DOI: 10.1016/j.hrmr.2016.12.009

When Does Virtuality Help or Hinder Teams?

Core Team Characteristics as Contingency Factors

John M. Schaubroeck
Departments of Management and Psychology
Michigan State University

Andrew Yu
Department of Management
Michigan State University

Abstract

In this paper, we seek to encourage scholars to consider how reliance on technology-mediated communications can bring both promises and perils in team-based work structures. Specifically, we argue that a team's core characteristics (including skill differentiation, temporal stability, and authority differentiation) will differentially affect the challenges and opportunities presented by the team's reliance on virtual means of communication. First, we will discuss how varying degrees of each core characteristic can affect outcomes when teams rely on virtual means of communication. We then propose how configurations of the three characteristics and virtuality can enhance understanding in both research and practice. We advance propositions that we hope will serve as a starting point for scholarly discussion about how the literature on virtual teams can leverage the existing theories and knowledge on team structure and interdependencies.

Keywords: computer-mediated communications; teams; technology; virtuality; virtual teams; workgroups

Published in *Human Resource Management Review*

Citation: Schaubroeck, J. M., & Yu, A. (2017). When does virtuality help or hinder teams? Core team characteristics as contingency factors. *Human Resource Management Review*, *27*(4), 635-647. https://doi.org/10.1016/j.hrmr.2016.12.009

Author Note: The authors contributed equally to this manuscript. Their names are listed in alphabetical order.

Introduction

Organizations have increasingly turned to team-based work structures as a means of responding to the increasing demands associated with rapid environmental changes, globalization, and heightened technical complexity. At the same time, the need to coordinate geographically dispersed units with diverse skillsets has limited organizations' abilities to co-locate team members. As a response to these demands and constraints, organizations have increasingly relied on information and telecommunication technologies to facilitate teamwork among individuals who have the necessary expertise to meet the demands of a given project or task (Townsend, DeMarie, & Hendrickson, 1998), notwithstanding cultural, spatial, and temporal boundaries (Gibson & Gibbs, 2006; Kirkman & Mathieu, 2005; Scott & Wildman, 2015). However, a reliance on technology-mediated communications in team-based structures poses unique challenges relative to teams in which members are co-located and meet face-to-face, such as difficulties in communicating across boundaries (Montoya-Weiss, Massey, & Song, 2001), social loafing (Alnuaimi, Robert, & Maruping, 2010), and developing trust within the team (Jarvenpaa & Leidner, 1999). The promises and perils that technology-mediated communications can bring to team-based structures have therefore raised important research questions concerning both the conditions under which these technologies can benefit teams and the best means to manage teams that rely extensively on such modes to coordinate taskwork.

Within the extant literature, several reviews have focused on specific issues related to technology-mediated communication in teams, or *virtual teams* (Gibson, Huang, Kirkman, & Shapiro, 2014; Hertel, Geister, & Konradt, 2005; Martins, Gilson, & Maynard, 2004; Scott & Wildman, 2015). Surprisingly, there has been limited conceptual or empirical work in organizational research that has attempted to synthesize work on technology-mediated communications, or virtual teams, with the extensive literature on traditional groups and teams. However, one must recognize that the literature on groups and teams provides little in the way of a roadmap for scholars to integrate the accumulated body of research focusing on virtual modes of communication and teams. As noted by Hollenbeck, Beersma, and Schouten (2012), the mainstream literature on groups and teams has "a confusing plethora of alternative team taxonomies and no consensus regarding how to describe or classify teams" (p.82). This may contribute to a belief that the distinctiveness of virtual teams, relative to face-to-face teams, and their diversity in form and function render them less suitable for the application of existing frameworks concerning work teams (Bell & Kozlowski, 2002).

We argue that scholarship will proceed more effectively by first recognizing that a team's level of reliance on technology-mediated communication, or *team virtuality* (Kirkman & Mathieu, 2005), is an important attribute on which work teams may be distinguished. Furthermore, teams high on virtuality may also differ on other important theoretical dimensions. To a considerable extent, these other characteristics of the team determine both the opportunities and challenges that implementing higher levels of virtuality poses to teams and their organizations. We take a contingency approach to conceptualizing how team virtuality influences team outcomes, such as learning and adaptation, efficiency, and innovation, as well as member identification and satisfaction. Whereas the geographic distribution of team members often dictates the level of team virtuality, we suggest that other dimensions, namely skill differentiation, temporal stability, and authority differentiation, can present either obstacles or opportunities to practitioners who seek to make greater use of technology-mediated

communications in how they choose to design, implement, and manage team structures. Thus, the chief aim of our paper is to propose an integrative theoretical framework that will allow future research to leverage the extant knowledge from research on traditional work groups, technology-mediated communication, and virtual teams.

We first briefly review the literature on communicating through virtual means and core team characteristics. Next, we consider how the separate influences of three core team characteristics (skill differentiation, temporal stability, and authority differentiation) on various team outcomes (e.g., efficiency) may differ depending on the level of team virtuality. We then present formal propositions concerning these contingency relationships. Finally, we consider how team virtuality affects relationships between various configurations of these core characteristics and team outcomes. This framework may also have important practical implications in suggesting how technology-mediated communication may be beneficial or counterproductive in different environments, and whether richer virtual modalities (e.g., videoconferencing vs. email) may be needed for teams that must rely extensively on virtual communication. We aim to provide researchers with a conceptual lens based on the existing literature on groups and teams that aids in organizing and motivating future work incorporating team virtuality. In doing so, we envision a literature on virtuality in teams that avoids the blind spots, fragmentation, and effort wasted on reinventing conceptual material (i.e., the "not invented here" syndrome) that often sidetracks new streams of literature.

Communicating through Virtual Means

The extensive literature surrounding the use of technology-mediated communications in groups and teams has developed across many research domains. Early research examining the differences between face-to-face and technology-mediated groups have demonstrated some of the potential advantages of utilizing technology as a medium for accomplishing work in teams, for instance decision-making (Hedlund, Ilgen, & Hollenbeck, 1998; Lam & Schaubroeck, 2000) and member satisfaction (Thompson & Coovert, 2002; Warkentin, Sayeed, & Hightower, 1997). As organizations have sought to implement new technologies into team-based structures, researchers began to identify hurdles that these teams may need to overcome. For example, they may face unique difficulties in team identification (Fiol & O'Conner, 2005; Wiesenfeld, Raghuram, & Garud, 2001), managing diversity across boundaries (Gibson & Gibbs, 2006; Scott & Wildman, 2015), and how to best manage virtual teams (Bell & Kozlowski, 2002; Hoch & Kozlowski, 2014). All of these challenges have the potential to mitigate, and in some cases supersede, the advantages of coordinating tasks through a virtual work structure. This has led some researchers to draw comparisons between 'virtual' and 'traditional' teams and has created what we view to be a rapidly expanding gulf between the mainstream literature on work teams and research on the topic of "virtual teams".

Within the literature on virtual teams, a divergent view has begun to challenge the "unrealistic and artificial" distinction of a team either being virtual or not (Cramton, 2001; Griffith, Sawyer, & Neale, 2003; Kirkman & Mathieu, 2005; Martins et al., 2004). This perspective acknowledges that geographic dispersion may lead to team members using virtual means of coordinating task activities, however this does not preclude teams that are co-located from using virtual tools as well (Kirkman & Mathieu, 2005). Indeed, it would be difficult to imagine, in today's workplace environment, a complete absence of mediating communication

technologies (e.g., email, video-conferencing, shared calendars, etc.). Almost all teams are likely to employ at least *some* type of technology to coordinate tasks and accomplish work. This has led Kirkman and Mathieu (2005) to put forth the concept of team virtuality, which refers to the extent and value of utilizing information and communication technologies within work teams. Moreover, the artificial dichotomization of teams, into being either virtual or not virtual, may not encourage researchers who specifically investigate teams high on virtuality to pay heed to the broader literature on groups and teams, particularly as this emerging stream of research develops its own nomenclatures and research questions, thus broadening the gulf in scholarship.

Henceforth, where we refer to higher levels of team virtuality, we follow Kirkman and Mathieu (2005) in referring not only to a team's frequency of use of technology-mediated communications, but also to the informational value provided by these technologies, and the extent to which the communication is synchronous or asynchronous (i.e., some virtual media afford richer information exchange than others). For example, videoconferencing provides nearly the same information quality exchange as face-to-face communication. On the other hand, email cannot convey visual or audio cues often needed to interpret information (Kruger, Epley, Parker, & Ng, 2005), and its asynchronous nature also reduces the likelihood members will engage in spirited discussion. If members use email and, nevertheless, are motivated to have a deep discussion, such discussions are likely to extend over a protracted period, with multiple members responding to the same emails. This makes it difficult to ascertain who is addressing whom.

One also cannot be sure if silence from one or more members represents their agreement, dissent, lack of understanding, or belief that their opinion needs to be solicited (Cramton, 2001; Kurtzberg, 2014; Miles & Hollenbeck, 2014). Whereas group chat is more synchronous than email, it still suffers from the same drawbacks relative to richer media in which visual and/or audio cues are conveyed (Driskell, Radtke, & Salas, 2003). Thus, to illustrate these distinctions, videoconferencing represents a lower level of team virtuality than reliance on group chat because it places fewer constraints on the process and quality of communication. Given its greater synchronicity, group-chat represents lower virtuality, by our measure, than email. It is also important to note that we refer only to conversations at the team level, that is, the focus of our present work surrounds the extent a team as a whole utilizes technology-mediated communications to coordinate taskwork.

Virtuality and Core Team Characteristics

One of the key advantages of organizing work virtually is that an organization can coordinate the inputs and actions of multiple employees and contractors across the organization, without the prerequisite that they be co-located together (Jarvenpaa & Leidner, 1999; Miles & Hollenbeck, 2014; Townsend et al., 1998). The extreme example of "Global Virtual Teams" (GVTs), which include members from around the world, is also growing in prevalence (Scott & Wildman, 2015). This suggests that virtuality can offer organizations flexibility when composing teams to tackle problems and pursue new opportunities. However, the concept of "team" assumes that the group members share a common purpose and set of interdependencies that is unique to their membership in a group. In addition, to achieving its purpose by fulfilling individual responsibilities to the team, members must interact not only for managing exceptions and future planning, but also for completing the team tasks. Given the complexity and uncertainty that make creation of a team suitable, members must frequently engage directly with

one another to complete team tasks. This contrasts with groups (units) in which individual efforts are pooled, and any needs for direct interaction are limited. Thus, quality of communication is particularly important for genuine work teams, opposed to that for other structures in which workers are interacting virtually.

When tasks are coordinated through technology, there is a considerable loss in communication richness compared to face-to-face communications, such as a lack of nonverbal and paraverbal cues that convey meaning and identify whether communication recipients have fully understood a given message (Lam & Schaubroeck, 2000; Miles & Hollenbeck, 2014). Indeed, researchers have noted that "just bringing people with the required knowledge and skills together virtually provides no guarantee that they will be able to work effectively and innovate across contexts" (Cramton, 2001, p. 452).Thus, communication difficulties that are characteristic of teams will be exacerbated if they rely on technology-mediated communication during critical phases of team action cycles. Thus, we argue that the potential advantages and challenges of team virtuality will depend substantially on characteristics of the teams that are frequently studied.

Although there is no explicit consensus of team types, there seems to be a consensus regarding the core characteristics that underlie different types of teams (e.g., short-term project teams, extreme action teams, self-managing teams). In order to develop an integrative theoretical framework for understanding team virtuality and the core characteristics inherent in teams, we draw upon the recently proposed conceptualization put forth by Hollenbeck et al. (2012) that describes what they proposed to be the three parsimonious underlying characteristics inherent in existing team taxonomies and typologies. By utilizing a dimensional scaling approach, the authors argued that "a more granulate, continuous, and multidimensional space for describing teams" (p. 83) can be constructed, thereby allowing researchers to describe different kinds of teams in a succinct manner when building and testing theories. Their approach also allows for the addition of other dimensions, such as team virtuality, as the literature evolves in their understanding of teams.

Based on their review of team taxonomies and typologies, Hollenbeck et al. (2012) identified skill differentiation, temporal stability, and authority differentiation as the core underlying characteristics that distinguish different types of teams. These characteristics have been empirically validated in a study reported by Lee, Koopman, Hollenbeck, Wang, and Lanaj (2015). By leveraging these core characteristics and including Kirkman and Mathieu's (2005) concept of team virtuality, we present the initial steps towards an integrative framework that examines the contingent effects of technology-mediated communications in team-based work structures. Within this framework, established dimensions of teams determine the extent to which the depth and breadth of utilization of these technologies can have beneficial or adverse effects across a range of team outcomes.

In keeping with the broader literature on work teams, we must first recognize that particular configurations of team attributes are beneficial or detrimental in relation to particular types of team outcomes. There are many conceptually distinct types of theoretical and practical team outcomes, such as efficiency, innovation, learning and adaptation, and member maintenance concerns (e.g., identification and satisfaction with group membership). Teams are efficient to the extent that they meet task requirements with minimum opportunity cost to

resources, such as member effort and time, that could be applied to other needs (Hoegl & Gemuenden, 2001). A team's success in meeting externally-defined objectives is normally considered the core criterion of team performance (Burke, Salas, & Diaz, 2008; De Dreu & Weingart, 2003; Kozlowski & Bell, 2008; Lovelace, Shapiro, & Weingart, 2001). Burke et al. (2008) defined team learning as "the process by which relatively permanent changes occur in the behavioral potential of the group because of group-interaction activities through which members acquire, share, and combine knowledge" (p. 218). Teams are more innovative when they demonstrate they can develop novel solutions and processes to problems (van de Ven & Chu, 1989). Finally, LePine (2005) defines team adaptation as "the ability of a team to function when confronted with unexpected change that makes the team's established routines inappropriate" (p. 1153).

There are also intermediate outcomes such as task and relationship conflict within the group (Behfar, Peterson, Mannix, & Trochim, 2008) and members' confidence in the ability of the team to overcome obstacles in challenging situations (i.e., team potency; Hu & Liden, 2011). Coordination refers to "the process of orchestrating the sequence and timing of interdependent actions" (Marks, Mathieu, & Zaccaro, 2001, p.367-368). Although we reference coordination of action within the team (Beersma et al., 2009) in this paper, teams also coordinate with other units of the organization (Davison, Hollenbeck, Barnes, Sleesman, & Ilgen, 2012). Constructs such as conflict, potency, and coordination are conceptualized as mediating relationships between team attributes and constructs that more directly represent effectiveness. Certain constructs we have defined as outcomes may also mediate relationships on other outcomes, as with the theoretical role of team learning in promoting greater innovation and performance over time (Edmondson, 1999).

For team members to develop their own novel solutions and products, members must integrate their individual knowledge and willingly take risks as they experiment with new modes of functioning. These construct distinctions are also important because teams are often successful in terms of certain outcomes and not others. For example, for many years scholars have recognized that teams need to balance the costs and benefits of more intensive communication and make choices for structuring team member interaction consistent with team requirements (Steiner, 1972). Highly efficient groups may meet the minimum requirements of the task, yet often do not achieve very high quality results, such as more effective product or service delivery. They may perform more effectively if they were to reflect on and deliberate more intensively about the quality of intra-team communication, or *teamwork* (Mathieu, Maynard, Rapp, & Gilson, 2008). As we will consider below, depending on the status of other team attributes, higher levels of team virtuality may favorably influence certain outcomes (e.g., efficiency) while at the same time hindering other outcomes (e.g., team learning).

Table 1 describes published theoretical observations and research findings related to virtually mediated teams and different team outcomes.

Insert Table 1 about here

In the following subsections, we consider how the level of team virtuality separately influences the underlying team characteristics outlined by Hollenbeck et al. (2012) – skill differentiation, temporal stability, and authority differentiation – in promoting key team outcomes. We present formal propositions based upon the existing literature on work teams in general and virtual teams in particular, and consider how mutual adjustment on these underlying dimensions can help teams overcome the hurdles associated with higher levels of team virtuality.

Skill Differentiation and Virtuality

One primary practical reason for forming a team is the need to resolve reciprocal interdependencies within a network of highly differentiated roles through direct interaction of position holders. Reciprocal interdependence exists when parties must exchange resources or expertise back and forth, such that the output of one party is the input of the other and vice versa. Teams permit rapid coordination among members by providing a forum for their interaction and aligning their interests around shared team objectives. Resolving a high volume of reciprocally interdependent roles through other means, such as by applying dedicated coordinating roles (i.e., liaisons) or direct supervision is not possible owing to the inability of a single mind to adequately comprehend the task contingencies and expertise of differentiated roles (Thompson, 1967). Thus, a qualitative difference in member skills is a crucial part of the rationale for forming a team. We suggest that the extent of skill differentiation may be especially problematic for teams that rely heavily on technology-mediated communication.

Skill differentiation refers to "the degree to which members have specialized knowledge or functional capacities that make it more or less difficult to substitute members" (Hollenbeck et al., 2012, p.84). As represented in organization theory under the rubric of horizontal specialization (Pugh, Hickson, & Hinings, 1969), skill differentiation denotes variance across team members in functional expertise and responsibilities. Even in the absence of virtuality, skill differentiation poses certain hurdles to effective coordination. Differences in individuals' repertoire of knowledge bases and perspectives, usually stemming from differences in educational background, training, and work experience, have been found to increase task conflict in teams (Jehn, Northcraft, & Neale, 1999). Research also indicates that teams composed of individuals from diverse functional backgrounds and expertise can suffer from ineffective communication and coordination of taskwork, thereby limiting the teams' ability to leverage the depth of knowledge each member may provide (Gibson & Gibbs, 2006; Scott & Wildman, 2015).

As summarized by Rice and Stohl (2006), mediated communication is particularly limiting for "multicue interactions and adjustments" (p.155) as are needed to convey complex information between parties with different expertise and perspective. One of the primary challenges derives from what has been called *semantic information distance*, which refers to the gap in information exchange caused by parties having distinct vernacular and knowledge that must often be bridged before parties can understand one another (Driskell et al., 2003; Tompkins, 1962). The semantic information distance between parties of an exchange can be more easily bridged when the sender and receiver communicates face-to-face, affording accessibility not only to verbal cues, but also to nonverbal ones as well. For example, in speaking face-to-face, the speaker can normally determine, from the intended receiver's facial expression and utterances, that their message needs to be restated in a less abstract manner or to define

certain terms that may have been assumed as common knowledge. When team members with different expertise or training communicate via technology that does not ensure a synchronous discussion, such as email, members often have neither the time nor the inclination to extend the discussion to resolve ambiguity and instead may proceed on the basis of an uncertain understanding (Kurtzberg, 2014; Rice & Stohl, 2006). This is less of a concern for homogeneous teams (i.e., low skill differentiation), as the semantic information distance between members will be smaller.

However, even in teams with low levels of skill differentiation, not all members of a team may be fluent in communicating their thoughts and advice in writing, and thus asynchronous media (e.g., email, group chats) may severely hamper the quality of their messages as received by other members. Scholars have also suggested that teams are normally created to tackle complex problems that often require the application of expertise that is based substantially on tacit knowledge. When communication is mediated by technology, particularly asynchronous communication media with little or no access to verbal, nonverbal, or paraverbal cues, conveying tacit knowledge is much more difficult (Miles & Hollenbeck, 2014). By definition, tacit knowledge cannot be conveyed through strictly verbal or written means, and thus even with the richest form of virtual communication, the gulf of tacit knowledge cannot easily be breached in highly skill differentiated teams. Thus, we suggest that the communication pitfalls associated semantic information distance in highly skill-differentiated teams, which are exacerbated by reliance on technology-mediated communication, are deepened by lack of skill and effort in communicating virtually, as well as by the differences in tacit knowledge that often accompany skill differentiation.

The communication pitfalls that derive from reliance on asynchronous communication, particularly in skill-differentiated groups, are likely to affect a broad class of team outcomes. They can disrupt team efficiency and adaptation when miscommunications result, and tasks or other interactions need to be revisited or completely redone. Teams will be unable to combine their expertise to achieve process, service, or product innovations if members cannot fully understand the unique value of inputs afforded by their different skills. Team performance, as reflected by criteria such as customer satisfaction or project completion, may suffer not only from inefficiencies, but also from failures in accountability that result from miscommunication. Ultimately, such communication difficulties can prevent members from coalescing as a team and deriving satisfaction from their interactions with other members, which is important for members to identify themselves personally with the team (Fiol & O'Conner, 2005). Finally, if teams are able to improve over time, they must take the time to engage in reflective learning about their about their past experience and consider ways they can improve (Burke et al., 2008; Marks et al., 2001). While even highly efficient teams often do not invest in learning how to perform better as a team, the communication difficulties engendered when highly skill differentiated teams rely chiefly on technology-mediated communication diminishes the feasibility of learning from team experiences. Moreover, learning from experience to improve team functioning can be most effective when members are communicating synchronously and with full access to the verbal and nonverbal cues that face-to-face interaction provides. Taken together, we expect that higher levels of team virtuality will present greater challenges to teams to the extent they are high on the dimension of skill differentiation.

Proposition 1: As reliance on virtual modes of communication increases, skill differentiation will have a less favorable influence on team-level outcomes related to efficiency, performance, adaptation, innovation, and learning, as well as member-level outcomes of satisfaction and identification with the team.

Temporal Stability and Virtuality

The second team characteristic that Hollenbeck et al. (2012) identified from their review of the teams literature is temporal stability. *Temporal stability* is defined as "the degree to which team members have a history of working together in the past and an expectation of working together in the future" (Hollenbeck et al., 2012, p.84). Teams that have a history of working together develop implicit norms and certain familiarities with one another, thereby reducing much of the uncertainty associated with how tasks are accomplished (Hackman & Katz, 2010). Similarly, teams that expect to remain working together in the future are more motivated to invest the time to develop these norms and mental models to better facilitate how work is accomplished. Indeed, stability in team membership has been found to promote the development of psychological linkages between team members and identification with the team (Fiol & O'Conner, 2005). These connections foster member satisfaction with the team and a greater willingness among members to contribute effort and time toward team needs and goals (Wiesenfeld et al., 2001).

Conversely, teams that lack a history together, or do not expect to work together in the future, are often brought together specifically for the purpose of accomplishing specific tasks (e.g., airline crews, surgical teams, project teams). Members of such teams often disband upon completion of their work (Jarvenpaa & Leidner, 1999; Kirkman, Rosen, Tesluk, & Gibson, 2004; Martins et al., 2004). Team membership can also be quite dynamic within the team life cycle, as individual members enter and leave the team due to the changing nature of the broader task environment. Members of highly virtual teams (e.g., global virtual teams) often lack a working history together prior to the formation of the team. In these cases, team members often have very little personal knowledge of one another that often aids in building trust, establishing group norms, and developing team mental models (Maruping & Agarwal, 2004).

The lack of familiarity between individuals in teams without a history of working together presents a great deal of uncertainty, due to, for instance, an absence of pre-established situational norms and status structures (Cohen & Bailey, 1997; Ginnett, 1993; Hackman & Katz, 2010). As a result, when these types of teams are assembled, they must spend time in establishing the appropriate norms and structures for effective team functioning. As levels of team virtuality increase, the lack of communication richness, relative to FTF interactions, will pose greater challenges for such teams to overcome. Similarly, teams that do not expect to remain intact in the future lack the time necessary to develop high collective efficacy and rich team mental models, both of which are important states critical to team adaptation and performance (Kozlowski & Bell, 2013). Effective teams develop a shared awareness and understanding, such that team members are 'on the same page' (Cramton, 2001). Yet, without a history or a future together, critical information often goes unshared (Cramton, 2001; Miles & Hollenbeck, 2014).

Technology-based communications in teams low in temporal stability could be beneficial *if* members shared all of the information that could be useful to the group. This is because virtual media, such as email, can enable communication to more than one party without added effort or time. However, a large body of research on the hidden profile paradigm indicates that in making decisions, members tend to focus on information that is already shared among members and they are less likely to share unique information with the group (Lam & Schaubroeck, 2000; Lu, Yuan, & McLeod, 2012). Thus, whereas virtuality may have benefits in terms of efficiency for many groups with low temporal stability, we expect that it will be detrimental for outcomes that require piecing together information from different group members, such as innovation and adaptation. Because of their lack of commitment to a future together as a team, the frictions that can arise through technology-based communications among members, who are not well acquainted, may also promote member dissatisfaction.

As team members develop familiarity with one another, they also develop a shared understanding that facilitates interactions. This enables teams to take fuller advantage of technology-based communications for sharing information, with fewer of the drawbacks to virtual communication we have noted above (e.g., miscommunication, poor message articulation). Expectations of future interaction as a team also motivates members to engage in team learning, as they understand that any improvements they may make to team functioning will benefit the team as a whole in the future. In addition, the stronger group norms and greater comfort that members tend to have, in teams high in temporal stability, also provide greater potential for open discussions about problems and solutions to group process issues. While outcomes such as team learning, adaptation, and innovation are best supported in face-to-face groups, when teams must rely primarily on virtual communication, we suggest that they will benefit considerably from higher temporal stability. In sum, we expect that the benefits of higher team virtuality will be better suited for teams high on temporal stability across a wide range of criteria.

> *Proposition 2: As reliance on virtual modes of communication increases, temporal stability will have more favorable influences on team-level outcomes related to performance, adaptation, innovation, and learning, as well as member-level outcomes of satisfaction and identification with the team.*

Authority Differentiation and Virtuality

The third team characteristic that Hollenbeck et al. (2012) identified from their review is authority differentiation. *Authority differentiation* fits with existing conceptualizations of vertical centralization and decentralization as first promulgated by organization theorists (e.g., Pugh et al., 1969). It concerns the vertical dimension of the organization chart, establishing who has responsibility and authority to make decisions. Hollenbeck et al. (2012) defined authority differentiation as "the degree to which decision-making responsibility is vested in individual members, subgroups of the team, or the collective as a whole" (p.84). Teams that measure high in authority differentiation have more of a centralized decision-making process, whereas teams low in authority differentiation have more of a decentralized decision-making process. This dimension represents the role that centralization can play in assuring progress toward meeting team requirements when members may not agree on means or ends.

A team's level of authority differentiation and role differentiation are chief criteria is assessing whether a team lies on a continuum ranging from "tight coupling" to "loose coupling." As noted by Hollenbeck, Ellis, Humphrey, Garza, and Ilgen (2011), high task interdependence, which is presumed in defining a group as a team, and *role* differentiation denote whether the task allocation structure is functional (i.e., member roles on the team are highly specialized by function) or divisional (i.e., team members all have broad role definitions). (Note that role differentiation is distinct from skill differentiation as discussed above). A team that is functionally organized and is high in authority differentiation (i.e. authority for decision-making is centralized) is considered the most tightly coupled. Teams that are low in authority differentiation, such that members jointly maintain decision-making authority, are considered to be loosely coupled. As stated by Hollenbeck et al. (2011), "In general, tight coupling promotes efficiency (and related outcomes such as depth of knowledge, performance quantity, implicit coordination), whereas loose coupling promotes adaptability (and related outcomes such as breadth of knowledge, performance quality, flexibility, and personal responsibility)" (p. 65).

Distinctions between teams on the continuum of loose to tight coupling, and the substantial contribution of authority differentiation to such distinctions, is important to understanding the impact that reliance on technology-mediated communication is likely to have on a range of different team outcomes. Going back to Steiner's (1972) work, scholars have suggested that highly structured teams can be very efficient and perform well when they do not need to process a large amount of information. Less structured teams (i.e. broadly defined member roles and low authority differentiation) are needed when team information processing requirements are high (c.f. Orton & Weick, 1990). Summarizing Weick's (1976) theory on tight-loose coupling, Hollenbeck et al. (2011) noted that to readily meet needs for integration, "…tightly coupled structures demand the development of norms, processes, and emergent states like implicit coordination, cohesiveness, and trust that are not necessarily required in loosely coupled structures where each person is more autonomous and working largely on their own" (p. 66).

However, managers who commission or organize teams often recognize the pitfalls of hoarding decision making power and limiting member autonomy. Because of such expectations, teams in which team leaders exercise broad authority over member actions and the decisions relevant to the team are likely to be more prevalent when the team mission and environmental context does not require team members who are highly trained or professionalized. In such contexts, the team leader, who may be external to the team, can effectively comprehend the contingencies facing each member. This is consistent with findings of early work on technology and organizational performance, which found that more tightly coupled ('mechanistic'; Burns & Stalker, 1961) work structures were best suited to moderately complex technologies (e.g., mass production) in which workers were neither craftsmen (low technical complexity) nor professional technicians (high technical complexity) (Mintzberg, 1979; Woodward, 1965).

In such conditions, members will have lower expectations for autonomy, and the semantic information distance between members will be minimal. Because members normally accept the legitimacy of formal leaders when they are seen to promote, rather than interfere with, team goals (Tyler, 2006), the artful application of authority-based power can often ensure group efficiency with little cost to member morale. Notably, requirements or expectations for team innovation are likely to be low in such circumstances. Likewise, team leaders can guide team

learning in ways that focus executing tasks efficiently, as with military officers commanding regular units in combat.

In sum, when the environment is relatively comprehensible to a team leader and members are not highly skilled, high authority differentiation may be more suitable. Under such conditions, we expect that technology-mediated communication can facilitate team efficiency and performance. The leader is able to adapt team member actions to changing needs by communicating large amounts of information to team members who are located in several distant places. In sum, we expect that in teams that are reliant on higher levels of virtuality, authority differentiation will assist teams in being efficient and productive.

Proposition 3a: Centralized authority (high authority differentiation) will have a more favorable influence on team-level outcomes related to efficiency and performance in virtually mediated teams, among teams with less skilled members.

Often, however, the diverse skill sets that motivate the formation of a team are highly professionalized, and under this condition, the application of centralized authority is more problematic. Wang, Waldman, and Zhang (2014) concluded from their meta-analysis that shared (decentralized) leadership is positively related to team effectiveness, but this effect is largely found when teams face very complex, dynamic environments where high levels of member skill are needed and adaptation and learning are of greater importance.

Hoch and Kozlowski (2014) found that a decentralized decision-making structure was positively related to team performance in research and development teams that relied on virtual communication, whereas a centralized structure was not. They suggested that a decentralized structure facilitates greater levels of cohesion and that these states are particularly important in technology-mediated teams because of the limitations on team members' interaction quality (i.e., communication richness) and frequency. Teams with high levels of authority differentiation may often fail to develop interaction patterns that enable them to share information and learn from one another in ways that support adaptation and innovation. In addition, members may not develop the sense of "teamness" (Salas, Rosen, Burke, & Goodwin, 2009) that undergirds identification with the team and the fulfillment of belongingness needs. Both team identification and belongingness needs are critical for members to maintain the personal motivation to overcome interpersonal barriers, such as those that exist when members differ substantially in their expertise and yet communicate primarily through virtual media. In sum, we expect that higher levels of team virtuality will pose additional challenges to teams when authority differentiation is high and yet members are highly skilled.

Proposition 3b: Centralized authority (high authority differentiation) will have an unfavorable influence on team performance, adaptation, innovation, and learning, as well as member satisfaction and identification, among teams with highly skilled members.

Table 2 summarizes relationships we expect between the core team characteristics and team outcomes.

Insert Table 2 about here

Configural Effects of Virtuality and Core Team Characteristics

As we have discussed, the benefits and drawbacks of reliance on virtual modes of communication are highly dependent on the characteristics of the team in question. Often, teams that rely on technology-mediated communications are brought together for a specific purpose to tackle a complex problem. Organizations and managers may have limited degrees of freedom to tailor each of the core characteristics and, at times, they may have little choice but to form teams that are not co-located and therefore must communicate primarily through virtual means. However, teams can be designed and managed in ways that alleviate some of the possible challenges to such arrangement that we discussed above, thus maximizing the benefits of utilizing technology-mediated communications.

Central to this idea is the recognition that organizations often have more choices concerning certain team attributes than others, and that the limitations of one team characteristic can be offset by a separate team characteristic. If a team that maintains certain fixed characteristics that create difficulties for team effectiveness (e.g., performing a project requires a highly skill-differentiated team and the team must communicate virtually), the organization can potentially adapt by designing into the team structure attributes that counterbalance the side effects of these characteristics. Thus, we consider contingency relationships associated with virtuality in teams that consider different core team characteristics as a configuration. Two distinctly different configurations reflect the challenge of using tight coupling to manage interdependencies among highly skill differentiated members. The factor distinguishing these configurations is the temporal stability of the team.

As we have noted, organizations form teams because a project or an ongoing work process requires highly skilled specialists to work closely together. Thus, high skill differentiation is often inherent in teams, such that reducing the extent to which expertise varies within the team would defeat the purpose of using a team. Established views of team structure suggest that teams high in skill differentiation perform best when team structures are loosely coupled. Members then have considerable discretion over how they define their roles and conduct themselves. They also have shared authority over decisions that affect the group as a whole, whether decisions are shared by members or are allocated selectively to different members contingent on the match between a given decision situation and their unique expertise (Mintzberg, 1979; Weick, 1976).

These established views, however, take little or no heed of the communication difficulties that arise when members with highly differentiated skills must coordinate through virtual means. For example, highly task interdependent teams, by definition, are at least somewhat tightly coupled, and we believe teams high in skill differentiation are rarely assigned as “teams” unless their work is expected to be highly interdependent (see Thompson, 1967). The established view

of loosely coupled teams also does not consider how the work of professionals normally must be fit into a schedule and meet the requirements and standards that are established externally, such as by the customer, by existing organizational protocols, or by higher-level authority figures. Thus, the proper application of authority that is external to the members is often essential to ensuring team reliability and efficiency, as well as producing team outcomes that meet externally set specifications.

Centralization of team authority (high authority differentiation) over final decisions, such as "go, no-go" decisions, is one means to overcome semantic and psychological distances between highly skill differentiated team members. A formal team leader is in a position to intervene in ways to ensure certain members are freely exchanging information and understanding one another and are effectively synchronizing the technical details of during each task cycle. Thus, a more nuanced view of centralized authority recognizes the limitations of the team leader's ability to comprehend the contingencies facing all team members. While granting authority over group direction and pacing, the leader makes important decisions only after consulting team members. Even then, his or her decisions are subject to members' review. The challenges of applying such authority, as we noted earlier, lies in ensuring that members have adequate levels of trust and cohesion to enable tighter coupling of their roles (Hollenbeck et al., 2012; Weick, 1976). Short-term teams rely on "swift trust," which is a tendency for newly established teams to trust in the competency and goodwill of one another based on assumptions rather than personal experience or even strong ability signals (Meyerson, Weick, & Kramer, 1996).

This mix of limited hierarchical authority and somewhat circumscribed roles ("tight coupling") for highly skill differentiated, and highly skilled, workers, communicating through virtual means, is common among project teams throughout the world. In actual practice with short-term teams (i.e., low temporal stability), team managers are often highly focused on monitoring the team's progress, providing feedback to keep the team on schedule, supplying members with resources, and boundary spanning to coordinate with other organizational units. This allows team members to focus on its tasks and avoid the distractions that administrative issues present. Such basic team design frameworks are generally viewed as successful. However, attributions of success may derive in some cases from low temporal stability, which limits the expectations for qualities of team processes that would be needed for teams to innovate, adapt, and learn over extended periods and across a spectrum of changing requirements. Thus, we expect that team virtuality is more beneficial for teams that are high in skill differentiation and low in temporal stability, provided the leader who supports mutual adjustment among members.

> *Proposition 4. Selective applications of external authority (moderate authority differentiation) can ensure satisfactory levels of team efficiency, team performance, and member satisfaction among virtually mediated teams with high skill differentiation and low temporal stability.*

However, swift trust can often dwindle rapidly as teams interact repeatedly over time (Jarvenpaa & Leidner, 1999; Meyerson et al., 1996). This is of particular concern when team members do not come in direct physical contact and yet are highly dependent on the pacing and quality of one another's work (Kanawattanachai & Yoo, 2002). This situation is further aggravated in highly skill differentiated teams, owing to the communication barriers we

discussed above in relation to Proposition 1, as well as the loss of member control as teams become more tightly coupled (Hollenbeck et al., 2012; Weick, 1976). Promoting and maintaining trust, based on demonstrated competence and high quality relationships, therefore becomes critical for maintaining member performance and satisfaction in teams that are expected to remain intact over a substantial period. Moreover, as temporal stability increases, team adaptation to a changing task environment and reflective team learning also become concerns. Team learning and adaptation are highly dependent on mutually supportive and trustful member relationships. As building trust and cohesion is particularly difficult when team-level communications are primarily mediated by technology, we suggest that team leaders need to play a concerted role in shaping and maintaining the a social environment that is conducive to team learning and adaptation.

The difficulties associated with a team leader brokering virtually mediated member interactions is perhaps best illustrated by efforts to take advantage of temporal stability by engaging in experiential team learning. As described by Burke et al. (2008), for experiential group learning to occur, members must engage in a free and open dialogue in which the team members state their views, often reconsider them, and seek to integrate discordant perspectives about the same issues and opportunities. The process of group learning requires all members to openly give and receive feedback, share general reflections, and be open to experimenting with new ways of interacting (Edmondson, 1999). The aim is to develop mental models of team process that are increasingly accurate and agreed upon by members (Smith-Jentsch, Blickensderfer, Cannon-Bowers, & Salas, 1998). Without a supportive group context, or a formal leader who serves as gatekeeper for such discussions, members are likely to avoid engaging in the intense and often contentious discussions that produce shared learning.

Although a formal team leader may instigate and guide such discussions associated with team learning and other contexts in which the team must demonstrate adaptability, the members themselves must take responsibility for this process (Kozlowski, Watola, Jensen, Kim, & Botero, 2009; Maier, 1950). The leader's primary role is to remove barriers to members' interaction, serving a coaching role as outlined by Edmondson (1999). Yet, when members rely on asynchronous media that lacks access to visual and/or audio cues (e.g., email) to discuss such issues, a free and open discussion is much more challenging, and thus a formal or informal team leader must play a more proactive role as instigator, gatekeeper, and guide. Even with such support, team learning is likely to progress at a slower pace than among co-located teams that normally interact face-to-face.

In teams high on virtuality, team leaders are often checking in with queries and feedback, as well as sharing information relevant to team taskwork. However, an effective manager of a team high on both team virtuality and skill differentiation has at least a minimal level of the core knowledge of each member, as needed to understand threaded conversations between two team members and recognize whether he/she, or others, need to become more directly involved to ensure adequate knowledge exchange. This brokerage role of a formal team leader, however, may be less critical as teams gain experience working together. Experience gained through repeated interactions will eventually enable members to bridge semantic divides between skill sets, even with the comparatively barren communication modalities typically associated with virtual teamwork. As teamwork capabilities improve through experiential team learning, members can begin to regulate the team through the use of standards and norms that are

established by the team, as with shared team leadership (Carson, Tesluk, & Marrone, 2007; Wang et al., 2014). The external controls of the team can be loosened, with formal team leaders becoming more selective in making decisions and imposing strict standards and controls of their own. An informal leader may also emerge, and this individual could help guide group discussions. Relative to formal leaders, emerging informal leaders enhance the team's commitments to decisions, as members are less predisposed to view decisions orchestrated by informal leaders as being imposed externally (Maier, 1950). As such, we suggest that low authority differentiation is more beneficial for teams high in team virtuality, as well as both skill differentiation and temporal stability.

> *Proposition 5: Decentralized authority (low authority differentiation) with selective intervention of a formal or informal leader can aid member coordination, learning, and adaptation among virtually mediated teams with high skill differentiation and high temporal stability.*

Our arguments pertaining to Propositions 4 and 5 applies to members who have considerable expertise, as we assume that in most cases a high average skill level accompanies skill differentiation and is part of the rationale to form teams. Yet, we should note that when the level of members' skills are low, even while members' skill sets may be different (see Proposition 3a), more complete centralization of authority (high authority differentiation) is not necessarily likely to impede team or member outcomes. In such situation, centralized control can be applied very effectively through virtual communication. Nevertheless, even teams low in skill differentiation can enhance their performance and innovation potential through team learning. This is better achieved when team leaders act as arbiters of learning processes, as with the team leader coaching role described above, rather than seeking to "teach" the team what it "should" have learned from good or bad team experiences. Members' motivation to learn as a team and improve team performance may be greater when members perceive they maintain considerable joint control over how they manage their interactions. Thus, irrespective of the extent to which teams communicate through virtual means, application of concerted control and authority by a formal team leader is ideally very selective.

> *Proposition 6: Centralized leadership (high authority differentiation) can effectively promote team performance, learning, and adaptation among virtually mediated teams with high skill differentiation and high temporal stability.*

Discussion

We have sought to describe ways in which the literature on technology-mediated communications and virtual teams can better leverage the extensive literature on workgroups and teams. We have illustrated how team virtuality (Kirkman & Mathieu, 2005) may present challenges, and in some cases opportunities, contingent on the core team characteristics identified by Hollenbeck et al. (2012).

Temporal stability is a generally salutary characteristic of teams, and virtual teams are no exception. Many of the barriers to communication posed by technology-mediated communications, become more pronounced and problematic as skill differentiation within the team increases. This can be more readily overcome when teams gain experience and members

behave reliably (Jarvenpaa & Leidner, 1999; Kurtzberg, 2014). Higher temporal stability also enables members to take on greater responsibility for the management of team processes, and decentralizing authority to members has its own potential advantages. This is even more the case as team virtuality increases, because effective virtual communication requires members' tacit knowledge about how team members prefer to communicate, how they process newly conveyed information, and how members establish reliable and cooperative norms.

Following Kurtzberg (2014), we suggest that the reliability of messaging may be most critical for members of virtual teams to master. Whether members maintain trust in the absence of face to face contact depends on continuing attributions of reliability, not only about fulfilling roles on a task but also in terms of communicating the amount and type of information that is expected and at the proper times. Here, as in other domains, leadership serves an important function for teams reliant on virtual modalities to thrive. Message volume and message continuity from leaders are positively related to member trust and engagement, thereby enabling smoother virtual team interactions (Gajendran, Harrison, & Delaney-Klinger, *in press*). As teams gain experience, they often become more effective in sharing leadership, or an informal leader emerges, and virtual teams are not unique in these respects (Wickram & Walther, 2007). Collectively or through the efforts of one person, teams who rely on virtual modalities must orchestrate how they communicate in ways that all members view as reliable and supportive.

Boundaries and Future Directions

Team process. An important next step is to examine the impact of team virtuality at different stages of team process models (e.g., Marks et al., 2001). For example, action teams (e.g., cabin crews, surgical teams, project teams) often have distinctive preparation and execution phases of their tasks. During the preparation phase, the generation of ideas on how to best accomplish work may be enhanced by higher levels of team virtuality (Gibson et al., 2014), because virtual communications can potentially mitigate judgment from others, pressures of conformity, and fear of punishment for contributing an idea (Connolly, Jessup, & Valacich, 1990). Yet, during the execution phase, team virtuality may pose as a hindrance to accomplishing the task, since task interdependencies are often higher in this phase of team processes. If researchers aggregated these effects into a single performance episode, the effects of team virtuality from different phases may cancel each other out. Thus, future research on technology-mediated communications in team-based work structures should investigate how reliance on virtual communication influences team processes at different stages of team action cycles.

Multiteam systems. Even when a team is effective at sharing leadership or it has a talented and respected informal leader, we nevertheless have proposed that for most teams, some control should be centralized, either within formal or informal leaders, to ensure team efficiency and that the team is accountable to other units in the organization. The accountability of teams to other units of the organization are most pronounced in multiteam systems. Broadly speaking, a multiteam system is comprised of individual component teams that are non-overlapping and non-redundant (Davison et al., 2012). Future research should consider how the behavior of teams within a multiteam system can be compromised or enhanced by relying on virtual modes of communication. What are often seen as important characteristics of stand-alone teams may, in fact, impede coordination in multiteam system. The high volume and wide dispersion of

messaging that is enabled by communication technology may be more advantageous in multiteam systems, as the resources of each component team may be too easily depleted when they rely on richer communication media such as face-to-face interaction or video conferencing.

Geographic and cultural distance. While we have highlighted the role of group context in this paper, we did not examine some other important dimensions of context that may further complicate the design of teams reliant on virtual media. Perhaps, most importantly, virtual teams span multiple spatial and temporal boundaries, and geographic distance has been suggested to be a defining characteristic of virtual teams (Gibson & Gibbs, 2006; Griffith et al., 2003; Hoch & Kozlowski, 2014). These distances frequently distinguish societal cultures, with local area natives serving as team members. One obvious challenge is the differences in time zones and other local area scheduling complications (e.g., due to holidays) that make timely communication difficult, thereby hampering members' perceptions of one another's' reliability. Distant members may not speak or write commonly in the *lingua franca* of the team, and thus these barriers can exacerbate communication difficulties that derive from the sterility of virtual media and semantic information distance.

Conflict and team leader coaching. Cultural barriers and other factors, such as skill differentiation, can lead to interpersonal antagonism and, in some cases, open conflict about the task or personal disputes. As suggested by Kurtzberg (2014), in such cases the fewer cues afforded by technology-mediated communication can be beneficial in limiting strife. Visual (e.g., defensive postures) and paraverbal (e.g., tones of voice) cues often exacerbate conflict and lead to contentious communication, wherein members compete rather than collaborate (Lovelace et al., 2001). This is where a strong formal team leader, can be crucial in encouraging the team to focus on its tasks and to facilitate the transfer of knowledge and other information. Face-to-face teams were shown to exhibit negative relationships between contentious communication and team outcomes (e.g., team learning, team performance, and team innovation) only when a team leader exhibited little coaching behaviors (Edmondson, 1999). The effectiveness of coaching behaviors depends on the perceived legitimacy of the leader, but not on his or her level of authority. Thus, team leader coaching may be useful in any of the situations we proposed. Future studies should seek to explore the potential role of team leader coaching across different configurations of core team characteristics, communications media, and cultural diversity.

Conclusion

We notice that studying virtual teams is the point of entry for many scholars to the study of teams. A simplifying lens through which these scholars can bridge to the broader teams literature may both enrich and streamline how 'virtual teamwork' researchers formulate research questions and hypotheses. Jarvenpaa and Leidner (1999) cautioned against calls for "an entirely new sociology of group communication and interaction behavior" (p. 812) to be applied to research that studies virtuality in the context of teams. We similarly believe that pursuing fundamentally new understandings of group and team processes strictly for application to virtual teams is not essential for this literature, at least at its current stage. Beliefs in the fundamental uniqueness of technology-mediated interaction in teams could ultimately be counterproductive if they serve to insulate the literature from established theory and research pertaining to face-to-face teams.

References

Alnuaimi, O. A., Robert, L. P., & Maruping, L. M. (2010). Team size, dispersion, and social loafing in technology-supported teams: A perspective on the theory of moral disengagement. *Journal of Management Information Systems*, *27*, 203–230.

Beersma, B., Hollenbeck, J. R., Conlon, D. E., Humphrey, S. E., Moon, H., & Ilgen, D. R. (2009). Cutthroat cooperation: The effects of team role decisions on adaptation to alternative reward structures. *Organizational Behavior and Human Decision Processes*, *108*, 131–142.

Behfar, K. J., Peterson, R. S., Mannix, E. A., & Trochim, W. M. (2008). The critical role of conflict resolution in teams: A close look at the links between conflict type, conflict management strategies, and team outcomes. *Journal of Applied Psychology*, *93*, 170–188.

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

Burke, C. S., Salas, E., & Diaz, D. (2008). The role of team learning in facilitating team adaptation within complex environments: Tools and strategies. In V. I. Sessa & M. London (Eds.), *Work group learning: Understanding, improving & assessing how groups learn in organizations* (pp. 217–241). New York: Lawrence Erlbaum Associates.

Burns, T., & Stalker, G. . (1961). *The management of innovation*. New York: Oxford University Press.

Carson, J. B., Tesluk, P. E., & Marrone, J. A. (2007). Shared leadership in teams: An investigation of antecedent conditions and performance. *Academy of Management Journal*, *50*, 1217–1234.

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*, 239–290.

Connolly, T., Jessup, L. M., & Valacich, J. S. (1990). Effects of anonymity and evaluative tone on idea generation in computer-mediated groups. *Management Science*, *36*, 689–703.

Cramton, C. D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science*, *12*, 346–371.

Davison, R. B., Hollenbeck, J. R., Barnes, C. M., Sleesman, D. J., & Ilgen, D. R. (2012). Coordinated action in multiteam systems. *Journal of Applied Psychology*, *97*, 808–824.

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*, 741–749.

Driskell, J. E., Radtke, P. H., & Salas, E. (2003). Virtual teams: Effects of technological mediation on team performance. *Group Dynamics: Theory, Research, and Practice*, *7*, 297–323.

Edmondson, A. C. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, *44*, 350–383.

Fiol, M., & O'Conner, E. J. (2005). Identification in face-to-face, hybrid, and pure virtual teams: Untangling the contradictions. *Organization Science*, *16*, 19–32.

Gajendran, R. S., Harrison, D. A., & Delaney-Klinger, K. (in press). Are telecommuters remotely good citizens? Unpacking telecommuniting's effects on performance via i-deals and job resources. *Personnel Psychology*.

Gajendran, R. S., & Joshi, A. (2012). Innovation in globally distributed teams: The role of LMX, communication frequency, and member influence on team decisions. *Journal of Applied Psychology*, *97*, 1252-1261.

Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly*, *51*, 451–495.

Gibson, C. B., Huang, L., Kirkman, B. L., & Shapiro, D. K. (2014). Where global and virtual meet: The value of examining the intersection of these elements in twenty-first century teams. *Annual Review of Organizational Psychology and Organizational Behavior*, *1*, 217–244.

Ginnett, R. C. (1993). Crews as groups: Their formation and their leadership. In E. K. Wiener, B. G. Kanki, & R. L. Helmreich (Eds.), *Cockpit resource management* (pp. 71–98). New York: Academic Press.

Griffith, T. L., Sawyer, J. E., & Neale, M. A. (2003). Virtualness and knowledge in teams: Managing the love triangle of organizations, individuals, and information technology. *MIS Quarterly, 27*, 265–287.

Hackman, J. R., & Katz, N. (2010). Group behavior and performance. In S. T. Fiske, D. T. Gilbert, & G. Lindzey (Eds.), *Handbook of social psychology* (pp. 1208–1251). Hoboken, New Jersey: John Wiley & Sons, Inc.

Hedlund, J., Ilgen, D. R., & Hollenbeck, J. R. (1998). Decision accuracy in computer-mediated versus face-to-face decision-making teams. *Organizational Behavior and Human Decision Processes, 76*, 30–47.

Hertel, G., Geister, S., & Konradt, U. (2005). Managing virtual teams: A review of current empirical research. *Human Resource Management Review, 15*, 69–95.

Hoch, J. E., & Kozlowski, S. W. J. (2014). Leading virtual teams: Hierarchical leadership, structural supports, and shared team leadership. *Journal of Applied Psychology, 99*, 390–403.

Hoegl, M., & Gemuenden, H. G. (2001). Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. *Organization Science, 12*(4), 435–449.

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*, 82–106.

Hollenbeck, J. R., Ellis, A. P., Humphrey, S. E., Garza, A. S., & Ilgen, D. R. (2011). Asymmetry in structural adaptation: The differential impact of centralizing versus decentralizing team decision-making structures. *Organizational Behavior and Human Decision Processes, 114*, 64–74.

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*, 851–862.

Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science, 10*, 791–815.

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*, 741–763.

Kanawattanachai, P., & Yoo, Y. (2002). Dynamic nature of trust in virtual teams. *Journal of Strategic Information Systems, 11*, 187–213.

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

Kirkman, B. L., Rosen, B., Tesluk, P. E., & Gibson, C. B. (2004). The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal, 47*, 175–192.

Kozlowski, S. W. J., & Bell, B. S. (2008). Team learning, development, and adaptation. In V. I. Sessa & M. London (Eds.), *Group learning* (pp. 15–44). Mahwah, NJ: LEA.

Kozlowski, S. W. J., & Bell, B. S. (2013). Workgroup and teams in organizations. In N. W. Schmitt & S. Highhouse (Eds.), *Handbook of industrial and organizational psychology* (Vol. 12, pp. 412–469). Hoboken, New Jersey: John Wiley & Sons, Inc.

Kozlowski, S. W. J., Watola, D. J., Jensen, J. M., Kim, B. H., & Botero, I. C. (2009). Developing adaptive teams: A theory of dynamic team leadership. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations: Cross-disciplinary perspectives and approaches* (pp. 113–155). New York: Taylor & Francis Group.

Kruger, J., Epley, N., Parker, J., & Ng, Z. W. (2005). Egocentrism over email: Can we communicate as well as we think? *Journal of Personality and Social Psychology, 89*, 925–936.

Kurtzberg, T. R. (2014). *Virtual teams: Mastering communication and collaboration in the digital age*. Santa Barbara, CA: Praeger.

Lam, S. S. K., & Schaubroeck, J. (2000). Improving group decisions by better pooling information: A comparative advantage of group decision support systems. *Journal of Applied Psychology, 85*, 565–573.

Lee, S. M., Koopman, J., Hollenbeck, J. R., Wang, L. C., & Lanaj, K. (2015). The team descriptive index (TDI): A multidimensional scaling approach for team description. *Academy of Management Discoveries, 1*, 1–26.

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*, 1153–1167.

Lovelace, K., Shapiro, D. L., & Weingart, L. R. (2001). Maximizing cross-functional new product teams' innovativeness and constraint adherence: A conflict communications perspective. *Academy of Management Journal*, *44*, 779–793.

Lu, L., Yuan, Y. C., & McLeod, P. L. (2012). Twenty-five years of hidden profiles in group decision making: A meta-analysis. *Personality and Social Psychology Review*, *16*, 54–75.

Maier, N. R. (1950). The quality of group decisions as influenced by the discussion leader. *Human Relations*, *3*, 155–174.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review*, *26*, 356–376.

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*, 805–835.

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

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*, 410–476.

Meyerson, D. E., Weick, K. E., & Kramer, R. M. (1996). Swift trust and temporary groups. In *Trust in organizations: Fronteirs of theory and research* (pp. 66–195). Thousand Oaks, CA: Sage.

Miles, J., & Hollenbeck, J. R. (2014). Teams and technology. In M. Coovert & L. F. Thompson (Eds.), *Psychology of workplace technology* (Vol. 1999, pp. 99–117). New York: Routledge.

Mintzberg, H. (1979). *The structuring of organizations*. Englewood Cliffs, NJ: Prentice-Hall.

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*, 1251–1262.

Mortensen, M., & Hinds, P. J. (2001). Conflict and shared identity in geographically distributed teams. *International Journal of Conflict Management*, *12*, 212–238.

Orton, J. D., & Weick, K. E. (1990). Loosely coupled systems: A reconceptualization. *Academy of Management Review*, *15*, 203–223.

Pugh, D. S., Hickson, D. J., & Hinings, C. R. (1969). An empirical taxonomy of structures of work organizations. *Administrative Science Quarterly*, *14*, 115–126.

Rice, R. E., & Stohl, C. (2006). Communication and human factors. In G. Salvendy (Ed.), *Handbook of human factors and ergonomics* (pp. 150–176). New York: Wiley.

Salas, E., Rosen, M. A., Burke, C. S., & Goodwin, G. F. (2009). The wisdom of collectives in organizations: An update of the teamwork competencies. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations: Cross-disciplinary perspectives and approaches* (pp. 39–79). New York: Routledge.

Scott, C. P., & Wildman, J. L. (2015). Culture, communication, and conflict: A review of the global virtual team literature. In J. L. Wildman & R. L. Griffith (Eds.), *Leading global teams: Translating multidisciplinary science to practice* (pp. 13–32). New York: Springer.

Smith-Jentsch, K. A., Blickensderfer, E., Cannon-Bowers, J. A., & Salas, E. (1998). Helping team members help themselves: Propositions for facilitating team self-correction. In M. Beyerlein, D. Johnson, & S. Beyerlein (Eds.), *Advances in interdisciplinary studies of work teams* (pp. 55–72). Bigley, UK: Emerald Publishing.

Staples, D. S., & Zhao, L. (2006). The effects of cultural diversity in virtual teams versus face-to-face teams. *Group Decision and Negotiation*, *15*, 389–406.

Steiner, I. (1972). *Group process and productivity*. New York: Academic Press.

Tompkins, P. K. (1962). An analysis of communication between headquarters and selected units of a national labor union. Unpublished doctoral dissertation, Purdue University.

Thompson, J. D. (1967). *Organizations in action*. New York: McGraw-Hill.

Thompson, L. F., & Coovert, M. D. (2002). Stepping up to the challenge: A critical examination of face-to-face and computer-mediated team decision making. *Group Dynamics: Theory, Research, and Practice*, *6*, 52–64.

Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *Academy of Management Executive*, *12*, 17–29.

Tyler, T. R. (2006). Psychological perspectives on legitimacy and legitimation. *Annual Review of Psychology*, *57*, 375–400.

Van de Ven, A. H., & Chu, Y. (1989). A psychometric assessment of the Minnesota innovation survey. In *Research on the management of innovation: The Minnesota studies* (pp. 55–103). New York: Harper & Row.

Wang, D., Waldman, D. A., & Zhang, Z. (2014). A meta-analysis of shared leadership and team effectiveness. *Journal of Applied Psychology*, *99*, 181–198.

Warkentin, M. E., Sayeed, L., & Hightower, R. (1997). Virtual teams versus face-to-face teams: An exploratory study of a web-based conference system. *Decision Sciences*, *28*, 975–996.

Weick, K. E. (1976). Educational organizations as loosely coupled systems. *Administrative Science Quarterly*, *21*, 1–19.

Wickram, K. R., & Walther, J. B. (2007). Perceived behaviors of assigned and emergent leaders in virtual groups. *International Journal of E-Collaboration*, *3*, 1–17.

Wiesenfeld, B. M., Raghuram, S., & Garud, R. (2001). Organizational identification among virtual workers: The role of need for affiliation and perceived work-based social support. *Journal of Management*, *27*, 213–229.

Woodward, J. (1965). *Industrial organization: Theory and practice*. Oxford: Oxford University Press.

Table 1
Theoretical and Empirical Research on Virtuality and Team Outcomes

	Theoretical Arguments	Empirical Findings
Team Efficiency	Virtual teams performing less complex tasks will be more efficient in information management and collaborations (Bell & Kozlowski, 2002). Availability of virtual tools will enable teams to complete work more efficiently (Kirkman & Mathieu, 2005).	Information flows were unevenly distributed and differences in salience amongst members, which disrupted collaboration (Cramton, 2001).
Team Innovation	Dynamic team structures and diverse expertise in virtual teams can enable innovation-related capabilities that are central to (Gibson & Gibbs, 2006).	Dimensions of virtuality are negatively relate to innovation (Gibson & Gibbs, 2006). Team-level member influence is positively related to team innovation processes (Gajendran & Joshi, 2012).
Team Learning & Adaptation	Teams higher on virtuality tend to rely on explicit knowledge, and are less likely to acquire tacit knowledge from their teammates (Griffith et al., 2003).	Differences in speed of access to information restricted the sharing of mutual knowledge in geographically dispersed teams (Cramton, 2001).
Member Satisfaction	Geographically dispersed members had difficulty gathering and remembering contextual information about other members (Cramton, 2001). This was an obstacle to team social cohesion (see also Driskell et al., 2003)	Virtual teams that were culturally heterogeneous were less satisfied and cohesive, had more conflict than homogeneous teams (Staples & Zhao, 2006). Virtual teams members reported lower levels of satisfaction, relative to face to face teams (Warkentin et al., 1997).
Member Identification	Virtual teams require greater members identification with the team because of their unique needs to reduce uncertainty (Fiol & O'Conner, 2005).	Shared team identity is associated with less task and affective conflict in virtual teams (Mortensen & Hinds, 2001).

Table 2

Effects of Virtuality and Core Characteristics on Team Outcomes

Core Characteristic	Team Efficiency	Team Performance	Team Learning & Adaptation	Member Satisfaction	Member Identification
Skill Differentiation	Negative	Negative	Negative	Negative	Negative
Temporal Stability	Positive	Positive	Positive	Positive	Positive
Authority Differentiation	Positive	Mixed	Negative	Mixed	Negative