), 227-261.

Boudreau, K. J., Lacetera, N., & Lakhani, K. R. 2011. Incentives and problem uncertainty in innovation contests: An empirical analysis. *Management Science*, *57*(5), 843-863.

Bowers, C. A., Pharmer, J. A., & Salas, E. 2000. When member homogeneity is needed in work teams: A meta-analysis. *Small Group Research*, *31*(3), 305-327.

Brannick, M. T., Roach, R. M., & Salas, E.1993. Understanding team performance: A multimethod study. *Human Performance*, *6*(4): 287-308.

Bregman, A., & Haythornthwaite, C. (2003). Radicals of presentation: visibility, relation, and co-presence in persistent conversation. *New Media & Society, 5*(1), 117-140.

Brewer, M. B., & Gardner, W. (1996). Who is this" We"? Levels of collective identity and self

representations. *Journal of Personality and Social Psychology, 71*(1), 83.

Brickson, Shelley. "The impact of identity orientation on individual and organizational outcomes in demographically diverse settings." *Academy of Management Review* 25.1 (2000): 82-101.

Brown, S. L., & Eisenhardt, K. M. (1995). Product development: Past research, present findings, and future directions. *Academy of management review*, *20*(2), 343-378.

Brown, J. S., & Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization science, 12*(2), 198-213.

Bruns, H. C. (2013). Working alone together: Coordination in collaboration across domains of expertise. *Academy of Management Journal, 56*(1), 62-83.

Byrne, D. E. 1971. *The attraction paradigm.* New York: Academic Press.

Brzozowski, M. J. (2009). *WaterCooler: exploring an organization through enterprise social media.* Paper presented at the Proceedings of the ACM 2009 international conference on Supporting group work.

Bughin, J. (2015, October). Taking the measure of the networked enterprise. Retrieved from https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/taking-the-measure-of-the-networked-enterprise.

Bunderson, J. S., & Sutcliffe, K. M. (2002). Comparing Alternative Conceptualizations of Functional Diversity in Management Teams: Process and Performance Effects. *The Academy of Management Journal, 45*(5), 875-893. doi:10.2307/3069319

Burke, C. S., Stagl, K. C., Klein, C., Goodwin, G. F., Salas, E., & Halpin, S. M. (2006). What type of leadership behaviors are functional in teams? A meta-analysis. *The Leadership Quarterly, 17*(3), 288-307.

Burris, E. R. (2012). The risks and rewards of speaking up: Managerial responses to employee voice. *Academy of Management Journal*, *55*(4), 851-875.

Burt, R. S. (2000). The network structure of social capital. *Research in Organizational Behavior, 22*, 345-423.

Burt, R. S. (2005). *Brokerage and closure: An introduction to social capital*. Oxford university press.

Burt, R. S. (2009). *Structural holes: The social structure of competition*: Harvard university press.

Byrne, D. E. (1971). *The attraction paradigm* (Vol. 11): Academic Pr.

Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization science, 15*(5), 555-568.

Carton, A. M., & Cummings, J. N. (2013). The impact of subgroup type and subgroup configurational properties on work team performance. *Journal of Applied Psychology, 98*(5), 732.

Cartwright, D., & Zander, A. (1968). *Group Dynamics*. London: Tavistock.

Choi, J. N. 2002. External activities and team effectiveness: Review and theoretical development. *Small Group Research*, *33*(2), 181-208.

Chui, M., Manyika, J., Bughin, J., Dobbs, R., Roxburgh, C., Sarrazin, H., Sands, G., and Westergren, M. (2012). "The Social Economy: Unlocking Value and Productivity through Social Technologies." *McKinsey Global Institute, 4*.

Cohen, S. G., & Bailey, D. E. 1997. What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, *23*(3): 239-290.

Colbert, A., Yee, N., & George, G. (2016). The digital workforce and the workplace of the future. *Academy of Management Journal, 59*(3), 731-739.

Coleman, J. S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology, 94*, S95-S120.

Contractor, N. (2013). Some assembly required: leveraging Web science to understand and enable team assembly. *Phil. Trans. R. Soc. A*, 371(1987): 20120385.

Contractor, N. S., DeChurch, L. A., Carson, J., Carter, D. R., & Keegan, B. (2012). The topology of collective leadership. *The Leadership Quarterly*, *23*(6), 994-1011.

Contractor, N., Monge, P., & Leonardi, P. M. 2011. Network Theory| multidimensional networks and the dynamics of sociomateriality: bringing technology inside the network. *International Journal of Communication*, *5*, 39.

Courtright, S. H., Thurgood, G. R., Stewart, G. L., & Pierotti, A. J. (2015). Structural interdependence in teams: An integrative framework and meta-analysis. *Journal of Applied Psychology, 100*(6), 1825.

Crawford, E. R., & Lepine, J. A. (2013). A configural theory of team processes: Accounting for the structure of taskwork and teamwork. *Academy of Management Review, 38*(1), 32-48.

Cramton, C. D. (2002). Finding common ground in dispersed collaboration. *Organizational dynamics*, *30*(4), 356-367.

Cramton, C. D., & Hinds, P. J. (2004). Subgroup dynamics in internationally distributed teams: Ethnocentrism or cross-national learning?. *Research in organizational behavior*, *26*, 231-263.

Crawford, E. R., & Lepine, J. A. (2013). A configural theory of team processes: Accounting for the structure of taskwork and teamwork. *Academy of Management Review*, *38*(1), 32-48.

Cross, R., & Cummings, J. (2004). Tie and Network Correlates of Individual Performance in Knowledge-Intensive Work. *The Academy of Management Journal*, 47(6), 928-937.

Cross, R., Nohria, N., & Parker, A. (2002). Six myths about informal networks-and how to overcome them. *MIT Sloan Management Review*, *43*(3), 67.

Cross, R. L., & Parker, A. (2004). *The hidden power of social networks: Understanding how work really gets done in organizations*. Harvard Business Review Press.

Cummings, J. N. (2004). Work groups, structural diversity, and knowledge sharing in a global organization. *Management science, 50*(3), 352-364.

Cummings, J. N., Kiesler, S., Zadeh, R. B., & Balakrishnan, A. D. (2013). Group heterogeneity increases the risks of large group size a longitudinal study of productivity in research groups. *Psychological Science, 24*(6), 880-890.

D'Innocenzo, L., Mathieu, J. E., & Kukenberger, M. R. 2016. A meta-analysis of different forms of shared leadership–team performance relations. *Journal of Management*, *42*(7), 1964-1991.

Dabbs, J. M., Ruback, R. B., & Evans, M. S. (1987). Grouptalk": Sound and silence in group conversation. *Nonverbal behavior and communication*, 501-520.

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. *Management Science*, 32(5), 554-571.

Daspit, J., Justice Tillman, C., Boyd, N. G., & Mckee, V. (2013). Cross-functional team effectiveness: An examination of internal team environment, shared leadership, and cohesion influences. *Team Performance Management: An International Journal, 19*(1/2), 34-56.

Davis, T. R. (1984). The influence of the physical environment in offices. *Academy of management review*, *9*(2), 271-283.

De Choudhury M., Counts S. 2013. *Understanding affect in the workplace via social media*. Paper presented at the Proceedings of the 2013 conference on Computer supported cooperative work. New York: ACM Press.

De Dreu, C. K. 2007. Cooperative outcome interdependence, task reflexivity, and team effectiveness: a motivated information processing perspective. *Journal of Applied Psychology*, *92*(3): 628-638.

De Dreu, C. K. W., & Gelfand, M. J. 2008. Conflict in the workplace: Sources, functions, and dynamics across multiple levels of analysis. In C. K. W. De Dreu & M. J. Gelfand (Eds.), *The organizational frontiers series. The psychology of conflict and conflict management in organizations* (pp. 3-54). New York: Taylor & Francis Group/Lawrence Erlbaum Associates.

De Dreu, C. K., Nijstad, B. A., & van Knippenberg, D. 2008. Motivated information processing in group judgment and decision making. *Personality and Social Psychology Review*, *12*(1), 22-49.

De Dreu, C. K., & Van Vianen, A. E. 2001. Managing relationship conflict and the effectiveness of organizational teams. *Journal of Organizational Behavior*, 22(3): 309-328.

De Dreu, C. K., & van Knippenberg, D. 2005. The possessive self as a barrier to conflict resolution: effects of mere ownership, process accountability, and self-concept clarity on competitive cognitions and behavior. *Journal of Personality and Social Psychology*, *89*(3), 345.

De Dreu, C. K., & Weingart, L. R. 2003. Task versus relationship conflict, team performance, and team member satisfaction: a meta-analysis. *Journal of Applied Psychology*, 88(4): 741.

De Wit, F. R., Greer, L. L., & Jehn, K. A. (2012). The paradox of intragroup conflict: a meta-analysis. *Journal of Applied Psychology*, *97*(2), 360.

De Vries, R. E., Van den Hooff, B., & de Ridder, J. A. (2006). Explaining knowledge sharing: The role of team communication styles, job satisfaction, and performance beliefs. *Communication research*, *33*(2), 115-135.

DeChurch, L. A., & Mesmer-Magnus, J. R. 2010. The cognitive underpinnings of effective teamwork: A meta-analysis. *Journal of Applied Psychology*, *95*(1), 32.

DeChurch, L. A., Mesmer-Magnus, J. R., & Doty, D. 2013. Moving beyond relationship and task conflict: Toward a process-state perspective. *Journal of Applied Psychology*, 98(4): 559.

Deloitte Insights. 2018 Global Human Capital Trends. (n.d.). Retrieved from https://www2.deloitte.com/insights/us/en/focus/human-capital-trends.html.

Dencheva, S., Prause, C. R., & Prinz, W. (2011). *Dynamic self-moderation in a corporate wiki to improve participation and contribution quality.* Paper presented at the ECSCW 2011: Proceedings of the 12th European Conference on Computer Supported Cooperative Work, 24-28 September 2011, Aarhus Denmark.

Denis, J. L., Lamothe, L., & Langley, A. 2001. The dynamics of collective leadership and strategic change in pluralistic organizations. *Academy of Management Journal*, *44*(4), 809-837.

Dennis, A. R., Fuller, R. M., & Valacich, J. S. (2008). Media, tasks, and communication processes: A theory of media synchronicity. *Mis Quarterly, 32*(3), 575-600.

Desanctis, G., & Gallupe, R. B. (1987). A foundation for the study of group decision support systems. *Management Science, 33*(5), 589-609.

Di Gangi, P. M., Wasko, M. M., & Hooker, R. E. (2010). Getting Customers' Ideas To Work For You: Learning From Dell How To Succeed With Online User Innovation Communities. *MIS Quarterly Executive, 9*(4).

Diefenbach, T., & Sillince, J. A. (2011). Formal and informal hierarchy in different types of organization. *Organization Studies, 32*(11), 1515-1537.

DiMicco, J. M., Geyer, W., Millen, D. R., Dugan, C., & Brownholtz, B. (2009). *People sensemaking and relationship building on an enterprise social network site.* Paper presented at the System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on.

Druskat, V. U., & Wheeler, J. V. 2003. Managing from the boundary: The effective leadership of self-managing work teams. *Academy of Management Journal*, *46*(4): 435-457.

Dubrovsky, V. J., Kiesler, S., & Sethna, B. N. (1991). The equalization phenomenon: Status effects in computer-mediated and face-to-face decision-making groups. *Human-Computer Interaction, 6*(2), 119-146.

Edmondson, A. C. (2012). *Teaming: How organizations learn, innovate, and compete in the knowledge economy*: John Wiley & Sons.

Edmondson, A.C., Bohmer, R.M. and Pisano, G.P., 2001. Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly*, 46(4): 685-716.

Eisenhardt, K. M., & Tabrizi, B. N. (1995). Accelerating adaptive processes: Product innovation in the global computer industry. *Administrative science quarterly*, 84-110.

Ellis, A. P. 2006. System breakdown: The role of mental models and transactive memory in the relationship between acute stress and team performance. *Academy of Management Journal*, *49*(3): 576-589.

Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication, 13*(1), 210-230.

Ellison, N. B., Gibbs, J. L., & Weber, M. S. (2015). The use of enterprise social network sites for knowledge sharing in distributed organizations: The role of organizational affordances. American Behavioral Scientist, 59(1), 103-123.

Emerson, R. M. (1972). Exchange theory, part I: A psychological basis for social exchange. *Sociological Theories in Progress, 2*, 38-57.

Erez, M., & Somech, A. 1996. Is Group Productivity Loss the Rule or the Exception? Effects of Culture and Group-Based Motivation. *The Academy of Management Journal*, 39(6): 1513-1537.

Erickson, T., & Kellogg, W. A. (2000). Social translucence: an approach to designing systems that support social processes. *ACM transactions on computer-human interaction (TOCHI), 7*(1), 59-83.

Evans, S. K., Pearce, K. E., Vitak, J., & Treem, J. W. (2016). Explicating Affordances: A Conceptual Framework for Understanding Affordances in Communication Research. *Journal of Computer-Mediated Communication*.

Faraj, S., & Azad, B. (2012). The materiality of technology: An affordance perspective. *Materiality and organizing: Social interaction in a technological world*, 237-258.

Faraj, S., Jarvenpaa, S. L., & Majchrzak, A. (2011). Knowledge Collaboration in Online Communities. *Organization science, 22*(5), 1224-1239. doi:10.1287/orsc.1100.0614

Farzan, Rosta, Joan M. DiMicco, and Beth Brownholtz. "Spreading the honey: a system for maintaining an online community." *Proceedings of the ACM 2009 International Conference on Supporting Group Work*. ACM, 2009.

Faulmüller, N., Mojzisch, A., Kerschreiter, R., & Schulz-Hardt, S. (2012). Do you want to convince me or to be understood? Preference-consistent information sharing and its motivational determinants. *Personality and Social Psychology Bulletin*, *38*(12), 1684-1696.

Fayard, A.-L., & Weeks, J. (2007). Photocopiers and water-coolers: The affordances of informal interaction. *Organization studies, 28*(5), 605-634.

Festinger, L. (1950). Informal social communication. *Psychological review, 57*(5), 271.

Fleishman, E. A., Mumford, M. D., Zaccaro, S. J., Levin, K. Y., Korotkin, A. L., & Hein, M. B.1991. Taxonomic efforts in the description of leader behavior: A synthesis and functional interpretation. *Leadership Quarterly*, 2: 245-287.

Flynn, Francis J. "Identity orientations and forms of social exchange in organizations." *Academy of Management Review* 30.4 (2005): 737-750.

Flyverbom, M., Leonardi, P., Stohl, C., & Stohl, M. (2016). Digital Age | The management of visibilities in the digital age—Introduction. *International Journal of Communication*, *10*, 12.

French, R. L. (1950). Verbal output and leadership status in initially leaderless discussion groups. *American Psychologist, 5*, 310-311.

Fulk, J., & Yuan, Y. C. (2013). Location, motivation, and social capitalization via enterprise social networking. *Journal of Computer-Mediated Communication, 19*(1), 20-37.

Furst, S.A., Reeves, M., Rosen, B. and Blackburn, R.S., 2004. Managing the life cycle of virtual teams. *The Academy of Management Executive*, 18(2):6-20.

Fussell, S. R., Kraut, R. E., Lerch, F. J., Scherlis, W. L., McNally, M. M., & Cadiz, J. J. (1998). *Coordination, overload and team performance: effects of team communication strategies.* Paper presented at the Proceedings of the 1998 ACM conference on Computer supported cooperative work.

Gallupe, R. B., DeSanctis, G., & Dickson, G. W. (1988). Computer-Based Support for Group Problem-Finding: An Experimental Investigation. *MIS Quarterly, 12*(2), 277-296.

Gao, H., Barbier, G., & Goolsby, R. (2011). Harnessing the crowdsourcing power of social media for disaster relief. *IEEE Intelligent Systems*, *26*(3), 10-14.

Gargiulo, M., Ertug, G., & Galunic, C. (2009). The two faces of control: Network closure and individual performance among knowledge workers. *Administrative Science Quarterly*, *54*(2), 299-333.

Geister, S., Konradt, U., & Hertel, G. (2006). Effects of process feedback on motivation, satisfaction, and performance in virtual teams. *Small Group Research, 37*(5), 459-489.

Gibbs, J. L., Rozaidi, N. A., & Eisenberg, J. (2013). Overcoming the "ideology of openness": Probing the affordances of social media for organizational knowledge sharing. *Journal of Computer-Mediated Communication, 19*(1), 102-120.

Gibson, J. J. (2014). *The ecological approach to visual perception: classic edition*: Psychology Press.

Gibson, C. B., & Cohen, S. G. (Eds.). (2003). Virtual teams that work: Creating conditions for virtual team effectiveness. John Wiley & Sons.

Gigone, D., & Hastie, R. (1993). The common knowledge effect: Information sharing and group judgment. *Journal of Personality and social Psychology*, *65*(5), 959.

Gilson, L. L., Maynard, M. T., Jones Young, N. C., Vartiainen, M., & Hakonen, M. 2015. Virtual teams research: 10 years, 10 themes, and 10 opportunities. *Journal of Management*, 41(5): 1313-1337

Gouldner, A. W. (1960). The norm of reciprocity: A preliminary statement. *American Sociological Review*, 161-178.

Grabowicz, P. A., Ramasco, J. J., Moro, E., Pujol, J. M., & Eguiluz, V. M. (2012). Social features of online networks: The strength of intermediary ties in online social media. *PloS one*, *7*(1), e29358.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology*, 1360-1380.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, *17*(S2), 109-122.

Greenhalgh, L., & Chapman, D. I. (1998). Negotiator relationships: Construct measurement, and demonstration of their impact on the process and outcomes of negotiation. *Group Decision and Negotiation, 7*(6), 465-489.

Griffin, A., & Hauser, J. R. (1992). Patterns of communication among marketing, engineering and manufacturing—A comparison between two new product teams. *Management science, 38*(3), 360-373.

Guimera, R., Uzzi, B., Spiro, J., & Amaral, L. A. N. (2005). Team assembly mechanisms determine collaboration network structure and team performance. *science, 308*(5722), 697-702.

Gully, S. M., Incalcaterra, K. A., Joshi, A., & Beaubien, J. M. 2002. A meta-analysis of team-efficacy, potency, and performance: interdependence and level of analysis as moderators of observed relationships. *Journal of Applied Psychology*, *87*(5), 819.

Guzzo, R. A., & Dickson, M. W. (1996). Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology*, *47*(1), 307-338.

Hackman, J. R. (1990). *Groups that work and those that don't*: Jossey-Bass.

Hackman, J. R. (2009). The perils of positivity. *Journal of Organizational Behavior, 30*(2), 309-319.

Hackman, J. R. (2012). From causes to conditions in group research. *Journal of Organizational Behavior, 33*(3), 428-444.

Hackman, J. R., & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. *Advances in experimental social psychology, 8*, 45-99.

Halevy, N., Y. Chou, E., & D. Galinsky, A. (2011). A functional model of hierarchy: Why, how, and when vertical differentiation enhances group performance. *Organizational Psychology Review*, *1*(1), 32-52.

Hampton, K. N. (2016). Persistent and pervasive community: New communication technologies and the future of community. *American Behavioral Scientist*, *60*(1), 101-124.

Hampton, K. N., Lee, C. J., & Her, E. J. (2011). How new media affords network diversity: Direct and mediated access to social capital through participation in local social settings. *new media & society*, *13*(7), 1031-1049.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative science quarterly*, *44*(1), 82-111.

Helmreich, R. L., Merritt, A. C., & Wilhelm, J. A. (1999). The evolution of crew resource management training in commercial aviation. *The international journal of aviation psychology*, *9*(1), 19-32.

Hertel, G., Konradt, U., & Orlikowski, B. (2004). Managing distance by interdependence: Goal setting, task interdependence, and team-based rewards in virtual teams. *European Journal of Work and Organizational Psychology*, 13(1): 1-28.

Hiltz, S. R., & Turoff, M. (1985). Structuring computer-mediated communication systems to avoid information overload. *Communications of the ACM*, *28*(7), 680-689.

Hinds, P. J., Carley, K. M., Krackhardt, D., & Wholey, D. (2000). Choosing work group members: Balancing similarity, competence, and familiarity. *Organizational Behavior and Human Decision Processes, 81*(2), 226-251.

Hinds, P., & Kiesler, S. (1995). Communication across Boundaries: Work, Structure, and Use of Communication Technologies in a Large Organization. *Organization science, 6*(4), 373-393.

Hinds, P. J., & Mortensen, M. (2005). Understanding conflict in geographically distributed teams: The moderating effects of shared identity, shared context, and spontaneous communication. *Organization science, 16*(3), 290-307.

Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin, 121*(1), 43.

Hoch, J. E., & Kozlowski, S. W. (2014). Leading virtual teams: Hierarchical leadership, structural supports, and shared team leadership. *Journal of Applied Psychology, 99*(3), 390.

Hoegl, M. (2005). Smaller teams–better teamwork: How to keep project teams small. *Business Horizons, 48*(3), 209-214.

Hoffman, L. R. (1978). The group problem-solving process. *Group processes*, 101-114.

Hogg, M. A. (2001). A social identity theory of leadership. *Personality and social psychology review, 5*(3), 184-200.

Hogg, M. A., Van Knippenberg, D., & Rast, D. E. 2012. Intergroup leadership in organizations: Leading across group and organizational boundaries. *Academy of Management Review*, *37*(2), 232-255.

Hollenbeck, J. R., Beersma, B., & Schouten, M. E. 2012. Beyond team types and taxonomies: A dimensional scaling conceptualization for team description. *Academy of Management Review*, 37(1): 82-106.

Hollingshead A.B. 1998. Retrieval processes in transactive memory systems. *Journal of Personality and Social Psychology*, 74, 659–671.

Hollingshead, A. B. (1998). Communication, learning, and retrieval in transactive memory systems. *Journal of Experimental Social Psychology*, *34*(5), 423-442.

Honey, C., & Herring, S. C. (2009, January). Beyond microblogging: Conversation and collaboration via Twitter. In *System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on* (pp. 1-10). Ieee.

Horwitz, S. K., & Horwitz, I. B. (2007). The effects of team diversity on team outcomes: A meta-analytic review of team demography. *Journal of Management, 33*(6), 987-1015.

Hu, J., & Liden, R. C. 2011. Antecedents of team potency and team effectiveness: an examination of goal and process clarity and servant leadership. *Journal of Applied Psychology*, 96(4): 851-862.

Hubert, L., & Schultz, J. (1976). Quadratic assignment as a general data analysis strategy. *British journal of mathematical and statistical psychology*, *29*(2), 190-241.

Hunter, D. R., Handcock, M. S., Butts, C. T., Goodreau, S. M., & Morris, M. (2008). ergm: A package to fit, simulate and diagnose exponential-family models for networks. *Journal of Statistical Software, 24*(3).

Hutchby, I. (2001). Technologies, texts and affordances. *Sociology, 35*(2), 441-456.

Ilgen, D.R., Hollenbeck, J.R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From input-process-output models to IMOI models. *Annual Review of Psychology*, 56, 517–543.

Jackson, A., Yates, J., & Orlikowski, W. (2007). *Corporate Blogging: Building community through persistent digital talk.* Paper presented at the System Sciences, 2007. HICSS 2007. 40th Annual Hawaii International Conference on.

Janis, I. L. (1982). *Groupthink: Psychological studies of policy decisions and fiascoes* (Vol. 349): Houghton Mifflin Boston.

Janis, I. L., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*. New York: Free press.

Janz, B.D., 1999. Self-directed teams in IS: correlates for improved systems development work outcomes. *Information & Management*, 35(3): 171-192.

Janz, B.D., Colquitt, J.A. and Noe, R.A., 1997. Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables. *Personnel Psychology*, 50(4): 877-904.

Jarvenpaa, S. L., & Leidner, D. E. (1998). Communication and trust in global virtual teams. *Journal of Computer-Mediated Communication*, *3*(4), 1-29.

Jehn, K. A. (1997). A Qualitative Analysis of Conflict Types and Dimensions in Organizational Groups. *Administrative science quarterly, 42*(3), 530-557. doi:10.2307/2393737

Jehn, K. A., Chadwick, C., & Thatcher, S. M. (1997). To agree or not to agree: The effects of value congruence, individual demographic dissimilarity, and conflict on workgroup outcomes. *International journal of conflict management, 8*(4), 287-305.

Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a difference: A field study of diversity, conflict and performance in workgroups. *Administrative science quarterly, 44*(4), 741-763.

Jehn, K. A., & Shah, P. P. (1997). Interpersonal relationships and task performance: An examination of mediation processes in friendship and acquaintance groups. *Journal of Personality and Social Psychology*, *72*(4), 775.

Jones, B. F. (2009). The burden of knowledge and the "death of the renaissance man": Is innovation getting harder? *The Review of Economic Studies, 76*(1), 283-317.

Johnson, M.D., Hollenbeck, J.R., Humphrey, S.E., Ilgen, D.R., Jundt, D. and Meyer, C.J., 2006. Cutthroat cooperation: Asymmetrical adaptation to changes in team reward structures. *Academy of Management Journal*, 49(1): 103-119.

Jones, B. F., Wuchty, S., & Uzzi, B. (2008). Multi-university research teams: Shifting impact, geography, and stratification in science. *science, 322*(5905), 1259-1262.

Joshi, A., & Roh, H. 2009. The role of context in work team diversity research: A meta-analytic review. *Academy of Management Journal*, *52*(3), 599-627.

Kane, G. C. (2015). Enterprise social media: Current capabilities and future possibilities. MIS Quarterly Executive, 14(1).

Kane, G., Alavi, M., Labianca, G., & Borgatti, S. (2014). What's different about social media networks? A framework and research agenda. *MIS Quarterly*, *38*(1), 274-304.

Kaplan A. M., Haenlein M. 2011. The early bird catches the news: Nine things you should know about micro-blogging. *Business Horizons*, 54: 105–113.

Karau, S. J., & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of personality and social psychology, 65*(4), 681.

Kirchler, E., & Davis, J. H. (1986). The influence of member status differences and task type on group consensus and member position change. *Journal of Personality and Social Psychology, 51*(1), 83.

Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist, 39*(10), 1123.

Kirkman, B. L., & Mathieu, J. E. (2005). The dimensions and antecedents of team virtuality. *Journal of Management, 31*(5), 700-718.

Kirkman, B. L., Rosen, B., Gibson, C. B., Tesluk, P. E., & McPherson, S. O. (2002). Five challenges to virtual team success: Lessons from Sabre, Inc. *The Academy of Management Executive*, *16*(3), 67-79.

Kleingeld, A., van Mierlo, H., & Arends, L. 2011. The effect of goal setting on group performance: A meta-analysis. *Journal of Applied Psychology*, 96(6): 1289-1304.

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological bulletin, 119*(2), 254.

Koch H., Leidner D. E., Gonzalez E. S. 2013. Digitally enabling social networks: Resolving IT–culture conflict. *Information Systems Journal*, 23: 501–523.

Kozlowski, S. W., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological science in the public interest, 7*(3), 77-124.

Kozlowski, S. W. J., & Bell, B. S. (2013). Work groups and teams in organizations *Work groups and teams in organizations* (Vol. 12, pp. 412-469): Wiley.

Krackhardt, D. (1988). Predicting with networks: Nonparametric multiple regression analysis of dyadic data. *Social networks*, *10*(4), 359-381.

Lazega, E., & Pattison, P. E. (1999). Multiplexity, generalized exchange and cooperation in organizations: a case study. *Social networks*, *21*(1), 67-90.

Latané, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology*, 37(6): 822-832.

Lau, D. C., & Murnighan, J. K. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of management review, 23*(2), 325-340.

Larson Jr, J. R. (1997). Modeling the Entry of Shared and Unshared information into Group Discussion A Review and Basic Language Computer Program. *Small Group Research, 28*(3), 454-479.

Larson Jr, J. R., Christensen, C., Franz, T. M., & Abbott, A. S. (1998). Diagnosing groups: the pooling, management, and impact of shared and unshared case information in team-based medical decision making. *Journal of Personality and Social Psychology*, *75*(1), 93.

Laughlin, P. R. (1980). Social combination processes of cooperative problem-solving groups on verbal intellective tasks. *Progress in Social Psychology, 1*, 127-155.

Lazarsfeld, P. F., & Merton, R. K. (1954). Friendship as a social process: A substantive and methodological analysis. *Freedom and control in modern society, 18*(1), 18-66.

Lee, J. Y., Bachrach, D. G., & Lewis, K. (2014). Social network ties, transactive memory, and performance in groups. *Organization Science*, *25*(3), 951-967.

Leenders, R. T. A., Van Engelen, J. M., & Kratzer, J. (2003). Virtuality, communication, and new product team creativity: a social network perspective. *Journal of Engineering and Technology Management*, *20*(1-2), 69-92.

Leonard, M., Graham, S., & Bonacum, D. (2004). The human factor: the critical importance of effective teamwork and communication in providing safe care. *BMJ Quality & Safety*, *13*(suppl 1), i85-i90.

Leonardi, P. M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *Mis Quarterly, 35*(1), 147-167.

Leonardi, P. M., Huysman, M., & Steinfield, C. (2013). Enterprise social media: Definition, history, and prospects for the study of social technologies in organizations. *Journal of Computer-Mediated Communication, 19*(1), 1-19.

Leonardi P. M. 2014. Social media, knowledge sharing, and innovation: Toward a theory of communication visibility. *Information Systems Research*, 25: 796–816

Leonardi P. M. 2015. Ambient awareness and knowledge acquisition: Using social media to learn "Who Knows What" and "Who Knows Whom". *Management Information Systems Quarterly*, 39: 747–762.

Leonardi, P. M., & Meyer, S. R. (2015). Social media as social lubricant: How ambient awareness eases knowledge transfer. *American Behavioral Scientist*, *59*(1), 10-34.

Leonardi, P M., & Vaast, E. (2017). Social Media and Their Affordances for Organizing: A Review and Agenda for Future Research. *Academy of Management Annals*, 11.

LePine, J. A. 2005. Adaptation of teams in response to unforeseen change: effects of goal difficulty and team composition in terms of cognitive ability and goal orientation. *Journal of Applied Psychology*, 90(6): 1153.

LePine, J. A., Piccolo, R. F., Jackson, C. L., Mathieu, J. E., & Saul, J. R. 2008. A meta-analysis of teamwork processes: tests of a multidimensional model and relationships with team effectiveness criteria. *Personnel Psychology*, 61(2): 273-307.

Levine, J. M., & Moreland, R. L. (1990). Progress in small group research. *Annual review of psychology, 41*(1), 585-634.

Lewis, K. 2003. Measuring transactive memory systems in the field: Scale development and validation. *Journal of Applied Psychology*, *88*(4): 587-603.

Lewis, K. 2004. Knowledge and performance in knowledge-worker teams: A longitudinal study of transactive memory systems. *Management Science*, *50*(11): 1519-1533.

Lewis, K., Belliveau, M., Herndon, B., & Keller, J.2007. Group cognition, membership change, and performance: Investigating the benefits and detriments of collective knowledge. *Organizational Behavior and Human Decision Processes*, *103*(2): 159-178.

Littlepage, G. E., & Silbiger, H. 1992. Recognition of expertise in decision-making groups: Effects of group size and participation patterns. *Small Group Research*, *23*(3): 344-355.

Locke, E. A., & Latham, G. P.1990. Work motivation and satisfaction: Light at the end of the tunnel. *Psychological Science*, *1*(4): 240-246.

Locke, E. A., & Latham, G. P. 2002. Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist*, *57*(9): 705-717.

Lungeanu, A., Huang, Y., & Contractor, N. S. 2014. Understanding the assembly of interdisciplinary teams and its impact on performance. *Journal of Informetrics*, 8(1): 59-70.

Lusher, D., Koskinen, J., & Robins, G. (Eds.). (2012). *Exponential random graph models for social networks: Theory, methods, and applications*. Cambridge University Press.

Mackie, D. M., & Goethals, G. R.1987. Individual and group goals. In C. Hendrick (Ed.), *Review of personality and social psychology, Vol. 8. Group processes* (pp. 144-166). Thousand Oaks, CA: Sage Publications.

Majchrzak, A., Faraj, S., Kane, G. C., & Azad, B. (2013). The contradictory influence of social media affordances on online communal knowledge sharing. *Journal of Computer-Mediated Communication, 19*(1), 38-55.

Malhotra, A., Majchrzak, A., & Rosen, B. (2007). Leading virtual teams. *The Academy of Management Perspectives*, 21(1), 60-70.

Malone, T. W. (1988). Modeling coordination in organizations and markets. In *Readings in Distributed Artificial Intelligence*(pp. 151-158).

Mannix, E., & Neale, M. A. (2005). What differences make a difference? The promise and reality of diverse teams in organizations. *Psychological science in the public interest, 6*(2), 31-55.

Marks, M. A., DeChurch, L. A., Mathieu, J. E., Panzer, F. J., & Alonso, A. (2005). Teamwork in multiteam systems. *Journal of Applied Psychology, 90*(5), 964.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A Temporally Based Framework and Taxonomy of Team Processes. *The Academy of Management Review, 26*(3), 356-376. doi:10.2307/259182

Marks, M.A., Zaccaro, S.J. and Mathieu, J.E., 2000. Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. *Journal of Applied Psychology*, 85(6): 971-986.

Marlow, S. L., Lacerenza, C. N., Paoletti, J., Burke, C. S., & Salas, E. (2018). Does team communication represent a one-size-fits-all approach?: A meta-analysis of team communication and performance. *Organizational Behavior and Human Decision Processes*, *144*, 145-170.

Marlow, S. L., Lacerenza, C. N., & Salas, E. (2017). Communication in virtual teams: a conceptual framework and research agenda. *Human Resource Management Review*, *27*(4), 575-589.

Marrone, J. A. 2010. Team boundary spanning: A multilevel review of past research and proposals for the future. *Journal of Management*, 36(4): 911-940.

Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual teams: What do we know and where do we go from here? *Journal of Management, 30*(6), 805-835.

Martocchio, J. J., & Frink, D. D.1994. A review of the influence of group goals on group performance. *Academy of Management Journal*, *37*(5): 1285-1301.

Maruping, L.M. and Agarwal, R., 2004. Managing team interpersonal processes through technology: A task-technology fit perspective. *Journal of Applied Psychology*, 89(6): 975-990.

Mathieu, J. E., Hollenbeck, J. R., van Knippenberg, D., & Ilgen, D. R. (2017). A century of work teams in the Journal of Applied Psychology. *Journal of Applied Psychology*, 102(3): 452-467.

Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. 2008. Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future. *Journal of Management*, 34(3): 410-476.

Mathieu, J. E., Tannenbaum, S. I., Donsbach, J. S., & Alliger, G. M. (2014). A review and integration of team composition models: Moving toward a dynamic and temporal framework. *Journal of Management*, 40(1), 130-160.

Mayer, R.C. and Davis, J.H., 1999. The effect of the performance appraisal system on trust for management: A field quasi-experiment. *Journal of Applied Psychology*, 84(1): 123-136.

Maznevski, M. L., & Chudoba, K. M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization science, 11*(5), 473-492.

McAfee, A. (2009). *Enterprise 2.0: New collaborative tools for your organization's toughest challenges*: Harvard Business Press.

McFarland, L. A., & Ployhart, R. E. 2015. Social media: A contextual framework to guide research and practice. *Journal of Applied Psychology*, 100(6): 1653-1677.

McLeod, P. L., & Liker, J. K. (1992). Electronic Meeting Systems: Evidence from a Low Structure Environment. *Information Systems Research, 3*(3), 195-223.

McNamara, K., Dennis, A. R., & Carte, T. A. (2008). It's the thought that counts: The mediating effects of information processing in virtual team decision making. *Information Systems Management*, *25*(1), 20-32.

Mesmer-Magnus, J. R., & DeChurch, L. A. 2009. Information sharing and team performance: a meta-analysis. *Journal of Applied Psychology,* 94(2): 535-546.

McGrath, J. E. (1984). *Groups: Interaction and performance* (Vol. 14). Englewood Cliffs, NJ: Prentice-Hall.

McGuire, T. W., Kiesler, S., & Siegel, J. (1987). Group and computer-mediated discussion effects in risk decision making. *Journal of Personality and Social Psychology*, *52*(5), 917.

Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: a meta-analysis. *Journal of Applied Psychology, 94*(2), 535.

Miller, K. I., Ellis, B. H., Zook, E. G., & Lyles, J. S. (1990). An integrated model of communication, stress, and burnout in the workplace. *Communication research*, 17(3), 300-326.

Minas, R. K., Potter, R. F., Dennis, A. R., Bartelt, V., & Bae, S. (2014). Putting on the thinking cap: using NeuroIS to understand information processing biases in virtual teams. *Journal of Management Information Systems*, *30*(4), 49-82.

Molm, L. D. (1994). Dependence and risk: Transforming the structure of social exchange. *Social Psychology Quarterly*, 163-176.

Molm, L. D. (2010). The structure of reciprocity. *Social Psychology Quarterly*, 73(2), 119-131.

Molm, L., Collett, J., & Schaefer, D. (2007). Building Solidarity through Generalized Exchange: A Theory of Reciprocity. American Journal of Sociology, 113(1), 205-242.

Molm, L. D., Takahashi, N., & Peterson, G. (2000). Risk and trust in social exchange: An experimental test of a classical proposition. *American Journal of Sociology*, 105(5), 1396-1427.

Monge, P. R., & Contractor, N. S. (2003). *Theories of Communication Networks*: Oxford University Press, USA.

Montoya-Weiss, M. M., Massey, A. P., & Song, M. (2001). Getting it together: Temporal coordination and conflict management in global virtual teams. *Academy of Management Journal, 44*(6), 1251-1262.

Morris, D. Z. (2017, January 3). New French Law Bars Work Email After Hours. Retrieved January 18, 2017, from http://fortune.com/2017/01/01/french-right-to-disconnect-law/

Mortensen, M., & Hinds, P. (2002). Fuzzy teams: Boundary disagreement in distributed and collocated teams. *Distributed work*, 283-308.

Mortensen, M., Woolley, A. W., & O'Leary, M. (2007). Conditions enabling effective multiple team membership *Virtuality and virtualization* (pp. 215-228): Springer.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), 242-266.

Nicol, E. H., & Farrell, F. M. (1963). Group problem solving under two types of executive structure. *The Journal of Abnormal and Social Psychology*, *67*(6), 550.

Nicolaides, V. C., LaPort, K. A., Chen, T. R., Tomassetti, A. J., Weis, E. J., Zaccaro, S. J., & Cortina, J. M. 2014. The shared leadership of teams: A meta-analysis of proximal, distal, and moderating relationships. *The Leadership Quarterly*, *25*(5), 923-942.

Nijstad, B. A., & Paulus, P. B. (2003). Group creativity. *Group creativity: Innovation through collaboration*, 326-229.

O'Daniel M, Rosenstein AH. Professional Communication and Team Collaboration. In: Hughes RG, editor. Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008 Apr. Chapter 33. Available from: https://www.ncbi.nlm.nih.gov/books/NBK2637/

Obstfeld, D. (2005). Social networks, the tertius iungens orientation, and involvement in innovation. *Administrative science quarterly*, *50*(1), 100-130.

Oh, H., Chung, M.-H., & Labianca, G. (2004). Group social capital and group effectiveness: The role of informal socializing ties. *Academy of Management Journal, 47*(6), 860-875.

Okhuysen, G. A. (2001). Structuring change: Familiarity and formal interventions in problem-solving groups. *Academy of Management Journal*, *44*(4), 794-808.

Okhuysen, G. A., & Eisenhardt, K. M. (2002). Integrating knowledge in groups: How formal interventions enable flexibility. *Organization Science, 13*(4), 370-386.

Oldroyd, J. B., & Morris, S. S. (2012). Catching falling stars: A human resource response to social capital's detrimental effect of information overload on star employees. *Academy of Management Review*, *37*(3), 396-418.

Oostervink, N., Agterberg, M., & Huysman, M. (2016). Knowledge sharing on enterprise social media: Practices to cope with institutional complexity. *Journal of Computer-Mediated Communication*, *21*(2), 156-176.

Orlikowski, W.J., 2008. Using technology and constituting structures: A practice lens for studying technology in organizations. In *Resources, co-evolution and artifacts* (pp. 255-305). Springer, London.

Parks, C. D., & Cowlin, R. A. (1996). Acceptance of uncommon information into group discussion when that information is or is not demonstrable. *Organizational Behavior and Human Decision Processes*, *66*(3), 307-315.

Pearsall, M. J., Ellis, A. P., & Bell, B. S. 2010. Building the infrastructure: the effects of role identification behaviors on team cognition development and performance. *Journal of Applied Psychology,* 95(1): 192-200.

Perretti, F., & Negro, G. (2007). Mixing Genres and Matching People: A Study in Innovation and Team Composition in Hollywood. *Journal of Organizational Behavior, 28*(5), 563-586.

Piccoli, G., Powell, A., & Ives, B. (2004). Virtual teams: team control structure, work processes, and team effectiveness. *Information Technology & People*, *17*(4), 359-379.

Pieterse, A. N., Van Knippenberg, D., & Van Dierendonck, D. 2013. Cultural diversity and team performance: The role of team member goal orientation. *Academy of Management Journal*, *56*(3), 782-804.

Pinder, C. C.1998. *Motivation in work organizations.* Upper Saddle River, NJ: Prentice Hall.

Pinto, M. B., Pinto, J. K., & Prescott, J. E. (1993). Antecedents and consequences of project team cross-functional cooperation. *Management Science*, *39*(10), 1281-1297.

Postmes, T., & Spears, R. (1998). Deindividuation and antinormative behavior: A meta-analysis. *Psychological bulletin, 123*(3), 238.

Powell, A., Piccoli, G., & Ives, B. (2004). Virtual teams: a review of current literature and directions for future research. *ACM Sigmis Database*, 35(1), 6-36.

Price, K. H., Harrison, D. A., & Gavin, J. H. 2006. Withholding inputs in team contexts: member composition, interaction processes, evaluation structure, and social loafing. *Journal of Applied Psychology*, 91(6): 1375-1384.

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly*, 48(2), 240-267.

Ren, Y., & Argote, L. (2011). Transactive memory systems 1985–2010: An integrative framework of key dimensions, antecedents, and consequences. *The Academy of management annals, 5*(1), 189-229.

Ren, Y., Kraut, R., & Kiesler, S. (2007). Applying common identity and bond theory to design of online communities. *Organization studies, 28*(3), 377-408.

Rentsch, J. R., Delise, L. A., Mello, A. L., & Staniewicz, M. J. (2014). The Integrative Team Knowledge Building Training Strategy in Distributed Problem-Solving Teams. *Small Group Research, 45*(5), 568-591.

Retelny, D., Robaszkiewicz, S., To, A., Lasecki, W. S., Patel, J., Rahmati, N., ... & Bernstein, M. S. (2014, October). Expert crowdsourcing with flash teams. In *Proceedings of the 27th annual ACM symposium on User interface software and technology* (pp. 75-85). ACM.

Rice, R. E., Evans, S. K., Pearce, K. E., Sivunen, A., Vitak, J. and Treem, J. W. (2017), Organizational Media Affordances: Operationalization and Associations with Media Use. *J Commun*, *67*, 106–130.

Rico, R., Sánchez-Manzanares, M., Gil, F., & Gibson, C.2008. Team implicit coordination processes: A team knowledge–based approach. *Academy of Management Review*, *33*(1): 163-184.

Ridings, C. M., Gefen, D., & Arinze, B. (2002). Some antecedents and effects of trust in virtual communities. *The Journal of Strategic Information Systems*, *11*(3-4), 271-295.

Robert Jr, L. P., Dennis, A. R., & Ahuja, M. K. (2008). Social capital and knowledge integration in digitally enabled teams. *Information systems research, 19*(3), 314-334.

Robins, G., & Lusher, D. (2013). Illustrations: simulation, estimation and goodness of fit. In *Exponential random graph models for social networks: Theory, methods and applications*, 167–185. Cambridge University Press, New York.

Rousseau, V., Aubé, C., & Savoie, A.2006. Teamwork behaviors: A review and an integration of frameworks. *Small Group Research*, *37*(5): 540-570.

Ruef, M., Aldrich, H. E., & Carter, N. M. (2003). The structure of founding teams: Homophily, strong ties, and isolation among US entrepreneurs. *American sociological review*, 195-222.

Rutte, C. G. (2005). Social loafing in teams. *The essentials of teamworking: International perspectives*, 191-208.

Salas, E., Cooke, N. J., & Rosen, M. A. (2008). On teams, teamwork, and team performance: Discoveries and developments. *Human factors*, *50*(3), 540-547.

Salas, E., Nichols, D. R., & Driskell, J. E. 2007. Testing three team training strategies in intact teams: A meta-analysis. *Small Group Research*, *38*(4), 471-488.

Sanger, D. E. (1986, March 02). CHALLENGER'S FAILURE AND NASA'S FLAWS. Retrieved March 20, 2018, from

https://www.nytimes.com/1986/03/02/weekinreview/challenger-s-failure-and-nasa-s-flaws.html

Schadeler T., Karcher P. 2012. *The state of workforce technology adoption: Global benchmark 2012.* Cambridge, MA: Forrester Research.

Shaw, M. E. (1954). Group structure and the behavior of individuals in small groups. *The Journal of psychology*, *38*(1), 139-149.

Shaw, M. E. (1964). Communication networks. In *Advances in experimental social psychology* (Vol. 1, pp. 111-147). Academic Press.

Shaw, R. (2016, February 10). Can Enterprise Social Networks Lead to Stronger Results for Businesses in 2016? *Margolis Group.* Retrieved from www.margolis.co.uk/enterprise-social-networks-study.

Siegel, J., Dubrovsky, V., Kiesler, S., & McGuire, T. W. (1986). Group processes in computer-mediated communication. *Organizational Behavior and Human Decision Processes*, *37*(2), 157-187.

Simmel, G. (1950). *The sociology of georg simmel* (Vol. 92892). Simon and Schuster.

Simon, H. A. (1971). Designing organizations for an information-rich world.

Smith-Jentsch, K.A., Cannon-Bowers, J.A., Tannenbaum, S.I. and Salas, E., 2008. Guided team self-correction: Impacts on team mental models, processes, and effectiveness. *Small Group Research*, 39(3): 303-327.

Somech, A., Desivilya, H., & Lidogoster, H. 2009. Team conflict management and team effectiveness: The effects of task interdependence and team identification. *Journal of Organizational Behavior*, 30(3): 359-378.

Sproull, L., & Kiesler, S. (1991). Computers, Networks and Work. Scientific American, 265(3), 116-127.

Sparrowe, R., Liden, R., Wayne, S., & Kraimer, M. (2001). Social Networks and the Performance of Individuals and Groups. *The Academy of Management Journal*, 44(2), 316-325.

Staples, D. S., & Webster, J. (2008). Exploring the effects of trust, task interdependence and virtualness on knowledge sharing in teams. *Information Systems Journal*, *18*(6), 617-640.

Stasser, G., Taylor, L. A., & Hanna, C. (1989). Information sampling in structured and unstructured discussions of three-and six-person groups. *Journal of personality and social psychology, 57*(1), 67.

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of personality and social psychology, 48*(6), 1467.

Stasser, G., & Titus, W. (1987). Effects of information load and percentage of shared information on the dissemination of unshared information during group discussion. *Journal of personality and social psychology, 53*(1), 81.

Steiner, I. D. 1972. *Group processes and group productivity*. New York: Academic

Communication, 10: 123-137.

Stewart, G. L., & Barrick, M. R. (2000). Team structure and performance: Assessing the mediating role of intrateam process and the moderating role of task type. *Academy of Management Journal*, *43*(2), 135-148.

Stohl, Cynthia, Michael Stohl, and Paul M. Leonardi (2016). "Digital Age| Managing Opacity: Information Visibility and the Paradox of Transparency in the Digital Age." *International Journal of Communication* 10: 15.

Sundstrom, Eric, Kenneth P. De Meuse, and David Futrell. "Work teams: Applications and effectiveness." *American Psychologist* 45.2 (1990): 120.

Sutcliffe, K. M., Lewton, E., & Rosenthal, M. M. (2004). Communication failures: an insidious contributor to medical mishaps. *Academic Medicine*, *79*(2), 186-194.

Tajfel, H. (1974). Social identity and intergroup behaviour. *Social Science Information/sur les sciences sociales*.

Tajfel, H. (1981). *Human groups and social categories: Studies in social psychology*: CUP Archive.

Tasa, K., Taggar, S., & Seijts, G. H. 2007. The development of collective efficacy in teams: a multilevel and longitudinal perspective. *Journal of Applied Psychology*, 92(1): 17-27.

Taylor, A., & Greve, H. R. (2006). Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Academy of Management Journal, 49*(4), 723-740.

Tekleab, A. G., Quigley, N. R., & Tesluk, P. E. (2009). A longitudinal study of team conflict, conflict management, cohesion, and team effectiveness. *Group & Organization Management, 34*(2), 170-205.

Thatcher, S. M., & Patel, P. C. 2012. Group faultlines: A review, integration, and guide to future research. *Journal of Management*, *38*(4): 969-1009.

Thom-Santelli, J., Muller, M. J., & Millen, D. R. (2008). *Social tagging roles: publishers, evangelists, leaders.* Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

Tjosvold, D. 1985. Implications of controversy research for management. *Journal of management*, 11(3): 21-37.

Treem J. W., Dailey S. L., Pierce C. S., Leonardi P. M. 2015. Bringing technological frames to work: How previous experience with social media shapes the technology's meaning in an organization. *Journal of Communication*, 65: 396–422.

Treem, J., & Leonardi, P. (2012). Social Media Use in Organizations: Exploring the Affordances of Visibility, Editability, Persistence, and Association. *Communication Yearbook, 36*, 143-189.

Torrance, E. P. (1955). Perception of group functioning as a predictor of group performance. *The Journal of Social Psychology*, *42*(2), 271-282.

Turner, M. E., & Pratkanis, A. R. (1998). Twenty-five years of groupthink theory and research: Lessons from the evaluation of a theory. *Organizational Behavior and Human Decision Processes*, *73*(2-3), 105-115.

Turnage, A. K. (2007). Email flaming behaviors and organizational conflict. *Journal of Computer-Mediated Communication*, *13*(1), 43-59.

Tushman, M. L.1977. Special boundary roles in the innovation process. *Administrative Science Quarterly*, 587-605.

Uzzi, B., & Spiro, J. (2005). Collaboration and creativity: The small world Problem1. *American Journal of Sociology, 111*(2), 447-504.

Vaast, Emmanuelle, and Evgeny Kaganer (2013). "Social media affordances and governance in the workplace: An examination of organizational policies." Journal of Computer-Mediated Communication *19*(1): 78-101.

van Ginkel, W. P., & van Knippenberg, D. 2008. Group information elaboration and group decision making: The role of shared task representations. *Organizational Behavior and Human Decision Processes*, *105*(1), 82-97.

van Knippenberg, D. 2000. Work motivation and performance: A social identity perspective. *Applied Psychology*, *49*(3), 357-371.

van Knippenberg, D., De Dreu, C. K., & Homan, A. C. 2004. Work group diversity and group performance: an integrative model and research agenda. *Journal of Applied Psychology*, 89(6), 1008.

van Knippenberg, D., & Hogg, M. A. 2003. A social identity model of leadership effectiveness in organizations. *Research in Organizational Behavior*, *25*, 243-295.

van Knippenberg, D., & Schippers, M. C. 2007. Work group diversity. *Annu. Rev. Psychol.*, *58*, 515-541.

van Knippenberg, B., & van Knippenberg, D. 2005. Leader self-sacrifice and leadership effectiveness: the moderating role of leader prototypicality. *Journal of Applied Psychology*, *90*(1), 25.

Van Knippenberg, D., & Schippers, M. C. (2007). Work group diversity. Annu. Rev. Psychol., 58, 515-541.

Van Osch, W., & Steinfield, C. W. (2016). Team boundary spanning: strategic implications for the implementation and use of enterprise social media. *Journal of Information Technology, 31*(2), 207-225.

Volpe, C.E., Cannon-Bowers, J.A., Salas, E. and Spector, P.E., 1996. The impact of cross-training on team functioning: An empirical investigation. *Human Factors*, 38(1), pp.87-100.

Von Glinow, M. A., Shapiro, D. L., & Brett, J. M. 2004. Can we talk, and should we? Managing emotional conflict in multicultural teams. *Academy of Management Review*, 29(4): 578-592.

Walther, J. B. (1993). Impression development in computer-mediated interaction. *Western Journal of Communication (includes Communication Reports), 57*(4), 381-398.

Wang, D., Waldman, D. A., & Zhang, Z. 2014. A meta-analysis of shared leadership and team effectiveness. *Journal of Applied Psychology*, *99*(2), 181.

Wasko, M. M., & Faraj, S. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly*, 35-57.

Wasserman, S., & Faust, K. 1994. *Social network analysis: Methods and application.* New York: Cambridge University Press.

Watts, D. J., & Strogatz, S. H. (1998). Collective dynamics of 'small world' networks. *Nature*, *393*(6684), 440.

Watson, R. T., DeSanctis, G., & Poole, M. S. (1988). Using a GDSS to Facilitate Group Consensus: Some Intended and Unintended Consequences. *MIS Quarterly, 12*(3), 463-478.

Wax, A., DeChurch, L. A., & Contractor, N. S. (2017). Self-Organizing Into Winning Teams: Understanding the Mechanisms That Drive Successful Collaborations. *Small Group Research*, *48*(6), 665-718.

Wegner, D. M. 1995. A computer network model of human transactive memory. *Social Cognition*, *13*(3): 319-339.

Wegner, D. M. 1987. Transactive memory: A contemporary analysis of the group mind. In B. Mullen & G. R. Goethals (Eds.), *Theories of Group Behavior*: 185 208. New York: Springer-Verlag.

Wegner, D. M., Giuliano, T., & Hertel, P. T. (1985). Cognitive interdependence in close relationships. In *Compatible and incompatible relationships* (pp. 253-276). Springer, New York, NY.

Wiesenfeld, B. M., Raghuram, S., & Garud, R.1999. Managers in a virtual context: The experience of self-threat and its effects on virtual work organizations. *Journal of Organizational Behavior*, *6*, 31-44.

Wiggins, A., & Crowston, K. (2011). *From conservation to crowdsourcing: A typology of citizen science.* Paper presented at the System Sciences (HICSS), 2011 44th Hawaii international conference.

Wilson, K. A., Salas, E., Priest, H. A., & Andrews, D. (2007). Errors in the heat of battle: Taking a closer look at shared cognition breakdowns through teamwork. *Human factors*, *49*(2), 243-256.

Wittenbaum, G. M., Hollingshead, A. B., & Botero, I. C. (2004). From cooperative to motivated information sharing in groups: Moving beyond the hidden profile paradigm. *Communication Monographs, 71*(3), 286-310.

Wuchty, S., Jones, B. F., & Uzzi, B. (2007). The increasing dominance of teams in production of knowledge. *science, 316*(5827), 1036-1039.

Yeatts, D., & Hyten, C. 1998. *High-performing self-managed work teams*. Thousand Oaks, CA: Sage.

Yuan Y. C., Gay G. 2006. Homophily of network ties and bonding and bridging social capital in computer-mediated distributed teams. *Journal of Computer-Mediated Communication*, 11: 1062–1084.

Zaccaro, S. J. 1991. Nonequivalent associations between forms of cohesiveness and group-related outcomes: Evidence for multidimensionality. *The Journal of Social Psychology*, 131(3): 387-399.

Zaccaro, S. J., & Lowe, C. A. (1988). Cohesiveness and performance on an additive task: Evidence for multidimensionality. *The Journal of Social Psychology*, 128(4): 547-558.

Zaccaro, S. J., & Marks, M. A. (1999). Leader roles in organizational teams. In E. Sundstrom (Ed.), *Supporting work team effectiveness: Creating contexts for high performance* (pp. 95-125). San Francisco: Jossey-Bass

Zaccaro, S. J., Marks, M. A., & DeChurch, L. 2012. *Multiteam systems: An organization form for dynamic and complex environments*. London: Routledge Academic.

Zammuto, R. F., Griffith, T. L., Majchrzak, A., Dougherty, D. J., & Faraj, S. (2007). Information technology and the changing fabric of organization. *Organization science, 18*(5), 749-762.

Zhu, M., Huang, Y., & Contractor, N. S. 2013. Motivations for self-assembling into project teams. *Social Networks*, 35(2): 251-264.

Zigurs, I., Poole, M. S., & DeSanctis, G. L. (1988). A Study of Influence in Computer-Mediated Group Decision Making. *MIS Quarterly, 12*(4), 625-644.

APPENDIX

Nebula is a graphical interface for online group discussions. Nebula visualizes posts as nodes and replies as directed edges, forming a communication network that shows who said what in the discussion. Nebula was designed and developed by Jacqueline Ng Lane, Bill White and Seyed Iravani of the Department of Industrial Engineering and Management Sciences in collaboration with Jacob Collins and Bill Parod of Northwestern Information Technology (NUIT).

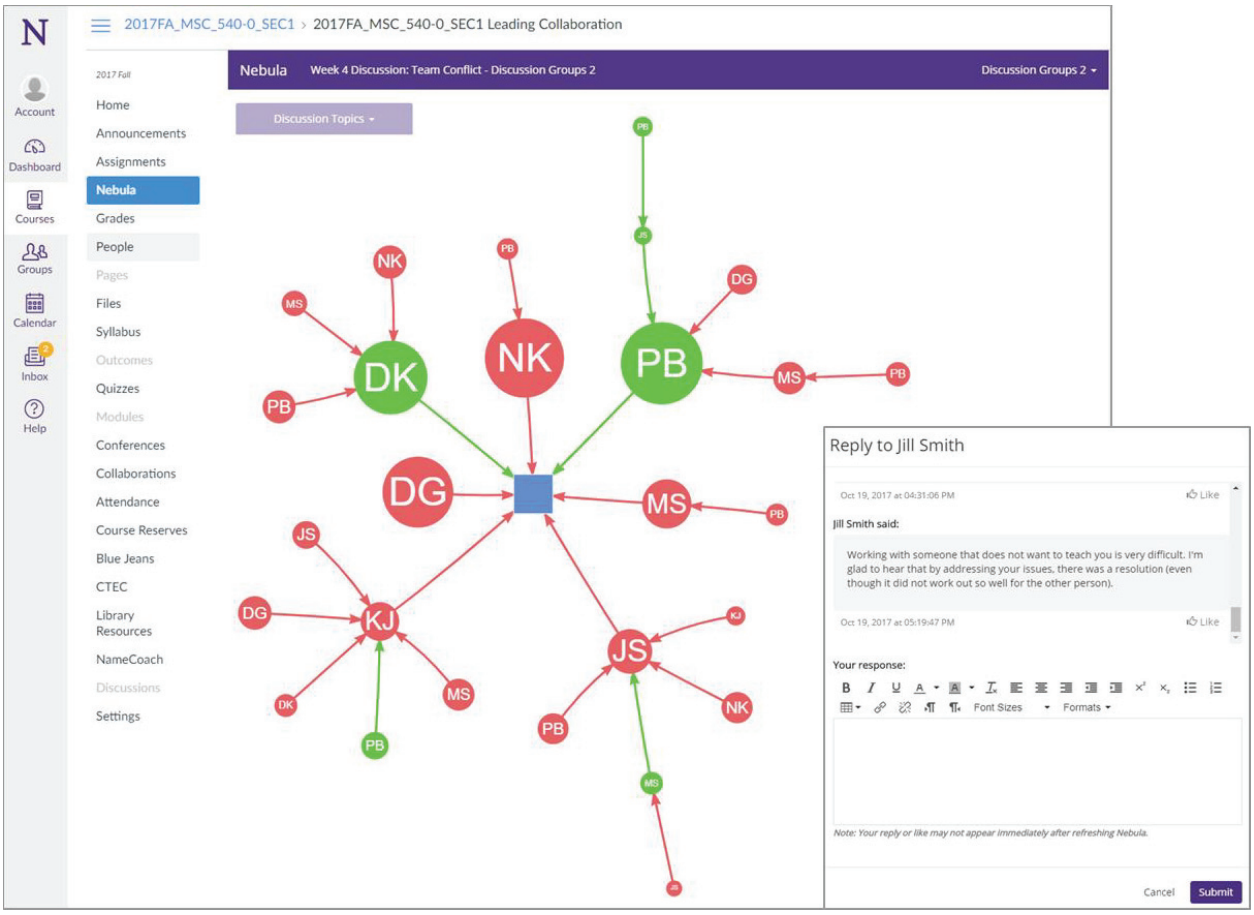


Figure A1. Nebula Communication Technology for Online Group Discussions.