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RELATIONAL COORDINATION
RESEARCH COLLABORATIVE

Relational Coordination:
Guidelines for Theory, Measurement and Analysis

Jody Hoffer Gittell
Director, Relational Coordination Research Collaborative
Professor, Heller School, Brandeis University
jgittell@brandeis.edu

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New section: "Changes in the RC Survey" in Chapter 3 Measuring Relational Coordination

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Relational Coordination:

Guidelines for Theory, Measurement and Analysis

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Chapter 1: What is Relational Coordination?

Relational coordination is an emerging theory for understanding the relational dynamics of coordinating work. Other theorists have argued for the importance of relationships for coordinating work, based on the argument that coordination is the management of task interdependence and is therefore a fundamentally relational process (Crowston and Kammerer, 1997; Bechky, 2006; Faraj and Sproull, 2000; Gittell, 2006; Weick and Roberts, 1994). According to the theory of relational coordination, coordination that occurs through frequent, high quality communication supported by relationships of shared goals, shared knowledge and mutual respect enables organizations to better achieve their desired outcomes. Specifically, "relational coordination is a mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration" (Gittell, 2002a: 301). According to this theory, three dimensions of relationships are integral to the process of coordination: shared knowledge, shared goals and mutual respect. Developed and tested in the context of air travel (Gittell, 2001; 2003), surgical care (Gittell, Fairfield, et al, 2000; Gittell, 2002b; Gittell, 2009), medical care (Gittell, Weinberg, Bennett and Miller, 2008), long term care (Gittell, Weinberg, Pfefferle and Bishop, 2008), care across the continuum (Weinberg, Lusenhop, Gittell and Kautz, 2007) and the criminal justice system (Bond and Gittell, 2010), relational coordination theory is expected to generalize to work processes in which multiple providers are engaged in carrying out highly interdependent tasks under conditions of uncertainty and time constraints. Exhibit 1 illustrates the multiple employees engaged in flight departures, and Exhibit 2 illustrates the multiple providers involved in a patient care process.

Exhibit 1: Flight Departures – A Coordination Challenge

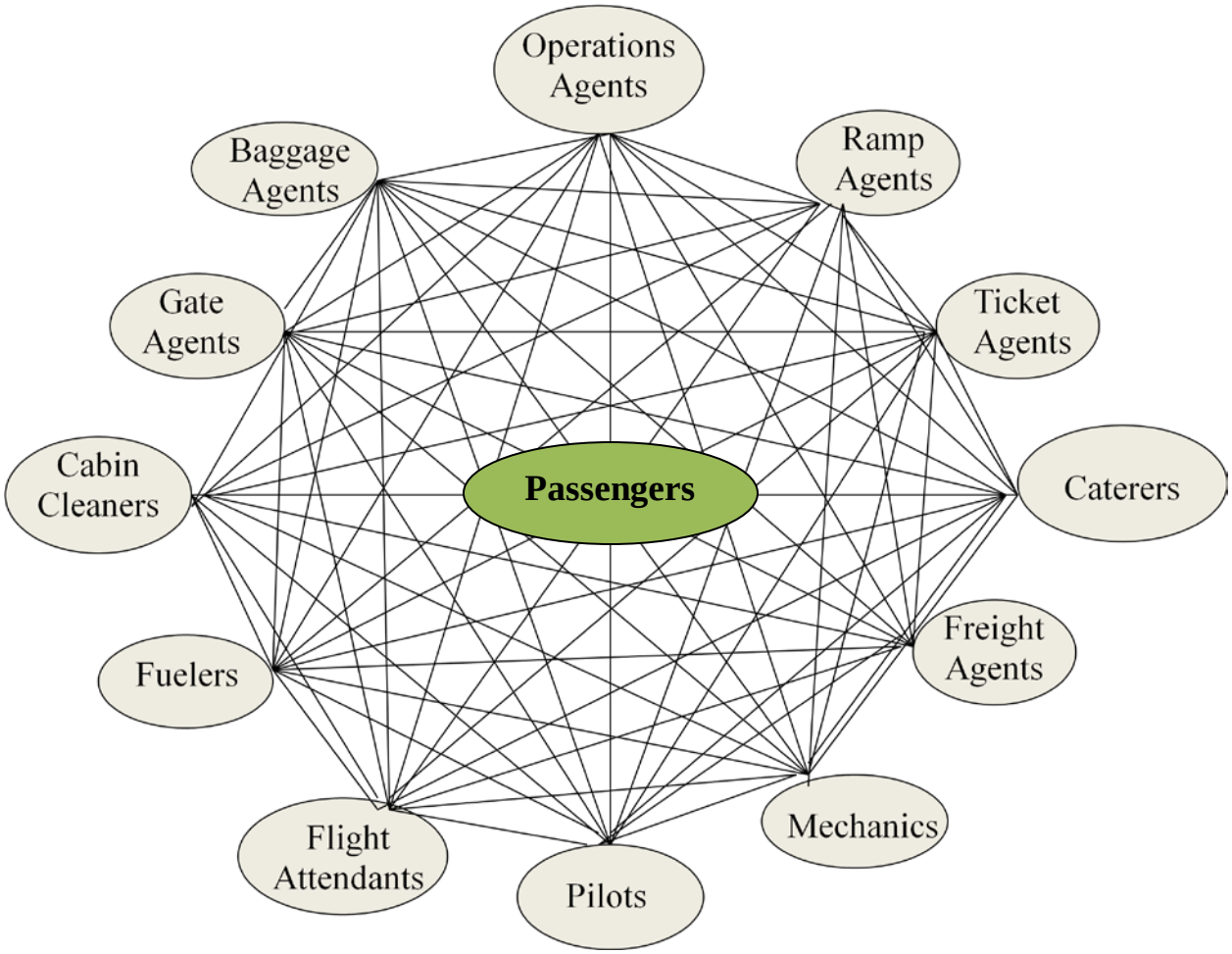
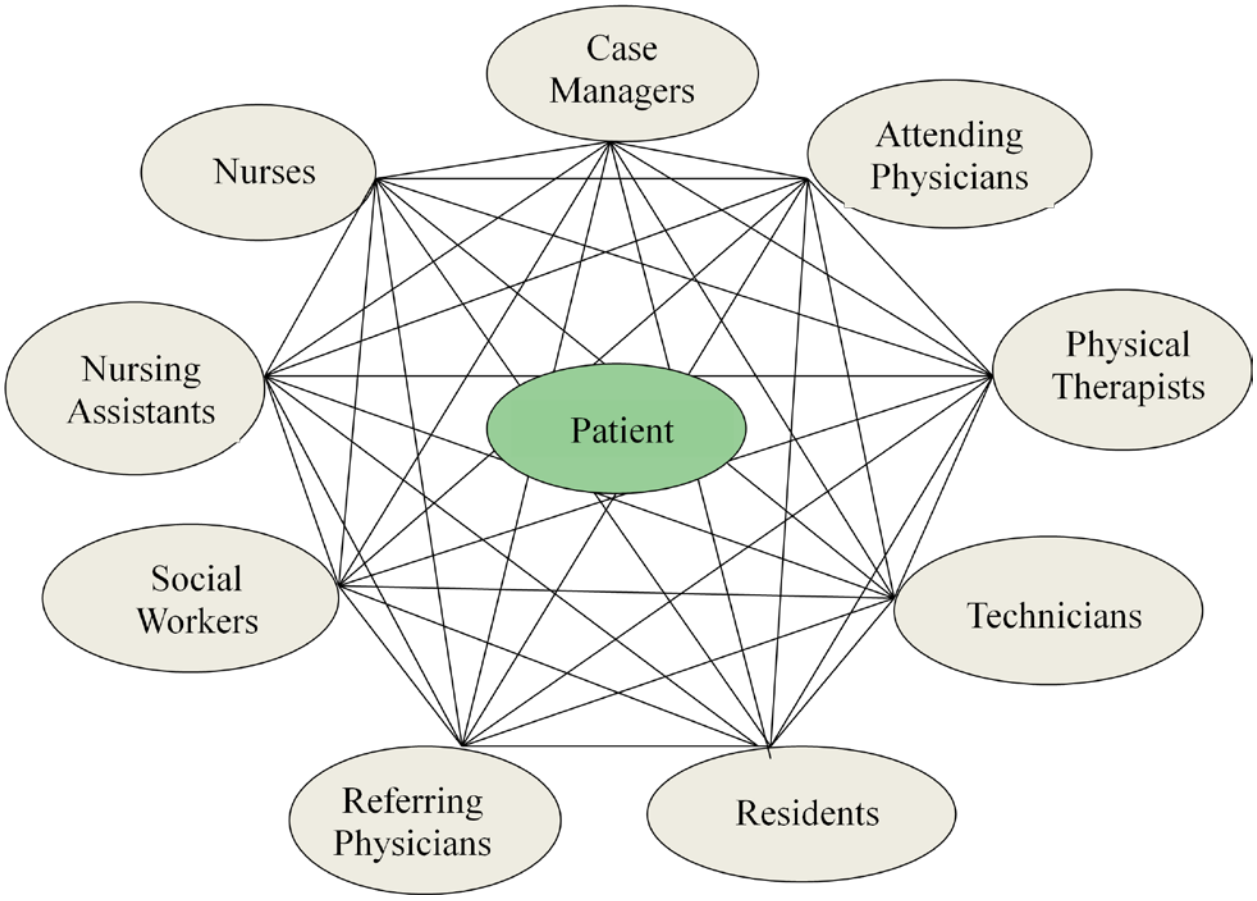
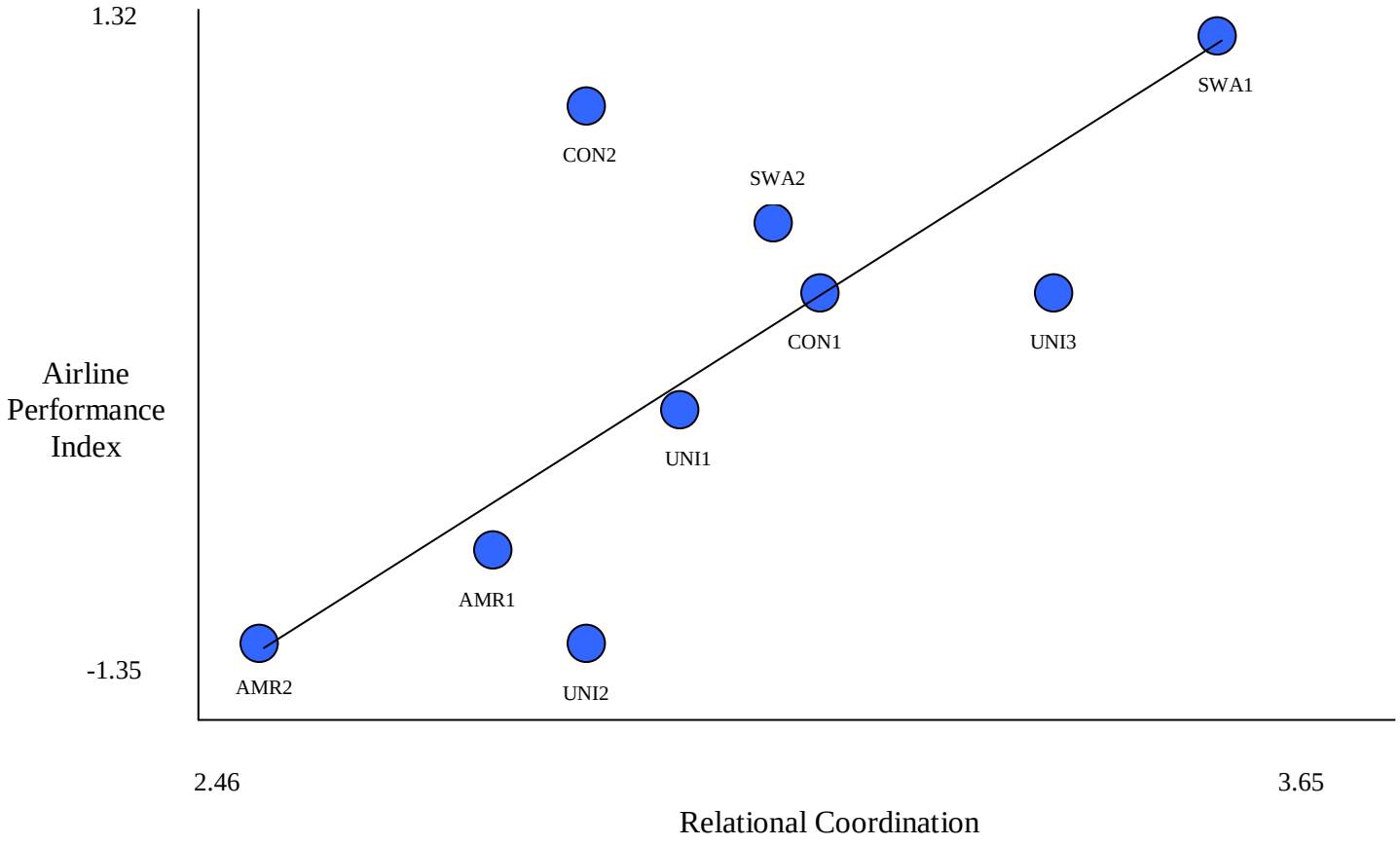


Exhibit 2: Patient Care – A Coordination Challenge



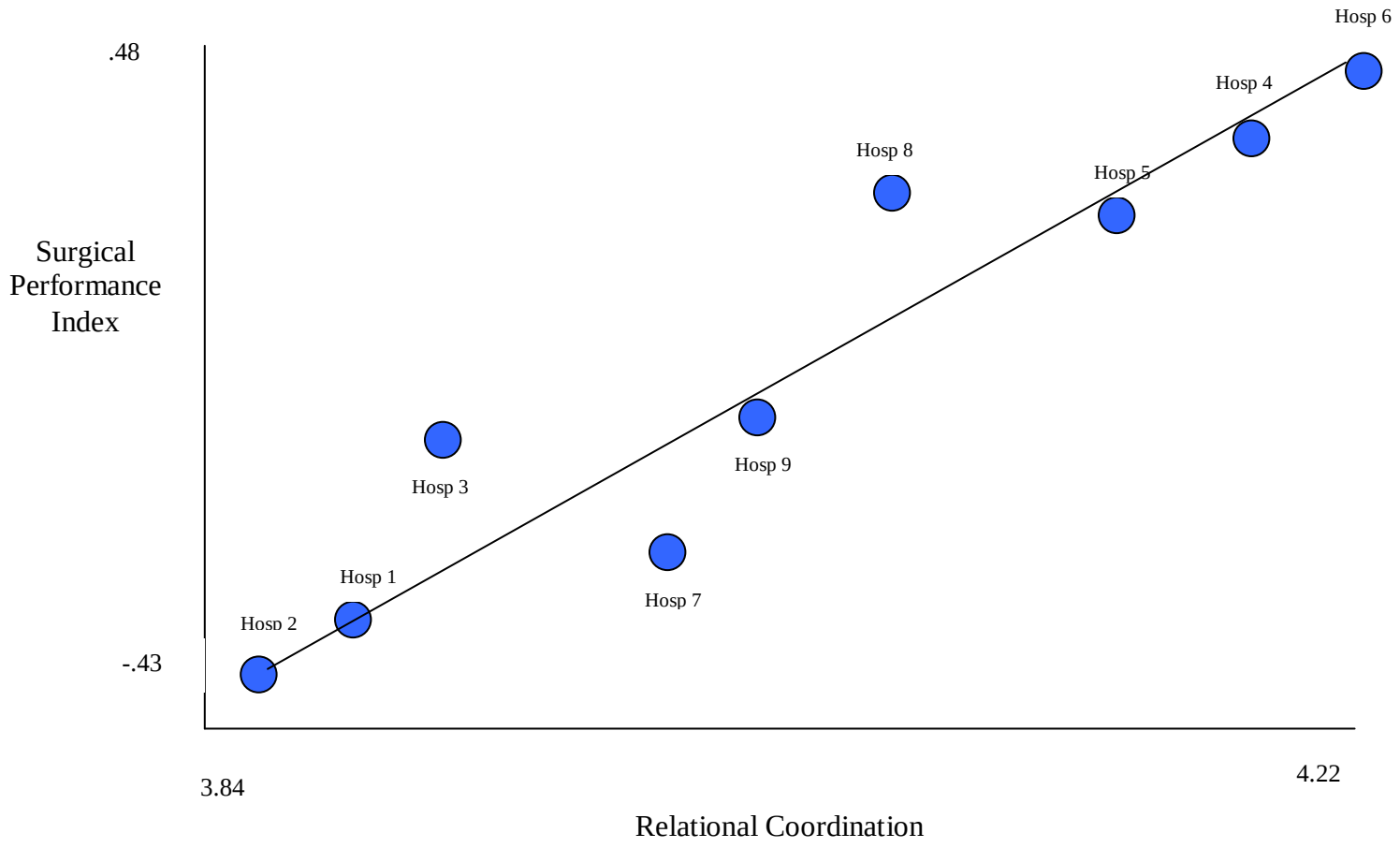
In many of the contexts where it has been explored, relational coordination appears to have a significant positive impact on key measures of performance, including both quality and efficiency. For example, Exhibits 3 and 4 summarize the impact of relational coordination on performance in the context of air travel, and in the context of surgical care. Performance effects of relational coordination will be explored later in this book, both the theoretical reasons underlying these performance effects, and the use of regression analyses to assess these performance effects.

Exhibit 3: Impact of Relational Coordination on Airline Performance[1]



[1] Each circle denotes one of the nine sites included in the study. Relational coordination, coordination carried out through relationships of shared goals, shared knowledge and mutual respect, is measured as the strength of cross-functional ties on a five-point scale, based on an employee survey. Airline performance is an index of quality: customer complaints, mishandled bags and late arrivals, as well as efficiency: gate time per departure and staff time per passenger. Each performance measure was adjusted for differences in product characteristics, and combined into a single performance index.

Exhibit 4: Impact of Relational Coordination on Surgical Performance[2]



[2] Each circle denotes one of the nine hospitals included in the study. Relational coordination, coordination carried out through relationships of shared goals, shared knowledge and mutual respect, is measured as the strength of cross-functional ties on a five-point scale, based on an employee survey. Surgical performance is an index of quality: patient satisfaction, post-operative freedom from pain and post-operative functioning, as well as efficiency: number of inpatient days in the hospital. Each performance measure was adjusted for differences in patient and hospital characteristics, and combined into a single performance index.

The dimensions of relational coordination were discovered through inductive field research, and have been validated through several subsequent studies. There are seven dimensions, including frequent, timely, accurate, problem-solving communication, and relationships of shared goals, shared knowledge and mutual respect. Exhibit 5 shows the basic survey items that have been used to measure relational coordination, while specific survey instruments are provided in the Appendix.

Exhibit 5: Sample Items for Measuring Relational Coordination

(For validated survey items, see surveys in the Appendices.)

Frequent Communication	How **frequently** do people in each of these groups communicate with you about [focal work process or client population]?
Timely Communication	Do people in these groups communicate with you in a **timely** way about [focal work process or client population]?
Accurate Communication	Do people in these groups communicate with you **accurately** about [focal work process or client population]?
Problem Solving Communication	When a problem occurs with [focal work process or client population], do the people in these groups blame others or work with you to **solve the problem**?
Shared Goals	Do people in these groups **share your goals** regarding [focal work process or client population]?
Shared Knowledge	Do people in each of these groups **know** about the work you do with [focal work process or client population]?
Mutual Respect	Do people in these groups **respect** the work you do with [focal work process or client population]?

Exhibit 6 provides a sample, in reverse chronological order, of the broad array of work that has contributed over the years to the study of relational coordination. This work spans across multiple literatures including organizational theory, social psychology, information technology, strategy, marketing, and health services research.

Exhibit 6: Sample of Work Contributing to the Study of Relational Coordination

(For a more recent and comprehensive listing, please see Relational Coordination Research Collaborative website, under Resources/Publications, and under Research Projects.)

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In this manual, I first summarize the theory of relational coordination – the communication and relationship dimensions that comprise it, the organizational practices that

support its development, its impact on performance, and the conditions that are expected to strengthen its impact on performance. I then review the methods and survey instruments for measuring relational coordination, providing several alternative instruments for measuring it in different work settings, either at the level of an overall work process or at the level of individual clients. Finally, I describe how to analyze relational coordination and how it works in a particular organization or industry, for example exploring its weak and strong links, how it influences critical aspects of performance, and identifying the organizational practices that support or undermine its development.

Chapter 2: The Theory of Relational Coordination

In James D. Thompson's seminal work on organizations in 1967, he argued that effective coordination in highly interdependent task settings is characterized by "mutual adjustment" among participants, as outcomes from one task feed back and create new information for participants performing related tasks (Thompson, 1967). However, Thompson saw mutual adjustment as playing a limited role in organizations. Because mutual adjustment is prohibitively costly, Thompson argued, coordination more commonly occurs through coordinating mechanisms such as supervision, routines, scheduling, pre-planning or standardization (Kogut and Zander, 1996). These coordinating mechanisms can enable organizations to achieve coordination with less direct interaction among participants. But due to their limited information processing capacity, these programmed coordinating mechanisms are only expected to be effective in settings with low levels of task interdependence and uncertainty (Galbraith, 1972; Van de Ven, Delbecq and Koenig, 1976; Tushman and Nadler, 1978; Argote, 1982).

Since Thompson's time, the nature of work has changed. Work is characterized by higher and higher levels of interdependence and uncertainty, expanding the relevance of mutual adjustment beyond what Thompson originally foresaw. As a result, organizational scholars have begun to see coordination as a fundamentally relational process. They have developed relational approaches to coordination that build on the concept of mutual adjustment, including Karl Weick and colleagues' concept of sense-making (Weick, 1993; Weick and Roberts, 1994), Samer Faraj and colleagues' concept of expertise coordination (Faraj and Sproull, 2000; Faraj and Xiao, 2006), Linda Argote and colleagues' concept of transactive memory (Liang, Moreland, Argote, 1995), Ryan Quinn and Jane Dutton's concept of coordination as energy-in-conversation (Quinn

and Dutton, 2005) and Charles Heckscher and colleagues' concept of collaborative community (Heckscher, 1994; Heckscher and Adler, 2007; Heckscher, et al, 2009).

In the context of this larger body of work, the theory of relational coordination offers a unique way to conceptualize the relational dynamics of coordination. Relational coordination is defined as "a mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration" (Gittell, 2002b: 301). The theory of relational coordination differs from these other theories by proposing three specific dimensions of relationships that are needed for effective coordination. While many of the more recent theories emphasize the importance of shared knowledge or shared understandings, the theory of relational coordination argues that shared knowledge or shared understandings are necessary but not sufficient. If effective coordination is to occur, participants must also be connected by relationships of shared goals and mutual respect. Together these three relational dimensions form the basis for coordinated collective action (Gittell, 2006).

Relational coordination differs in another fundamental way from other relationship-based approaches to coordination – in particular, relational coordination focuses on relationships *between roles* rather than on relationships *between unique individuals*. Relational coordination is not the first approach to focus on coordination between roles. James D. Thompson's (1967) seminal work also focused on role-based coordination, as does Beth Bechky's (2006) recent work. A focus on role-based relationships more generally is found in Deb Meyerson and colleagues' (1996) work on swift trust and in Klein and colleagues' (2006) recent work on de-individualization.

Why focus on role-based coordination? Role-based coordination has a practical advantage over coordination that is based on personal ties. In an organization or work process

that is characterized by high levels of relational coordination, employees are connected by relationships of shared goals, shared knowledge and mutual respect regardless of whether or not they have strong personal ties. This feature allows for the interchangeability of employees, allowing employees to come and go without missing a beat, an important consideration for organizations that strive to achieve high levels of performance while allowing employees the scheduling flexibility to meet their outside commitments. While role-based coordination may require greater organizational investments to foster than personal friendship ties – for example designing cross-functional boundary spanner roles and cross-functional performance measurement systems versus hosting after-work parties – role-based coordination is also more robust to staffing changes that occur over time.[i]

To summarize, the theory of relational coordination is unique in identifying specific dimensions of relationships that are integral to the coordination of work, in particular going beyond shared knowledge to include shared goals and mutual respect, while focusing on the development of these relationships between roles rather than between unique individuals. The following sections describe both the communication and the relationship dimensions of relational coordination, then describe the ways in which these dimensions mutually reinforce one another.

Communication Dimensions of Relational Coordination

Frequent communication. Organization design and group theorists have explored the characteristics of communication that is carried out for the purpose of coordinating work.[ii] In much of this work, the frequency of communication between participants has played a central role. But the role of communication is not merely informational. Frequent communication helps to build relationships through the familiarity that grows from repeated interaction. Indeed, in network theory, strong ties are defined primarily and sometimes solely in terms of frequency.[iii]

By contrast, some argue that high quality connections can exist independent of the frequency of communication.[iv] While recognizing the importance of frequent communication for coordinating highly interdependent work, relational coordination encompasses far more than simply the frequency of communication.

Timely communication. Communication can be frequent and still be of poor quality. For one thing, it can lack timeliness. In coordinating highly interdependent work, timing can be critical. Delayed communication may result in errors or delays, with negative implications for organizational outcomes. Though timely communication has not been widely recognized as essential to the coordination of highly interdependent work, research by Wanda Orlikowski and Joanne Yates, as well as more recent research by Mary Waller, supports the importance of timely communication for successful task performance.[v]

Accurate communication. The effective coordination of work depends not only on frequent and timely communication, but also on accurate communication. If updates are received frequently and in a timely way but the information is inaccurate, either an error will occur, or instead a delay will occur as participants halt the process to seek more accurate information. Consistent with this reasoning, Charles O'Reilly and Karlene Roberts showed that accurate communication plays a critical role in task group effectiveness. The accuracy of communication can also have implications for trustworthiness and therefore affect the likelihood of knowledge seeking, as suggested recently by Daniel Levin and Rob Cross.[vi]

Problem solving communication. Task interdependencies often result in problems that require joint problem solving. Hence, effective coordination requires that participants engage in problem solving communication. But the more common response to interdependence is conflict as well as blaming and the avoidance of blame. As J. Edward Deming predicted in his work on

Total Quality Management, the resort to blaming rather than problem solving reduces opportunities to solve problems, with negative consequences for performance. William Stevenson and colleagues, as well as Saul Rubinstein, have explored more deeply the role that problem solving communication plays in the coordination of highly interdependent work.[vii]

Relationship Dimensions of Relational Coordination

But communication does not occur in a vacuum. Participants' ability to effectively coordinate their work is also influenced by the quality of their relationships, particularly the extent of shared goals, shared knowledge and mutual respect.

Shared goals. Effective coordination depends upon participants having a high level of shared goals for the work process in which they are engaged. With a set of shared goals for the work process, participants have a powerful bond and can more easily come to compatible conclusions about how to respond as new information becomes available. However, shared goals are often lacking among participants who work in different functional areas. In their classic work on organizations, James March and Herbert Simon described the negative outcomes that occur when participants pursue their own functional goals without reference to the superordinate goals of the work process in which they are engaged. Theorists such as Richard Saavedra and colleagues, and Ruth Wageman more recently, have identified shared goals as playing an important role in the coordination of highly interdependent work.[viii]

Shared knowledge. Furthermore, effective coordination depends upon participants having a high degree of shared knowledge regarding each other's tasks. When participants know how their tasks fit together with the tasks of others in the same work process, they have a context for knowing who will be impacted by any given change and therefore for knowing who needs to know what, and with what urgency. But shared knowledge is often lacking. Consistent with

sociological theories, Deborah Dougherty showed that participants from different functional backgrounds often reside in different "thought worlds" due to differences in their training, socialization and expertise. She showed that these thought worlds create obstacles to effective communication and therefore undermine the effective coordination of work. Karl Weick's "sense-making" theory suggests that collective mind, or shared understanding of the work process by those who are participants in it, can connect participants from these distinct thought worlds and thereby enhance coordination.[ix]

Mutual respect. Finally, effective coordination depends upon participants having respect for other participants in the same work process. Disrespect is one of the potential sources of division among those who play different roles in a given work process. Occupational identity serves as a source of pride, as well as a source of invidious comparison. Members of distinct occupational communities often have different status and may bolster their own status by actively cultivating disrespect for the work performed by others, as illustrated by John Van Maanen and Stephen Barley. When members of these distinct occupational communities are engaged in a common work process, the potential for these divisive relationships to undermine coordination is apparent. By contrast, respect for the competence of others creates a powerful bond, and is integral to the effective coordination of highly interdependent work.[x]

How the Dimensions of Relational Coordination Reinforce One Another

To summarize, the theory of relational coordination states that the coordination of work is most effectively carried out through frequent, high quality communication and through high quality relationships among participants. Furthermore, the theory of relational coordination argues that relationships of shared goals, shared knowledge and mutual respect *support* frequent, high quality communication and vice versa – and that these dimensions work together to enable

participants to effectively coordinate their work. Scholars in the field of communication have found that relationships influence the frequency and quality of communication, and that the frequency and quality of communication in turn influence the quality of relationships. For example, communications scholar Theodore Newcomb argued that frequent, high quality communication is rewarding for those who engage in it and thus develops the basis for trusting and respectful relations. Others, like Albert Rubenstein and his colleagues, have argued for the reverse causal path, namely that strong group member relations form the basis for effective communication. This mutual influence between communication and relationships lies at the heart of relational coordination.[xi]

Shared goals motivate participants to move beyond sub-goal optimization and to act with regard for the overall work process. Shared knowledge informs participants of how their own tasks and the tasks of others contribute to the overall work process, enabling them to act with regard for the overall work process. Respect for the work of others encourages participants to value the contributions of others and to consider the impact of their actions on others, further reinforcing the inclination to act with regard for the overall work process. This web of relationships reinforces, and is reinforced by, the frequency, timeliness, accuracy and problem-solving nature of communication, enabling participants to effectively coordinate the work processes in which they are engaged.

Low quality relationships have the opposite effect, undermining communication and hindering participants' ability to effectively coordinate their work. For example, when participants do not respect or feel respected by others who are engaged in the same work process, they tend to avoid communication, and even eye contact, with each other. Participants who do not share a set of superordinate goals for the work process are more likely to engage in blaming

rather than problem solving with each other when problems occur. Finally, participants who are not connected to each other through shared knowledge of the work process are less able to engage in timely communication with each other – they do not understand what others are doing well enough to anticipate the urgency of communicating particular information to them.

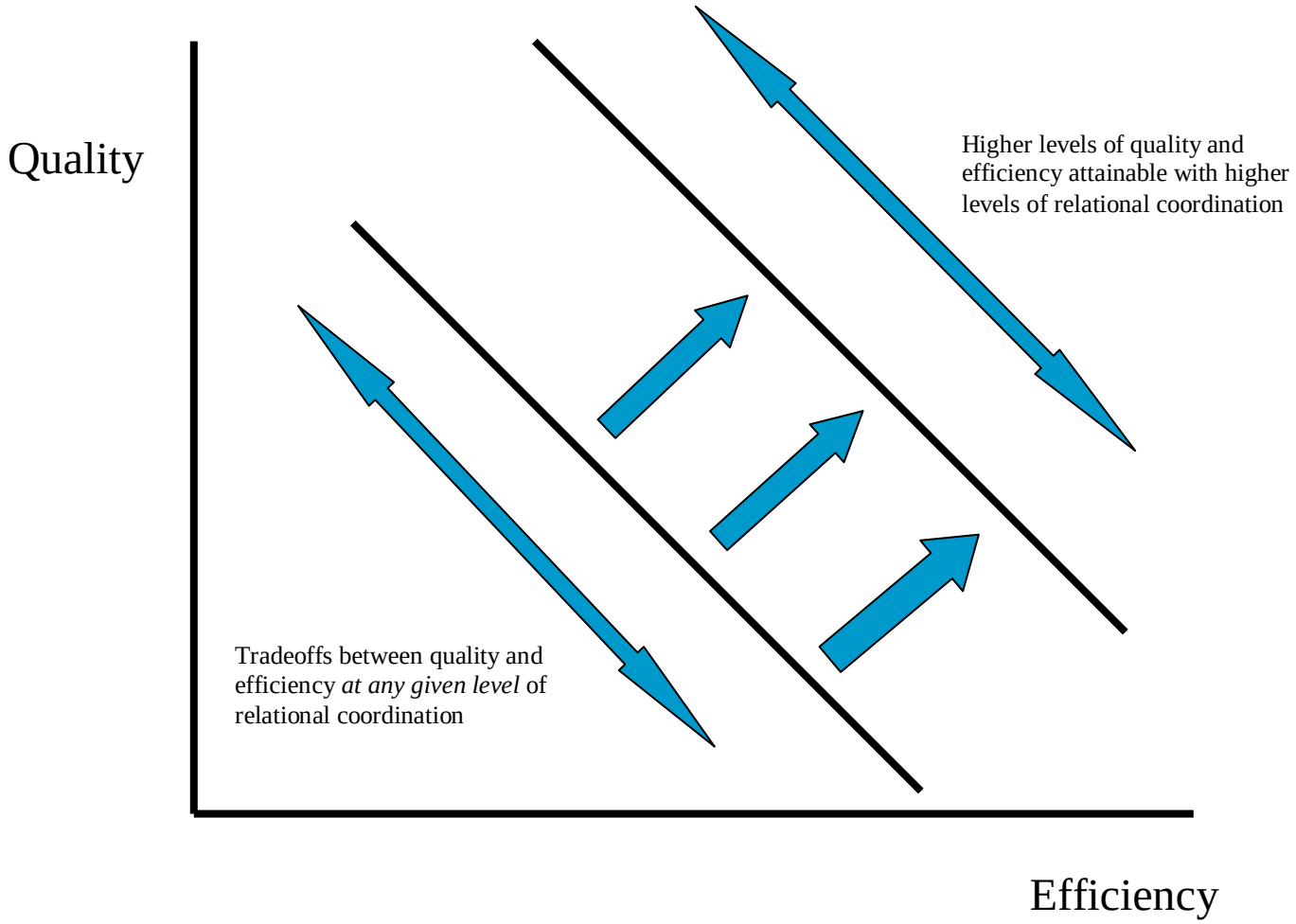
See Exhibit 7 for a portrayal of the mutual reinforcement that is expected to occur between the communication and relationship dimensions of relational coordination, illustrating how this mutual reinforcement can occur in either a positive or negative direction.

Exhibit 7: Mutual Reinforcement between Dimensions of Relational Coordination

Expected Performance Effects of Relational Coordination

Any production process can be understood in terms of a production possibilities frontier, representing the optimal outcomes that can be achieved at different levels of quality and efficiency. On a given production possibilities frontier, quality and efficiency are in opposition to each other, such that one must be "traded off" in order to improve the other. By increasing inputs per output, the quality of the outputs can be improved, but at the expense of efficiency. Conversely, by decreasing inputs per output, efficiency can be improved, but often at the expense of quality. This tradeoff is illustrated in Exhibit 8.[xii]

Exhibit 8: Impact of Relational Coordination on Production Possibilities Frontier



The production possibilities frontier can potentially be shifted out to a more favorable position with the introduction of a new technology or fundamental process improvement. Total quality management and continuous quality improvement have both focused on achieving fundamental process improvements that enable the simultaneous achievement of both higher quality and greater efficiency, as outlined by James Womack, Daniel Jones and Daniel Roos in their analysis of the auto industry and its transformation by Toyota. The underlying argument, which quality guru Joseph Juran labeled the "cost of quality," or more accurately, the cost of poor quality, is that work processes that generate poor quality also tend to be inefficient, and that the same process improvements that lead to better quality outcomes often waste fewer resources as well.[xiii]

Relational coordination is an example of a fundamental process improvement that enables a work group, department or organization to shift out its production possibilities frontier to a more favorable position, achieving higher levels of quality while simultaneously achieving greater efficiencies. More specifically, relational coordination improves a work process by improving the quality of work relationships between people who perform different functions in that work process, thus leading to higher quality communication. Task interdependencies are therefore managed in a more seamless way, with fewer redundancies, lapses, errors and delays.

Relational coordination enables employees to more effectively coordinate their work with each other, thus pushing out the production possibilities frontier to achieve higher quality outcomes while using resources more efficiently – for example, enabling hospital workers to achieve higher patient-perceived quality of care along with shorter patient lengths of stay. Relational coordination is therefore particularly relevant in industries that must maintain or improve quality outcomes while responding to cost pressures. In an increasingly competitive

economy, nearly all industries are likely to face this dual challenge. Thus far, the performance effects of relational coordination have been documented in the airline industry, in the hospital industry, and in the nursing home industry.[xiv]

But the achievement of relational coordination depends on the adoption of a set of organizational practices that support its development. As discovered in the context of flight departures:

> "Lean resources in the form of less ground time and leaner staffing could inspire teamwork across functional groups to 'get the job done,' or the added stress could simply engender unproductive conflict and a deterioration of service. Other research suggests that Southwest [Airlines] has developed a set of organizational practices that build cohesion and common goals across groups, allowing the stress to be used in a productive way."[xv]

This finding raises a new question: which organizational practices tend to support the development of relational coordination and which ones tend to hinder its development?

Organizational Practices that Support Relational Coordination

As theorized in Gittell's "Organizing Work to Support Relational Coordination" (2000), organizational practices are expected to influence the level of relational coordination observed among participants in a work process. These practices include coordinating mechanisms that govern the flow of information in organizations, both programmed (information systems and standardized routines) and non-programmed (boundary spanners and team meetings). The effects of these coordinating mechanisms on relational coordination are explored in Gittell's "Coordinating Mechanisms in Care Providers Groups" (2002) and in Gittell and Weiss' "Coordination Networks Within and Between Organizations" (2004).[xvi] These coordinating

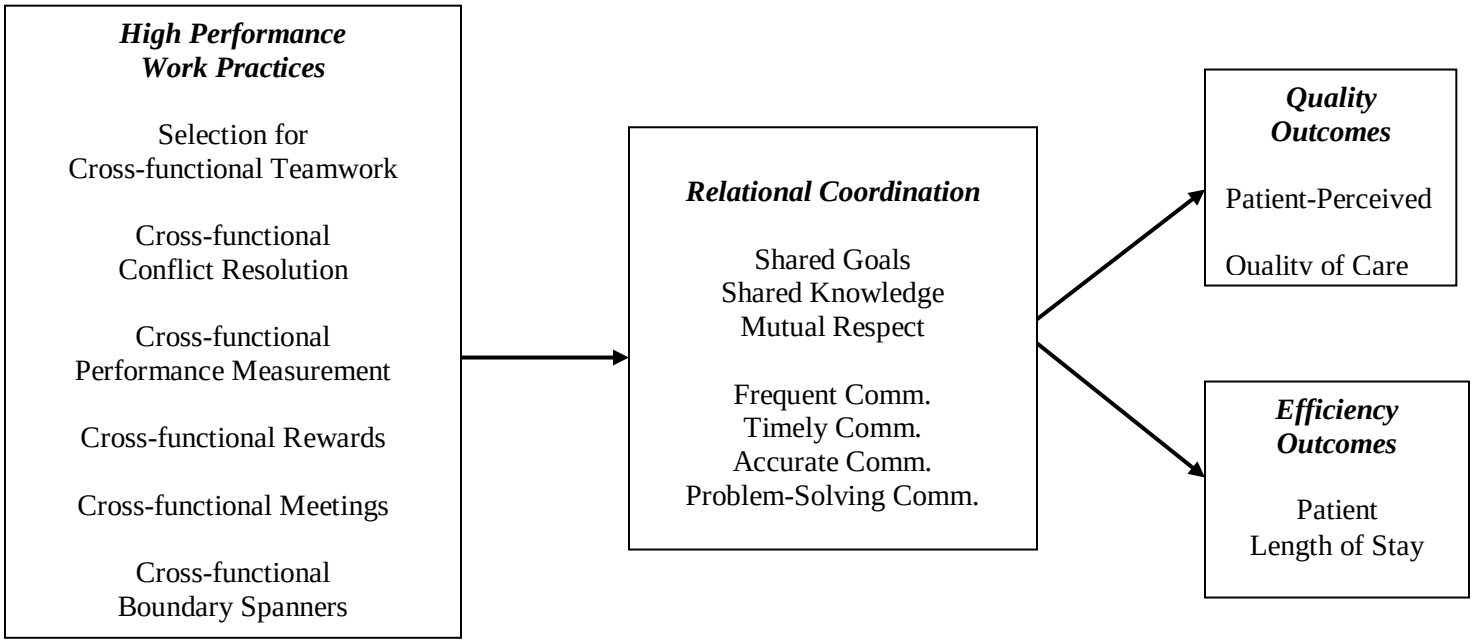
mechanisms strengthen relational coordination and thereby improve quality and efficiency performance.

Relational coordination is also influenced by the design of human resource practices. "Organizing Work to Support Relational Coordination" (2000) also explores how human resource practices can support or undermine relational coordination, depending on how they are designed. Some traditionally designed human resource practices tend to divide workers in different functions, and fail to support the development of relational coordination between them. Human resource practices can however be designed in such a way as to foster cross-functional relationships, thus supporting the development of relational coordination, and leading to improved performance outcomes. Thus far, the expected effects of supervision, performance measurement, conflict resolution, job design, and hiring practices have been explored in a number of publications including: "Paradox of Coordination and Control" (2000), "Supervisory Span, Relational Coordination and the Flight Departure Process" (2001), "A Relational Approach to Job Design and the Coordination of Work" (2008), and in *The Southwest Airlines Way: Using the Power of Relationships to Achieve High Performance* (2003).[xvii]

"A Theory of Relational Coordination" (2003) explores how these different theoretical approaches to the design of coordinating mechanisms and human resource practices contrast with traditional organizational theories, and calls for a new approach to organization design. "A Relational Model of How High Performance Work Systems Work" (2010) argues further that these organizational practices can be *combined* to form a high performance work system that differs from a traditional high performance work system by its focus on fostering relational coordination among participants. In contrast to high performance work systems that foster the development of individual knowledge and skills, or individual motivation and commitment, this

new type of high performance work system fosters the development of relational coordination, leading to improved quality and efficiency performance for the organization. It is theorized specifically that the effects of high performance work systems on performance outcomes are mediated through their effects on relational coordination, as shown in Exhibit 9. The emergence of these unique high performance work systems and their variation across organizations in the healthcare industry is documented in great detail in *High Performance Healthcare: Using the Power of Relationships to Achieve Quality, Efficiency and Resilience* (2009).[xviii]

Exhibit 9: A Relational Model of How High Performance Work Systems Work



Contingent Effects of Relational Coordination

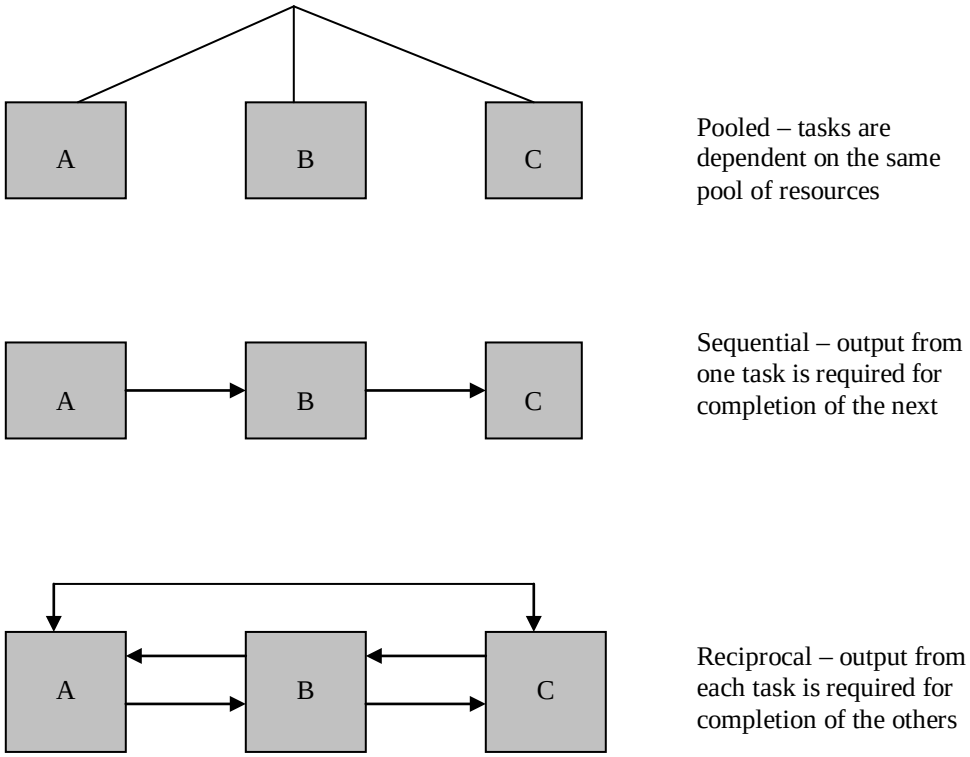
Relational coordination is a communication and relationship-intensive form of coordination that is expected to be particularly important for achieving high performance under high levels of task interdependence, uncertainty, and time constraints. Under these conditions, effective coordination is expected to be particularly dependent on the quality of communication and relationships that exist among participants. The following sections explain the theory behind these contingency arguments.

Task interdependence. Given that coordination is the management of task interdependence, as argued by coordination scholars Thomas Malone and Kevin Crowston, coordination is only relevant for work processes that are characterized by task interdependence. But there are different types of task interdependence. According to Thompson's classic typology, task interdependence can be pooled, sequential or reciprocal. See below in Exhibit 10 for an illustration of all three types of task interdependence. Pooled interdependence exists between tasks that are dependent on a common pool of resources, or between tasks that produce intermediate outputs that must then be "pooled together" to achieve the desired output. Sequential interdependence exists between any two tasks where one depends on completion of the previous one in order to be completed. Reciprocal interdependence exists between any two tasks where each depends on completion of the other in order to be completed. Reciprocal interdependence is considered to be the most challenging of these three forms, from a coordination standpoint. According to Thompson's theory reciprocal interdependence is the only type of interdependence that requires "mutual adjustment" in order to be effectively managed.[xix]

Relational coordination is a form of coordination that enables workers to "mutually adjust" in the sense intended by Thompson, enabling them to coordinate their work 'on the fly'.

Relational coordination is therefore expected to have a greater impact on the performance of work processes that have reciprocal task interdependencies, relative to those that have only pooled or sequential task interdependencies.

Exhibit 10: Three Types of Task Interdependence



Uncertainty. According to information processing theories of organization design as developed by scholars such as Jay Galbraith, Linda Argote and others, any form of uncertainty increases information-processing requirements, which increases the need for information processing capacity. Coordinating mechanisms have differing levels of information processing capacity. Programmed mechanisms such as protocols, routines and information systems have lower levels of information processing capacity and thus are expected to be less useful under conditions of uncertainty. Non-programmed or feedback mechanisms have higher levels of

information processing capacity and thus are expected to be more useful under conditions of uncertainty. The communication and relationship ties that comprise relational coordination generate a high level of information processing capability through relationship and communication connections among workers. Relational coordination is therefore expected to have a greater impact on the performance of work processes that are characterized by high levels of uncertainty, than for those that are characterized by low levels of uncertainty.[xx]

Time constraints. Time constraints exacerbate the effects of both task interdependence and uncertainty, leaving little slack in the system and placing a premium on responsiveness as illustrated by Paul Adler in the automobile industry.[xxi] Relational coordination is therefore expected to have a greater impact on the performance of work processes that are characterized by high levels of time constraints, relative to those with few time constraints.

Implications. Investments in relational coordination should therefore yield greater returns, the greater the levels of reciprocal task interdependence, uncertainty and time constraints in the target work process. This argument does not imply that relational coordination will not improve performance of work processes that have other forms of task interdependence, low levels of uncertainty or relatively weak time constraints, but rather that, other things equal, these performance effects will be smaller.

New Directions for Relational Coordination Theory

In sum, relational coordination theory starts by conceptualizing coordination as occurring through a network of relational and communication ties among participants in a work process, where a work process is a set of interdependent tasks that transforms inputs into outcomes of value to the organization. Second, this theory identifies three distinctive dimensions of relationships – shared goals, shared knowledge and mutual respect – that together are argued to

underlie the effective coordination of work. Third, these dimensions are conceived as existing between work roles rather than between individual participants. Fourth, the theory explains how relational forms of coordination influence quality and efficiency outcomes, and how this influence is weaker or stronger depending upon the nature of the work. Fifth and finally, the theory explains how formal organizational structures can be designed to support relational forms of coordination, rather than suggesting that formal structures are necessarily substitutes or impediments to relational coordination.

Despite providing a unique perspective on coordination and despite promising results of empirical testing thus far as well as perceived usefulness to multiple practitioner communities, the theory of relational coordination remains at an early stage of development. In "New Directions for Relational Coordination Theory" (forthcoming), Gittell proposes five potential directions for its further development. The first proposed direction is to develop the social psychological foundations of relational coordination theory, placing it more firmly into the context of relational theory. The second is to extend relational coordination theory from its focus on role relationships to include personal relationships and to explore the interplay between them. Third is to broaden relational coordination networks beyond the core workers who have typically been considered, to include multiple other participants: so-called non-core workers who nevertheless play key supporting roles in the work process, the customer herself as a key participant in the work process, and participants outside the focal organization who are involved in the same supply chain. Fourth is to extend the theorized outcomes of relational coordination beyond outcomes for the organization and its customers to include outcomes for workers as well. The fifth proposed direction is to go beyond the linear model of organizational change implicit in relational coordination theory and to consider a more dynamic and iterative model of change.

Chapter 3: Measuring Relational Coordination

This section outlines methods for measuring relational coordination, including survey design, data collection, data entry and variable construction.

Who to Survey, About Whom and About What

Relational coordination is measured by surveying participants in a particular work process about their communication and relationships with other participants in that work process. Because coordination is the management of interdependencies between tasks, and because people are typically assigned to tasks through their roles, relational coordination is measured as coordination between roles rather than between unique individuals.

The first step in measuring relational coordination is to identify a work process that serves a client population of interest – the focal work process – then to identify the roles or functional groups that are involved in carrying out that focal work process. It is helpful to conduct informational interviews to identify all functional groups that are expected to impact the quality and efficiency outcomes of that focal work process. The set of functional groups involved in a patient care process, for example, may include *physicians, nurses, therapists, case managers* and *social workers*. These functional groups are listed in the relational coordination survey instrument below each of the seven relational coordination questions enabling the survey respondent to answer each of the questions about their coordination with members of each of these functional groups. See Appendices for samples of the relational coordination survey.

The next step is to identify which of these functional groups you will be able to survey. Perhaps you will have access to survey only a subset of the functional groups involved in the work process. Partial access is not unusual and is not insurmountable, so long as you sample the same subset of functional groups consistently throughout the study. If you are able to survey *all*

of the functional groups you have identified as being central to the work process, you will end up with a complete or symmetrical matrix of relational coordination ties as shown in Exhibit 11.

Exhibit 11: Symmetrical Matrix of Relational Coordination Ties

	Relational Coordination Reported With				
	Physicians	**Nurses**	**Physical Therapists**	**Case Managers**	**Social Workers**
Physicians	**3.82**	3.94	4.03	3.75	3.70
Nurses	3.81	**4.48**	4.27	4.03	3.92
Physical Therapists	3.85	4.25	**4.71**	4.06	3.94
Case Managers	3.83	4.36	4.43	**4.45**	4.37
Social Workers	3.93	4.01	4.03	4.17	**4.36**
All	3.85	4.21	4.29	4.09	4.06

Exhibit 12: Asymmetrical Matrix of Relational Coordination Ties

	Relational Coordination Reported With				
	Physicians	**Residents**	**Nurses**	**Therapists**	**Case Managers**
Nurses	3.77	3.93	**4.35**	3.86	4.05
Therapists	2.36	2.46	3.97	**4.28**	3.74
Case Managers	3.65	3.25	4.23	3.17	**4.52**
All	3.26	3.21	4.18	3.77	4.10

If you are able to survey only a subset of the functional groups involved in the work process, you will end up with an incomplete or asymmetrical matrix of relational coordination ties as shown above in Exhibit 12. In the case of an asymmetrical matrix, you can still learn a great deal about relational coordination – you can learn about relational coordination between the functional groups that were surveyed, about relational coordination between them and the functional groups that were not surveyed, and about relational coordination *within* the functional groups that were surveyed. But you cannot learn about relational coordination between any two functional groups that were not surveyed, or about coordination *within* any of the functional groups that were not surveyed. For example, in the asymmetrical matrix shown in Exhibit 12 we can see that coordination with physicians and residents is consistently weaker than coordination with nurses, therapists, social workers and case managers. We can also see that participants tend

to have stronger relational coordination with those in the same functional group than with those in other functional groups. But we cannot assess coordination *among physicians*, *among residents*, or *between physicians and residents*.

The bottom line is as follows. If there are two functional groups between which you have reason to believe coordination is essential (due to task interdependence between them), you need to have access to at least one of those groups in order to assess that coordination. If there is a functional group for which you believe *within-function* coordination may be essential, you need to have access to members of that functional group in order to assess their within-function coordination.

Survey Items

The relational coordination measures shown above are aggregated from seven survey questions including four questions about communication (frequency, timeliness, accuracy, problem-solving) and three questions about relationships (shared goals, shared knowledge, mutual respect). Respondents from each of the functions believed to be most central to the focal work process are asked to answer each of the following questions with respect to each of the other functions, with responses recorded on a five-point Likert-type scale. For validated survey items and response categories, please see Appendices.

To lessen the problem of socially desirable responses to survey questions, the relational coordination survey asks respondents to report the behaviors of *others* as opposed to being asked to report their own behaviors. For example we ask: "Do people in these groups communicate with you in a timely way about [focal work process or client population]?" Due to social desirability bias, respondents are likely to overestimate the extent to which they communicate in a timely way with other employees, for example, but less likely to overestimate extent to which

other employees communicate with them in a timely way. In addition, relational coordination questions are asked to elicit respondents' perceptions of typical patterns rather than specific incidents. Finally, in order to reduce the problem of retrospective response error, the questions do not ask for retrospective reports; rather they ask respondents to describe current working conditions.[xxii]

Changes in the RC Survey

Several changes have occurred in the RC Survey over time, as its use has spread to many different work settings in multiple industries and multiple countries.

1) First, some of the survey questions themselves have changed, including:
    a. Accurate communication has been included as a dimension of relational coordination. This item has been included since the late 1990's, with results first published in Gittell, et al (2000). It became apparent when studying the healthcare context that accurate communication was as important (and challenging to achieve) as frequent, timely and problem-solving communication.
    b. A short form of the RC survey was created, with fewer items and fewer response categories. This shorter RC survey was created for the purpose of surveying certified nursing aides in nursing homes, given a lower education level than the previously survey populations, as well as the need to translate the survey into multiple languages. Results from this version of the survey were published in the Gittell, et al (2008) study of nursing homes. See Appendices for this survey.

c. The question on frequent communication was changed from "How frequently do you communicate with people in these groups about [focal work process]?" to "How frequently do people in these groups communicate with you about [focal work process]?" The rationale was simply that all other RC survey items ask the respondent to evaluate the behavior of the other groups, rather than to evaluate the respondent's own behavior, to minimize social desirability bias. This logic had not been applied to the frequency question initially, given that frequency is less value-laden than the other questions and thus likely to be less vulnerable to social desirability bias. But in 2010 the frequency question was altered simply to achieve consistency of perspective with the other RC survey items.

2) In addition, the RC survey has been translated into about ten different languages by now, a process that the newly formed Relational Coordination Research Collaborative is beginning to monitor for quality control and standardization.

3) Finally, the RC survey is now available in an online version through the Relational Coordination Research Collaborative, for greater ease of customizing the questions to the given work process, as well as ease of survey administration, data analysis an data reporting.

Unit of Observation and Unit of Analysis

The unit of observation for relational coordination is the individual participant in the work process, represented by the individual survey respondent. These individual respondents are then aggregated into a larger unit of analysis in order to construct a measure of relational coordination. That unit of analysis will depend on the hypothesis you are exploring. If you are

studying an intervention that is expected to improve relational coordination of a particular work process, and the performance of that work process, your unit of analysis will be different periods of time, i.e. before and after the intervention has been implemented. If you are doing a cross-sectional study in which multiple sites that independently carry out the same work process are expected to have different levels of relational coordination, which are expected to result in different level of performance, your unit of analysis will be the site.

Focal Work Process or Individual Client?

Instead of asking relational coordination survey questions about a focal work process and perhaps a focal client population served by that work process, as seen in Appendices A, B and C, the relational coordination survey questions can be asked instead about individual clients. See Appendix D for an example of this alternative survey. With this alternative approach, one can construct a measure of relational coordination that is specific to individual clients, which is useful in organizations where different practices or interventions are being used for different clients. In this case, questions are asked about specific clients, rather than asking for general perceptions of typical patterns. Questions are asked about the respondents' specific interactions with other functions regarding a particular client. This introduces a greater potential for retrospective response error. To minimize that response error, it is desirable to survey participants as soon as possible after they have interacted with a particular client. The other challenge arises if the same participants are involved in providing service to multiple clients, thus requiring them to complete numerous surveys for the same study, one about each individual client, rather than a single survey about general patterns of interaction. Numerous surveys sent to a given participant about individual clients may be completed, but response rates are more challenging to achieve given the greater burden on the study participants.

One study that measured relational coordination for individual clients was reported in a paper called "Is the Doctor In? A Relational Approach to Job Design and the Coordination of Work" (2008). This was a one-hospital study in which some patients were cared for by physicians with the traditional job design, while other patients were cared for by physicians with a new "hospitalist" job design. It was hypothesized that the new physician job design would result in higher levels of relational coordination between physicians and other members of the care provider team, thus resulting in better risk-adjusted patient outcomes including shorter lengths of stay, lower total costs, fewer readmissions and lower mortality. Measuring relational coordination for individual patients enabled the assessment of this new job design that had been adopted for some patients and not others.[xxiii]

Why the Network Approach to Measuring Relational Coordination?

Relational coordination is measured based on a matrix, or network, methodology, in which each cross-functional tie is measured separately. Wouldn't it be much simpler to ask respondents for a global assessment each of these seven relational coordination dimensions, rather than creating a measure of relational coordination based on a matrix of specific cross-functional ties? Certainly. Indeed, a recent study in which researchers had access to only a few representatives of each organization, not nearly enough to enable a network measure of relational coordination, instead asked the relational coordination questions more generally about patterns of interaction in the organization as a whole. This study did find statistically significant relationships between the abridged measure of relational coordination and both psychological safety and learning from failures.[xxiv]

However, the concept of relational coordination is more accurately captured as a network of ties. In the coordination of work, each tie potentially has a differential impact on performance,

which would be lost in a more aggregated or global assessment of relational coordination. When respondents are asked to assess the quality of their communication and relationships with all functions globally, a particularly negative connection with one of the other groups could disproportionately influence the overall assessment. By asking respondents to evaluate separately their connections with each other function, the accuracy of measurement is enhanced.

The final and perhaps most compelling reason for a network measure of relational coordination is the ability to disaggregate the network into its component ties for the purpose of diagnosis and intervention. By measuring each cross-functional tie separately, the researcher reserves the possibility of doing a sensitivity analysis to learn which of the ties has the greatest impact on performance. The researcher can also diagnose for an individual site which ties are weakest. Cross-functional ties that have a significant impact on performance, *and* that are problematic for a particular site, should become a high priority for management attention in that site.

For example, in the study of physician job design reported above, the largest and most significant differences in relational coordination between the old and new physician job design were found in the ties between the physician and other members of the team, rather than among non-physician members of the team, with the biggest impact being on the physician/nurse tie. This type of finding, drilling down to the level of the dyad within the team, is only possible with a network measure.

Administering the Survey

The relational coordination survey can be administered in person, by mail or by email. Once you have identified the functional groups you will survey, you need to survey participants from each functional group. For my flight departure study as a graduate student, I used a highly

time intensive approach, delivering the survey in person, and being present to answer questions from respondents as they completed the study. At each of the nine participating sites, I administered the survey in person on a single day to employees working the morning shift, distributing surveys in the break rooms. All surveys were conducted on weekdays between Tuesday and Thursday, to avoid disrupting the operations and to increase the number of surveys completed because passenger loads were typically lighter on these three days. Respondents typically required 20 minutes to complete the survey. Four hundred surveys were administered with 354 completed, for an overall response rate of 89%.

For my patient care coordination study, as a junior faculty member, I chose a much less time intensive approach. At each of the nine participating sites, a key departmental administrator designated by the department chief was asked to identify all eligible care providers. The administrator was supplied written guidelines as to whom should be included (all providers from the five particular functions who were directly or indirectly involved with providing care for joint replacement patients). Surveys were mailed to all eligible care providers initially during the second month of the study period, with one repeat mailing during the study period for non-respondents. I received responses from 338 of 666 providers, for an overall response rate of 51%. The mailed survey approach resulted in an acceptable response rate, but one that was far lower than the response rate when the survey was administered in person.

Scoring the Responses and Constructing the Relational Coordination Measure

Relational coordination is first constructed for each individual respondent, seeing each respondent as the center of his or her own relational coordination network. As we will see below, if analyses support the proposition that relational coordination is significantly different across sites in your sample, you can then aggregate to a site-level measure of relational

coordination. However, relational coordination is first of all an individual respondent-level measure, measuring the connections between an individual respondent and others. Please see Exhibit 13 for a sample of survey responses from a hypothetical Respondent 13 who is a member of Function 4 at Site A.

Exhibit 13: Survey Responses from Respondent 13 (member of Function 4, Site A)

Frequent	Never	Rarely	Occasionally	Often	Constantly
Function 1	1	2	**3**	4	5
Function 2	1	2	**3**	4	5
Function 3	1	2	3	**4**	5
Function 4	1	2	3	4	**5**
Function 5	**1**	2	3	4	5
Timely	Never	Rarely	Occasionally	Often	Always
Function 1	1	2	3	**4**	5
Function 2	1	2	3	**4**	5
Function 3	1	2	3	**4**	5
Function 4	1	2	3	4	**5**
Function 5	1	**2**	3	4	5
Accurate	Never	Rarely	Occasionally	Often	Always
Function 1	1	2	**3**	4	5
Function 2	1	**2**	3	4	5
Function 3	1	2	3	**4**	5
Function 4	1	2	3	**4**	5
Function 5	1	2	**3**	4	5
Problem-solving	Never	Rarely	Occasionally	Often	Always
Function 1	1	2	**3**	4	5
Function 2	1	2	**3**	4	5
Function 3	1	2	3	4	**5**
Function 4	1	2	3	4	**5**
Function 5	1	**2**	3	4	5
Shared Knowledge	Nothing	A Little	Some	A Lot	Everything
Function 1	1	**2**	3	4	5
Function 2	1	2	3	**4**	5
Function 3	1	2	3	4	**5**
Function 4	1	2	3	4	**5**
Function 5	1	**2**	3	4	5
Mutual Respect	Not at All	A Little	Somewhat	A Lot	Completely
Function 1	1	2	**3**	4	5
Function 2	1	2	**3**	4	5
Function 3	1	2	3	**4**	5
Function 4	1	2	3	**4**	5
Function 5	**1**	2	3	4	5
Shared Goals	Not at All	A Little	Somewhat	A Lot	Completely
Function 1	1	2	3	**4**	5
Function 2	1	2	3	**4**	5
Function 3	1	2	3	**4**	5
Function 4	1	2	3	4	**5**
Function 5	1	**2**	3	4	5

Exhibit 14 provides a summary of responses for Respondent 13, including recommended variable names. Note that the first variable is the respondent's site (A), the second variable is the respondent ID (13), and the third variable is the functional identity of the respondent (4). The relational coordination variables are taken directly from the survey above, reflecting each of the seven dimensions of relational coordination measured with respect to each of the functional groups – five in this example. If there are five functional groups in the work process, as in this example, the number of relational coordination scores for each respondent will equal 7*5 or 35.

Exhibit 14: Summary of Responses from Respondent 13 (member of Function 4, Site A)

Variable Name	Value
Respondent site	A
Respondent ID	13
Respondent function	4
Freqfunc1	3
Freqfunc2	3
Freqfunc3	4
Freqfunc4	5
Freqfunc5	1
Timefunc1	4
Timefunc2	4
Timefunc3	4
Timefunc4	5
Timefunc5	2
Accufunc1	3
Accufunc2	2
Accufunc3	4
Accufunc4	4
Accufunc5	3
Probfunc1	3
Probfunc2	3
Probfunc3	5
Probfunc4	5
Probfunc5	2
Knowfunc1	2
Knowfunc2	4
Knowfunc3	5
Knowfunc4	5
Knowfunc5	2
Respfunc1	3
Respfunc2	3
Respfunc3	4
Respfunc4	4
Respfunc5	1

Goalfunc1	4
Goalfunc2	4
Goalfunc3	4
Goalfunc4	5
Goalfunc5	2

Second, compute a variable for each of the seven dimensions of relational coordination. The frequency of communication, for example, will be an average of the scores reported by the respondent for each of the functional groups: Freq = mean (Freqfunc1 Freqfunc2 Freqfunc3 Freqfunc4 Freqfunc5).[3] See Exhibit 15 for the variable names and equations used to construct these variables. You will have seven variables for each survey respondent – one for the frequency of communication, one for the timeliness of communication, one for the accuracy of communication, and so on. Relational coordination is then constructed for each individual respondent as an equally weighted index of the 35 scores, resulting in one single score for relational coordination for each respondent.

[3] Relational coordination can be constructed as the average strength of ties reported by an individual respondent, or as the percent of strong ties (4 or 5 on the 5-point scale) reported by an individual respondent. The more common approach by far is the average strength of ties, so that approach is presented here.

Exhibit 15: New Variables Created for Respondent 13 (member of Function 4, Site A)

Variable Name	Value	Equation
Respondent site	A	
Respondent ID	13	
Respondent function	4	
Freq	3.20	mean (Freqfunc1 Freqfunc2 Freqfunc3 Freqfunc4 Freqfunc5)
Time	4.60	mean (Timefunc1 Timefunc2 Timefunc3 Timefunc4 Timefunc5)
Accu	3.20	mean (Accufunc1 Accufunc2 Accufunc3 Accufunc4 Accufunc5)
Prob	3.60	mean (Probfunc1 Probfunc2 Probfunc3 Probfunc4 Probfunc5)
Know	3.60	mean (Knowfunc1 Knowfunc2 Knowfunc3 Knowfunc4 Knowfunc5)
Resp	3.00	mean (Respfunc1 Respfunc2 Respfunc3 Respfunc4 Respfunc5)
Goal	3.80	mean (Goalfunc1 Goalfunc2 Goalfunc3 Goalfunc4 Goalfunc5)
RC	3.46	mean (Freqfunc1 … Goalfunc5)
RCfunc1	3.14	mean (Freqfunc1 Timefunc1 Accufunc1 Probfunc1 Knowfunc1 Respfunc1 Goalfunc1)
RCfunc2	3.29	mean (Freqfunc2 Timefunc2 Accufunc2 Probfunc2 Knowfunc2 Respfunc2 Goalfunc2)
RCfunc3	3.71	mean (Freqfunc3 Timefunc3 Accufunc3 Probfunc3 Knowfunc3 Respfunc3 Goalfunc3)
RCfunc4	4.71	mean (Freqfunc4 Timefunc4 Accufunc4 Probfunc4 Knowfunc4 Respfunc4 Goalfunc4)
RCfunc5	1.86	mean (Freqfunc5 Timefunc5 Accufunc5 Probfunc5 Knowfunc5 Respfunc5 Goalfunc5)
RC	3.46	mean (Freqfunc1 … Goalfunc5)

Third, you may also want to look at relational coordination between particular functions in order to assess relational coordination at the dyadic level. Relational coordination with Function 1, for example, will be an average of the seven different scores reported by the respondent for Function 1: RCfunc1 = mean (Freqfunc1 Timefunc1 Accufunc1 Probfunc1 Knowfunc1 Respfunc1 Goalfunc1). This will result in five new variables for each survey respondent – one for relational coordination with Function 1, another for relational coordination with Function 2, and so on. See the lower panel of Exhibit 15 for the equations that are used to create these new variables.

These new variables that measure relational coordination with each individual functional group (including his or her own functional group) can be placed into a matrix diagram like the ones shown earlier in Exhibits 11 and 12. Because our sample respondent is a member of

Function 4, his or her scores are placed in the row for Function 4. See Exhibit 16 for an example of how this works. As we receive additional survey responses and compute scores from the responses, these scores can also be added to our matrix diagram.

Exhibit 16: Matrix of Relational Coordination Ties for Respondent 16

	Relational Coordination Reported With				
	Function 1	**Function 2**	**Function 3**	**Function 4**	**Function 5**
Function 1					
Function 2					
Function 3					
Function 4	3.14	3.29	3.71	4.71	1.86
Function 5					

Chapter 4: Analyzing Relational Coordination

This chapter outlines analyses that can be conducted using the measures of relational coordination that have been created using the methods outlined above.

Cronbach's Alpha and Factor Analysis to Determine Index Validity

First, you should test the validity of aggregating the seven dimensions of RC into a single index. Using individual survey responses as your unit of observation, test Cronbach's alpha among the seven dimensions of RC to see if they constitute a valid index. For index validity, Cronbach's alpha should be greater than 0.70 for an exploratory study, and greater than 0.80 for a non-exploratory study. For the first two studies conducted with the RC measure, flight departures and patient care coordination, the Cronbach's alpha was 0.80 for the flight departure study, and 0.86 for the patient care coordination study.[xxv]

You should then conduct an exploratory factor analysis to test whether relational coordination behaves as a single factor in your setting, or whether instead it separates into multiple factors. Exploratory factor analyses for the nine-site study of flight departures as well as for the nine-hospital study of patient care suggested that relational coordination was best characterized as a single factor. For the nine-hospital study of patient care, the eigenvalue for factor 1 was 3.41, while the eigenvalue for factor 2 was 0.55. An additive scaling method was used in which each item was standardized with a mean of zero and a standard deviation of one so that each of the seven items was equally weighted. Cronbach's alpha was 0.86, suggesting that this construct has a high level of reliability. No items were dropped due to weak factor loadings, and no cross-loadings greater than 0.40 were found. Furthermore, all items had item-to-total correlation scores of 0.40 or greater. We concluded that the relational coordination index meets standards for reliability and convergent validity. See Exhibit 17 for the factor loadings found in

the nine-site study of flight departures, as well as the nine-hospital study of patient care.

Note that this index of relational coordination can also be constructed based on all of the underlying scores (e.g. 35 scores in our previous example), not just the seven aggregate scores for Frequent Communication, Timely Communication, Accurate Communication and so on. This approach to index construction would reflect more of the underlying information that comprises the concept of relational coordination.

Exhibit 17: Factor 1 Loadings for Relational Coordination

	Study 1: Nine-Site Study of Flight Departures	**Study 2: Nine-Hospital Study of Patient Care**
Frequent Communication	0.55	0.57
Timely Communication	0.71	0.78
Accurate Communication	NA[4]	0.80
Problem Solving Communication	0.62	0.78
Shared Knowledge	0.57	0.63
Shared Goals	0.54	0.63
Mutual Respect	0.72	0.66
Eigenvalue for Factor 1	2.32	3.41
Cronbach's Alpha	0.80	0.86

Analyzing the Patterns of Relational Coordination Between Functional Groups

Once you have determined that the dimensions of relational coordination as measured in your survey do indeed constitute a reliable index, you can then analyze the patterns of relational coordination found between different functional groups. Your data can be used to build a matrix diagram to visualize patterns of relational coordination between the functional groups in the focal work process. This type of diagram, shown here in Exhibit 18 and also shown above in Exhibits 10, 11 and 15, is known as a "Dependency Structure Matrix," was developed initially by

[4] Accuracy of communication was not included in the RC measure until Study 2.

Donald Steward and then further developed by Manuel Sosa, Steven Eppinger and colleagues in order to understand complex engineering and design processes.[xxvi]

Exhibit 18: Symmetrical Matrix of Relational Coordination Ties

	Relational Coordination Reported With				
	Physicians	**Nurses**	**Physical Therapists**	**Case Managers**	**Social Workers**
Physicians	**3.82**	3.94	4.03	3.75	3.70
Nurses	3.81	**4.48**	4.27	4.03	3.92
Physical Therapists	3.85	4.25	**4.71**	4.06	3.94
Case Managers	3.83	4.36	4.43	**4.45**	4.37
Social Workers	3.93	4.01	4.03	4.17	**4.36**
All	3.85	4.21	4.29	4.09	4.06

See Exhibit 18 for an example of a matrix diagram that was created for the nine-hospital study of surgical care. This matrix diagram shows patterns of relational coordination with physicians, nurses, therapists, case managers and social workers, as reported by the care providers in the left-hand column. Within-function ties are highlighted in bold. Because all functional groups in this work process were surveyed, it is a symmetrical matrix, meaning that the same functional groups are represented along the left hand column and along the top row.

The data we have collected enables us to observe the strength of ties between each of the functional groups in the study, and also to observe the strength of ties within each of the functional groups in the study. We can assess where ties are weakest, and where they are strongest. For example, we can see that within-function ties reported by any given functional group tend to be stronger than the between function ties reported by that functional group (and indeed t-tests show that these differences are significant). We can also see that the weakest ties reported by any functional group, except physicians, are their ties with physicians (again, t-tests show that these differences are significant).

Exhibit 19: Asymmetrical Matrix of Relational Coordination Ties

	Relational Coordination Reported With				
	Physicians	**Residents**	**Nurses**	**Therapists**	**Case Managers**
Nurses	3.77	3.93	**4.35**	3.86	4.05
Therapists	2.36	2.46	3.97	**4.28**	3.74
Case Managers	3.65	3.25	4.23	3.17	**4.52**
All	3.26	3.21	4.18	3.77	4.10

If you have not been able to survey all functional groups in your work process, your matrix will be asymmetrical, meaning that only a subset of the functional groups shown in the top row will also be found in the left hand column. Exhibit 19 shows a matrix diagram from a

study of medical care, showing patterns of relational coordination with physicians, residents, nurses, therapists and case managers, as reported by the care providers in the left-hand column. Physicians and residents were determined to be central to the work process but were not surveyed; therefore they are represented along the top row but not along the left hand column. The data we have collected therefore enables us to observe the strength of ties between each of the functional groups that were surveyed for the study, and also to observe the strength of ties within each of the functional groups that were surveyed. But we cannot assess the ties between physicians and residents, or the ties among physicians or among residents.

Still, just as in the symmetrical matrix in Exhibit 18, we can see that the within-function ties reported by any given functional group tend to be stronger than the between function ties reported by that functional group (and indeed t-tests show that these differences are significant). We can also see, consistent with our results in the symmetrical matrix in Exhibit 18, that the weakest ties reported by any functional group are their ties with physicians (again, t-tests show that these differences are significant).

In sum, a matrix diagram – whether symmetrical or asymmetrical – can be built from the relational coordination data collected for any focal work process to identify the weak and strong ties among participants in that work process.

Testing for Differences between Sites or between Intervention and Non-Intervention

In addition to looking for differences in the strength of ties between dyads, we are typically very interested in assessing differences in the strength of ties between sites, or between intervention and non-intervention in the same site. To assess these differences, you conduct analyses of variance to find whether you have significant differences in relational coordination between your units of analysis (e.g. cross-site, or between an intervention and non-intervention).

In the nine-site flight departure study, significant cross-site differences were found in relational coordination ($p<0.0001$), as well as significant cross-functional ($p<0.0001$) differences. When site-level and cross-functional differences were considered jointly, site-level differences remained significant with an F-statistic of 0.0003. The intra-site correlation for relational coordination was significantly greater than zero ($p<0.001$). Taken together, these results were consistent with treating relational coordination as a site-level construct.

For the nine-hospital patient care study, similar descriptive analyses were conducted with some additional detail. Using one-way analysis of variance, significant cross-site differences in relational coordination were found, $F(8,327) = 5.32$, $p<0.001$, as well as significant cross-functional differences in relational coordination, $F(5,330) = 2.89$, $p<0.05$. When site-level and function-level differences were considered jointly, site-level differences remained significant, $F(8,322) = 4.51$, $p<0.001$, while function-level differences became insignificant, $F(5,322) = 1.75$, $p=0.12$. To further assess treating relational coordination as a site-level construct, we computed intra-class correlations ICC(1) and ICC(2). ICC(1) is the proportion of total variance that is explained by site membership with values ranging from -1 to +1 and values between 0.05 and 0.30 being most typical. This number provides an estimate of the reliability of a single respondent's assessment of the site mean. ICC(2) provides an overall estimate of the reliability of site means, with values equal to or above 0.70 being acceptable. For relational coordination, ICC(1) = 0.25 and ICC(2) = 0.81. We concluded that relational coordination performed well on both forms of intra-class correlation. Taken together, these results are consistent with treating relational coordination as a site-level construct.

Aggregating to Site Level

If you have found significant site-level differences and significant intra-site correlations in your relational coordination construct, you have the basis for building a site-level construct. To aggregate to the site level, you could simply construct a mean score for each site, equally weighting the responses of each survey respondent. However, it is recommended to use a weighted mean, in which individual responses are weighted according to the size of their function in that particular site, so that the site level measure of relational coordination reflects the functional composition of that site. Otherwise your measure of relational coordination will be influenced by the relative response rates of different functional groups.

For example, if physical therapists tend to engage in higher levels of relational coordination than nurses, and their survey response rate is *higher* than that of nurses, your site-level measure of relational coordination will be biased *upward* due to the over-representation of the functional group that is more engaged in relational coordination. If physical therapists tend to engage in higher levels of relational coordination than nurses but their survey response rate is *lower* than that of nurses, your site-level measure of relational coordination will be biased *downward* due to the under-representation of the functional group that is more engaged in relational coordination. This is especially problematic if the relative response rates of the functional groups differ between sites as they might easily do. Your site-level measures of relational coordination should reflect the functional composition of each site, and not the response rates of the functional groups in each site.

We can see from our data entry in Exhibit 20 that we had 20 respondents from the five functional groups that were surveyed at Site A. Summing the RC scores for all 20 respondents and dividing by 20, we get an un-weighted average RC score of 3.24 for Site A.

Exhibit 20: Relational Coordination Data for Site A

ID	Site	Function	RC	Site-Level RC (un-weighted)
1	A	1	3.00	3.24
2	A	1	3.21	3.24
3	A	1	3.88	3.24
4	A	2	3.53	3.24
5	A	2	2.98	3.24
6	A	2	2.55	3.24
7	A	2	3.10	3.24
8	A	2	3.12	3.24
9	A	3	3.32	3.24
10	A	3	3.11	3.24
11	A	3	3.45	3.24
12	A	3	3.48	3.24
13	A	4	3.46	3.24
14	A	4	3.59	3.24
15	A	5	3.21	3.24
16	A	5	3.89	3.24
17	A	5	3.33	3.24
18	A	5	2.49	3.24
19	A	5	2.83	3.24
20	A	5	3.32	3.24

We can also see from Exhibit 20 that, of the 20 respondents, 3 were from Function 1 (15%); 5 were from Function 2 (25%); 4 were from Function 3 (20%); 2 were from Function 4 (10%); and 6 were from Function 5 (30%). Our un-weighted RC score for Site A therefore derives 10% of its value from Function 4 and 30% of its value from Function 5, for example, simply because 10% of the RC scores included in the aggregate site-level score include responses from Function 4 while 30% of those scores represent responses from Function 5.

But suppose Site A had 30 workers in the focal work process, meaning that we achieved a 67% response rate overall (20/30 = 67%). Furthermore, suppose that 4 of these workers were in Function 1 (13%); 8 were in Function 2 (27%); 6 were in Function 3 (20%), 5 were in Function 4 (17%), and 7 were in Function 5 (23%). Our aggregate RC measure should reflect

the actual distribution of workers across functions in Site A who are engaged in the focal work process we are trying to understand, not the distribution of survey responses.

To do the proper weighting of RC scores for site-level aggregation, we set up a table as seen in Exhibit 21. To create a properly weighted RC score for Site A, we create a weighting factor for each function based on the number of workers in each function relative to the number of workers in the site involved in the focal work process. We then determine the mean RC score for each function, multiply the mean RC score for the function by the weighting factor to get an intermediate score, then sum those intermediate scores to achieve a properly weighted site-level RC score. This properly weighted score is 3.27 rather than 3.24, not a dramatic difference, but more accurate than the non-weighted score for reflecting the focal work process.

1) Weighting Factor for Function = Workers in Function/Workers in Site

2) Intermediate Score for Function = Weighting Factor for Function * mean (RC for Function)

3) Site-Level RC = sum (Intermediate Scores for all Functions)

Exhibit 21: Determining Weights for Site-Level Aggregation for Site A

Site	Function	Workers in Function	Workers in Site	Weighting Factor	Mean RC for Function	Intermediate Score	Site-Level RC (weighted)
A	1	4	30	13%	3.36	.44	3.27
A	2	8	30	27%	3.06	.83	3.27
A	3	6	30	20%	3.34	.67	3.27
A	4	5	30	17%	3.53	.60	3.27
A	5	7	30	23%	3.18	.73	3.27

Exhibit 22: Comparing Un-Weighted and Weighted Site-Level Aggregation for Site A

Un-Weighted Site-Level RC Score
(3.00+3.21+3.88+3.53+2.98+2.55+3.10+3.12+3.32+3.11+3.45+3.48+3.46+3.59+3.21+3.89+ 3.33+2.49+2.83+3.32)/20 = 3.24
Weighted Site-Level RC Score
.13[(3.00+3.21+3.88)/3] + .27[(3.53+2.98+2.55+3.10+3.12)/5] + .20[(3.32+3.11+3.45+3.48)/4] + .17[(3.46+3.59)/2 + .23[(3.21+3.89+3.33+2.49+2.83+3.32)/6] = 3.27

Analyzing Performance Effects of Relational Coordination

As explained above under "Expected Performance Effects of Relational Coordination," relational coordination is expected to improve both the quality and efficiency performance of a given work process, particularly when that work process is characterized by high levels of task interdependence, uncertainty and time constraints. Ideally, performance measures will include critical measures of both quality and efficiency for the focal work process. In the flight departure study, the impact of relational coordination was evaluated for efficiency (gate time per departure; employees per passenger) as well as quality (on-time performance; baggage handling performance; customer satisfaction). In the patient care study, the impact of relational coordination was evaluated for efficiency (length of stay), as well as quality (post-operative pain; post-operative functioning; patient satisfaction). It is a good idea to choose these performance measures based on a consensus among practitioners regarding the performance measures that are vital for success in their industry.

In order to assess the impact of relational coordination on performance, one must also understand and measure the other factors that affect those performance outcomes. Again, industry practitioners can be a vital source of information. For the flight departure study, these control measures (or covariates) included scale of operations (flights/month); size of flight (passengers/departure); length of flight (miles/departure); percent connections (passengers connecting/total passengers); and freight loading requirements (tons of freight/departure). For the patient care study, these control measures (or covariates) included site-level volume (surgeries/month); as well as patient age; comorbid conditions; type of surgery; pre-operative pain and functioning; overall health; psychological well-being; marital status; race; and gender.

For your models that predict performance, the independent variable of interest is relational coordination, measured at the site-level (unless you decided to collect a separate measure of relational coordination for each client). The control variables or covariates are also included as independent variables in the model. The dependent variables are the quality and efficiency performance measures. A separate regression model should be run to predict each measure of performance.

Multi-level regression analysis should be used to adjust coefficients and standard errors for the multi-level nature of the data. Previous analyses of the performance effects of relational coordination have nearly always used random effects models, a form of multi-level analysis. The unit of analysis is the individual client or monthly observation within the site. The random effect is the site. Random effects regressions will produce both a within-site R square, and a between-site R square. Within-site R square indicates the percent of within-site variation that is explained by the variables in the models. Between-site R square indicates the percent of between-site variation that is explained by the variables in the model. Either or both can be reported, but should be labeled and explained to readers.[xxvii]

Random effects models are increasingly common, and a sentence such as the following can be used to explain their use: "For the above analyses, random effects modeling was used to adjust standard errors for the multi-level nature of the data, accounting for non-independence of the error terms."[xxviii]

Analyzing the Predictors of Relational Coordination

The organizational practices that are expected to predict relational coordination are typically measured at the site-level of analysis. To assess their impact on relational coordination, you can use a model in which the unit of analysis is the individual respondent to the relational

coordination survey. In this multi-level model, the organizational practice or practices are the independent variables, the control variables or covariates are the functional identity of the individual respondents (and any other individual-level predictors you want to include), and the dependent variables are the individual-level measure of relational coordination. This model allows the effects of organizational practices on relational coordination to be tested at the level of the individual participant, controlling for his or her functional identity.

As you did when evaluating the effect of relational coordination on performance, multi-level regression analysis should again be used to adjust coefficients and standard errors for the multi-level nature of the data (individual observations within multiple sites). The unit of analysis for this model is the individual participant within the site. The random effect is the site. As before, the analysis will produce both a within-site R square, and a between-site R square. Within-site R square indicates the percent of within-site variation that is explained by the variables in the models. Between-site R square indicates the percent of between-site variation that is explained by the variables in the model. Either or both can be reported, but should be labeled and explained to readers.

Analyzing Mediation

If you have been able to measure relational coordination, performance outcomes, and some of the organizational practices you expect might influence relational coordination, you may be interested in articulating and testing a mediation hypothesis. This hypothesis will take the form: "Organizational practice X is expected to affect performance measure Y through its effect on relational coordination." In other words, relational coordination is expected to mediate (at least partially) the effect of certain organizational practices on performance. Relational coordination is a multi-level theory that operates across multiple levels of analysis, and

mediation can be tested across these multiple levels of analysis, consistent with previous studies of relational coordination.[xxix]

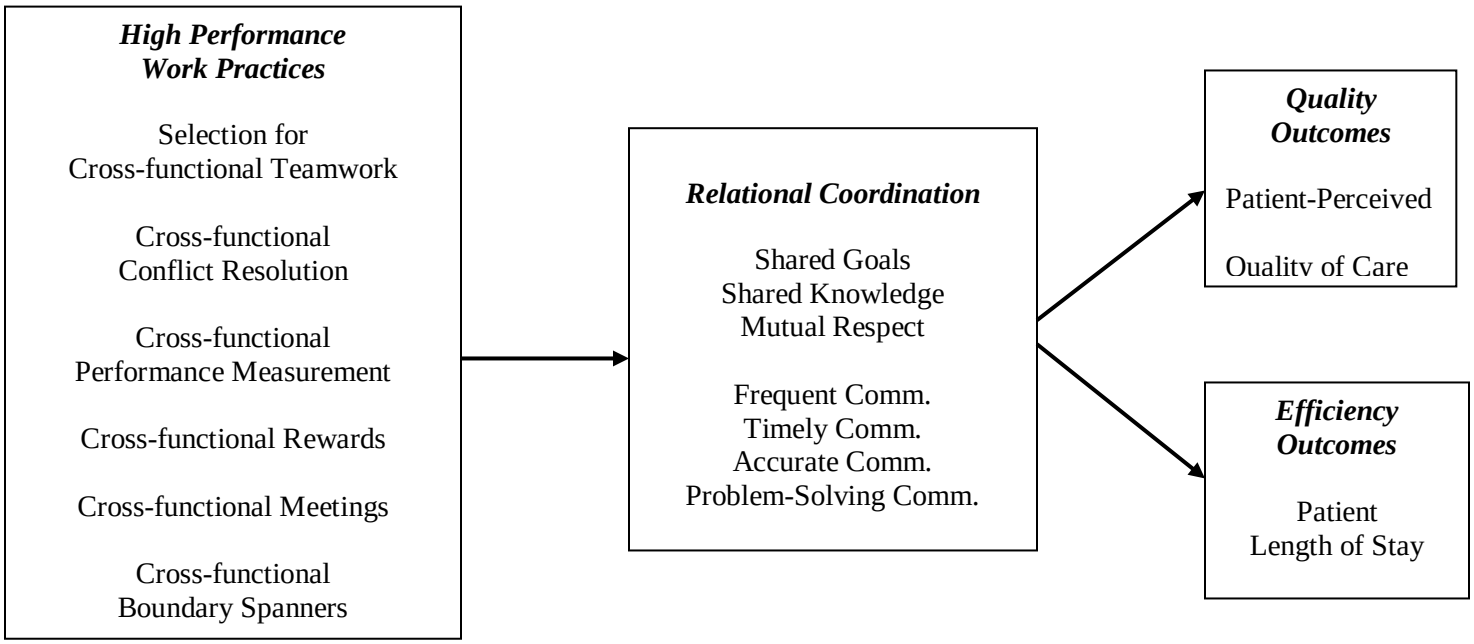
Following the method developed by Reuben Baron and David Kenny, evaluating the mediation hypothesis requires three equations and a test of the path's overall significance. First, the organizational practice must have a significant effect on relational coordination. Second, the organizational practice must have a significant effect on the performance outcomes of interest. Third, if in addition the coefficient on the organizational practice becomes insignificant when relational coordination is added to the outcomes equation, this result can be taken to suggest that relational coordination mediates between the organizational practice and outcomes, or in other words that the organizational practice influences outcomes through its effect on relational coordination.[xxx]

Finally, the overall path must be significant. The Sobel test can be used to determine whether the association between organizational practices and performance is reduced significantly when controlling for the mediator of relational coordination, drawing upon the critical values identified by MacKinnon and colleagues to determine whether the results are supportive of mediation. A recent paper reported the results of a Sobel test of the theory of relational coordination: "Results of the Sobel test suggest that the association between high performance work practices and quality of care is significantly mediated by relational coordination ($z' = 1.87$, $p<0.01$). Together, these results suggest that high performance work practices predict quality outcomes, and that they do so by strengthening relational coordination among employees in different functions (*Hypothesis 2*)." And later: "Results of the Sobel test suggest that the association between high performance work practices and length of stay is significantly mediated by relational coordination ($z' = 2.40$, $p<0.01$). Together, these results

suggest that high performance work practices predict efficiency outcomes, and that they do so by strengthening relational coordination among employees in different functions (*Hypothesis 3*)."[xxxi]

For an example of the mediation model that was tested in "A Relational Model of How High Performance Work Systems Work" (Gittell, Seidner and Wimbush, 2010), please see Exhibit 23.

Exhibit 23: Example of a Mediation Model



Analyzing Moderation

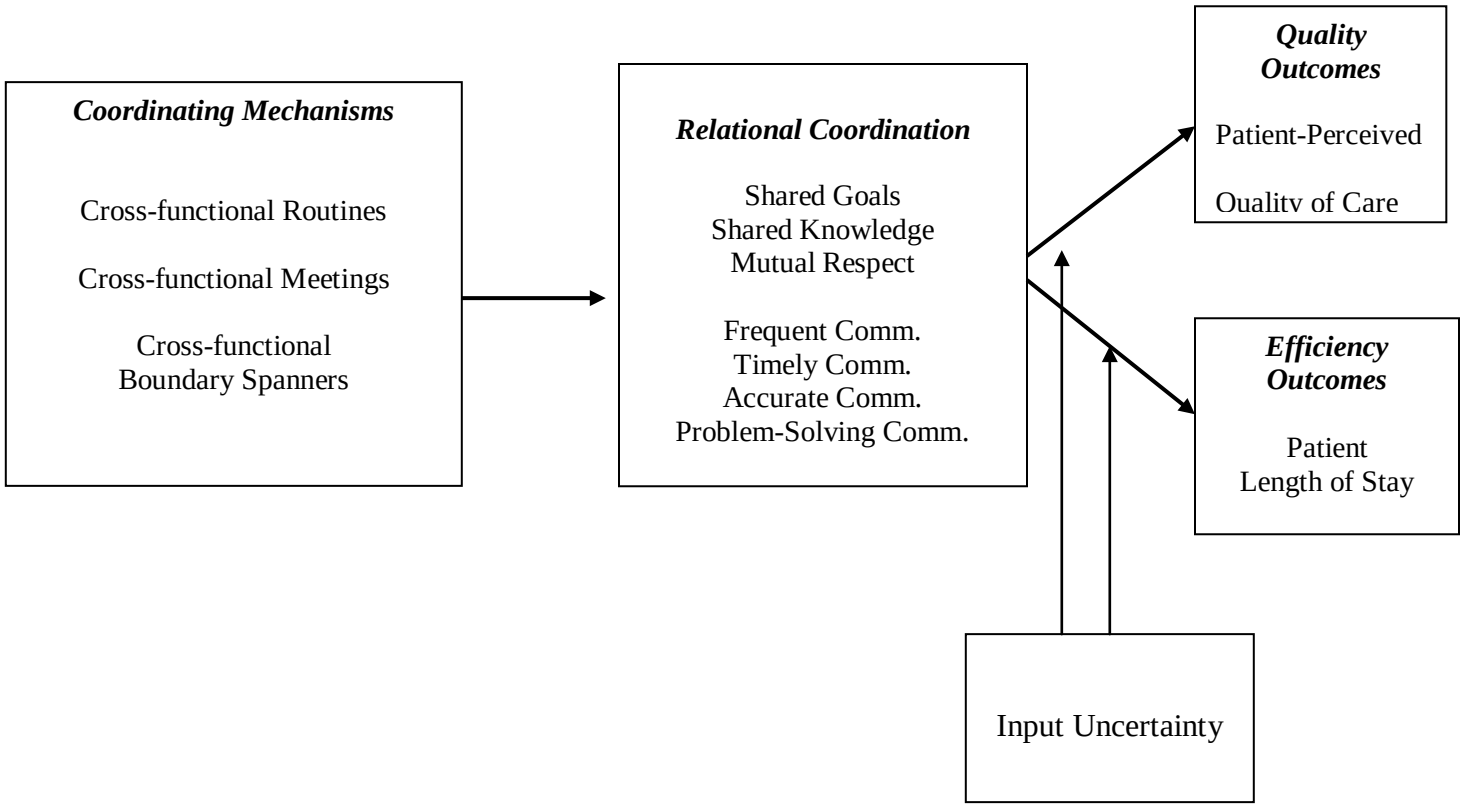
If you have been able to measure relational coordination, performance outcomes, and some of the factors that are expected to increase the impact of relational coordination on performance, you may be interested in articulating and testing a moderation hypothesis. This hypothesis will take the form: "Factor X (task interdependence, uncertainty or time constraints) is expected to increase (or decrease) the impact of relational coordination on performance measure Y." In other words, factor X is expected to moderate the effect of relational coordination on performance.

Again following the method developed by Reuben Baron and David Kenny, evaluating the moderation hypothesis requires testing two equations. First, relational coordination must have a significant effect on the performance outcome of interest, controlling for factor X. In a second equation, the product of relational coordination and factor X (RC*factor X) must have significant effect on performance, controlling for both relational coordination and factor X. This approach is consistent with the recommendation of organizational theorist Claudia Schoonhoven for operationalizing contingency hypotheses.[xxxii]

An example from "Coordinating Mechanisms in Care Provider Groups" (Gittell, 2002) can be used to illustrate the use of this method for testing the theory of relational coordination. First, a random effects regression equation showed that relational coordination was associated with increased quality of care ($r = 0.23$, $p<0.01$), and with reduced hospital lengths of stay ($r=-0.31$, $p<0.01$). In addition, the product of relational coordination and input uncertainty was associated with increased quality of care ($r = 0.14$, $p<0.05$) and reduced hospital lengths of stay ($r = -0.20$, $p<0.01$), suggesting that input uncertainty increased impact of relational coordination on performance outcomes of interest.[xxxiii]

For an example of the moderation model that was tested in "Coordinating Mechanisms in Care Provider Groups: Relational Coordination as a Mediator and Input Uncertainty as a Moderator of Performance Effects" (Gittell, 2002), please see Exhibit 24.

Exhibit 24: Example of a Moderation Model (that also includes mediation)



Chapter 5: Summing Up

This guide is intended to enable scholars to replicate and extend the research that has been conducted to date on the theory of relational coordination. I welcome comments from users on areas that need additional clarification. I thank you in advance for doing work on the subject of relational coordination. I have found relational coordination to be a fascinating way to understand how relationships among people who work together influence critical performance outcomes, and how organizations can better facilitate and support these efforts. I look forward to hearing your questions and seeing your results!

Appendices

Appendix A: Relational Coordination Survey for Flight Departures

1. How *frequently* do you communicate with people in these groups about flight departures?

Pilots	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Flight attendants	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Gate agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Ticketing agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Ramp agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Baggage agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Freight agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Mechanics	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Operations agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Cabin cleaning	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Fueling	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Catering	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐

2. Do people in these groups communicate with you in a *timely* way about flight departures?

Pilots	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Flight attendants	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Gate agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Ticketing agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Ramp agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Baggage agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Freight agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Mechanics	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Operations agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Cabin cleaning	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

Fueling	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Catering	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

3. **Do people in these groups communicate with you *accurately* about flight departures?**

Pilots	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Flight attendants	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Gate agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Ticketing agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Ramp agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Baggage agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Freight agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Mechanics	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Operations agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Cabin cleaning	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Fueling	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Catering	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

4. **When problems occur with flight departures, do people in these groups work with you to *solve the problem*?**

Pilots	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Flight attendants	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Gate agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Ticketing agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Ramp agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Baggage agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Freight agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Mechanics	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Operations agents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Cabin cleaning	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Fueling	Never	Rarely	Occasionally	Often	Always

	☐	☐	☐	☐	☐
Catering	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

5. How much do people in these groups *know* about the work you do?

Pilots	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Flight attendants	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Gate agents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Ticketing agents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Ramp agents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Baggage agents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Freight agents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Mechanics	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Operations agents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Cabin cleaning	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Fueling	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Catering	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐

6. How much do people in these groups *respect* the work you do?

Pilots	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Flight attendants	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Gate agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Ticketing agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Ramp agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Baggage agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Freight agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Mechanics	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Operations agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Cabin cleaning	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Fueling	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Catering	Not at all	A little	Somewhat	A lot	Completely

	☐	☐	☐	☐	☐

7. How much do people in these groups *share your goals* for flight departures?

Pilots	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Flight attendants	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Gate agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Ticketing agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Ramp agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Baggage agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Freight agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Mechanics	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Operations agents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Cabin cleaning	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Fueling	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Catering	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐

Appendix B: Relational Coordination Survey for Patient Care

1. **How *frequently* do you communicate with care providers in these groups about _____ patients?**

Surgeons	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Nurses (nursing unit)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Case managers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Physical therapists	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Social workers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐

2. **Do care providers in these groups communicate with you in a *timely* way about _____ patients?**

Surgeons	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Nurses (nursing unit)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Case managers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Physical therapists	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Social workers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

3. **Do care providers in these groups communicate with you *accurately* about _____ patients?**

Surgeons	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Nurses (nursing unit)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Case managers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Physical therapists	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Social workers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

4. When problems arise regarding the care of _____ patients, do care providers in these groups work with you to *solve the problem*?

Surgeons	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Nurses (nursing unit)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Case managers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Physical therapists	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Social workers	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

5. How much do care providers in these groups *know* about the work you do in caring for _____ patients?

Surgeons	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Residents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Nurses (nursing unit)	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Case managers	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Physical therapists	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Social workers	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐

6. How much do care providers in these groups *respect* the work you do in caring for _____ patients?

Surgeons	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Residents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Nurses (nursing unit)	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Case managers	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Physical therapists	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Social workers	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐

7. How much do care providers in these groups *share your goals* for the care of _____ patients?

Surgeons	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Residents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Nurses (nursing unit)	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Case managers	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Physical therapists	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Social workers	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐

Appendix C: Short Form Relational Coordination Survey for Nursing Homes[5]

1. CNAs on your unit

How **often** do you talk with the CNAs on your unit?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
When there are problems, do they try to **solve the problem**?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
Do they **know** very much about the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Everything** ☐
Do they **respect** the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐
Do they **have the same goals** as you do for taking care of residents?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐

2. Nurses on your unit

How **often** do you talk with the nurses on your unit?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
When there are problems, do they try to **solve the problem**?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
Do they **know** very much about the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Everything** ☐
Do they **respect** the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐
Do they **have the same goals** as you do for taking care of residents?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐

3. Food service staff

How **often** do you talk with the food service staff?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
When there are problems, do they try to **solve the problem**?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
Do they **know** very much about the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Everything** ☐
Do they **respect** the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐
Do they **have the same goals** that you do for taking care of residents?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐

[5] Note that this survey includes just five of the seven relational coordination dimensions, and that the answers are measured on a 3-point scale rather than the 5-point scale that is typically used for relational coordination. In addition, some of the wording of the questions has been changed. These changes were made to shorten and simplify the instrument for the target employees, many of whom did not have English as their first language.

4. Housekeeping staff

How **often** do you talk with the housekeeping staff?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
When there are problems, do they try to **solve the problem**?	**NA** ☐	**Rarely** ☐	**Often** ☐	**All the Time** ☐
Do they **know** very much about the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Everything** ☐
Do they **respect** the work you do?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐
Do they **have the same goals** that you do for taking care of residents?	**NA** ☐	**Very Little** ☐	**A Lot** ☐	**Completely** ☐

Appendix D: Relational Coordination Survey for Patient Care, by Individual Patient[6]

1. How *frequently* did you communicate with each of these care providers about this patient?

Attending physician	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Case manager(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Floor nurses	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐
Therapist(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Constantly ☐

2. Did these care providers communicate with you in a *timely* way about this patient?

Attending physician	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Case manager(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Floor nurses	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Therapist(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

3. Did these care providers communicate with you *accurately* about this patient?

Attending physician	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Case manager(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Floor nurses	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Therapist(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

4. When problems arose regarding the care of this patient, did these care providers work with you to *solve the problem*?

Attending physician	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Case manager(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

[6] Patient name can be inserted for individual patients. If known, the names of each provider can be provided in the left hand column along with the function.

Floor nurses	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Residents	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐
Therapist(s)	Never ☐	Rarely ☐	Occasionally ☐	Often ☐	Always ☐

5. How much did these care providers *know* about your role in caring for this patient?

Attending physician	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Case manager(s)	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Floor nurses	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Residents	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐
Therapist(s)	Nothing ☐	Little ☐	Some ☐	A lot ☐	Everything ☐

6. How much did these care providers *respect* your role in caring for this patient?

Attending physician	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Case manager(s)	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Floor nurses	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Residents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Therapist(s)	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐

7. How much did these care providers *share your goals* for the care of this patient?

Attending physician	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Case manager(s)	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Floor nurses	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Residents	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐
Therapist(s)	Not at all ☐	A little ☐	Somewhat ☐	A lot ☐	Completely ☐

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Endnotes for Chapter 3

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[xxv] For guidance regarding index development and interpretation of Cronbach's alpha, please see J. Nunnally (1978). *Psychometric Theory*. New York: McGraw Hill.

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[xxvii] To learn more about random effects multiple regression, please see J.A. Hausman (1978). "Specification tests in econometrics." *Econometrica*, 46: 1251-1271; and A.S. Bryk and S.W. Raudenbusch (1992). *Hierarchical Linear Models: Applications and Data Analysis Methods.* Newbury Park: Sage Publications.

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[xxix] For studies that have used mediation analysis to test theories of relational coordination, please see Jody Hoffer Gittell (2001). "Supervisory span, relational coordination and flight departure performance: Reassessing post-bureaucracy theory." *Organization Science*, 12(4): 467-482; Jody Hoffer Gittell (2002). "Coordinating mechanisms in care provider groups: Relational coordination as a mediator and input uncertainty as a moderator of performance effects." *Management Science*, 48(11): 1408-1426; and Jody Hoffer Gittell, Rob B. Seidner and Julian Wimbush (2009). "A relational model of how high performance work systems work." *Organization Science*, forthcoming.

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the paper in which the sample results were reported, see Jody Hoffer Gittell, Rob B. Seidner and Julian Wimbush (2009). "A relational model of how high performance work systems work." *Organization Science*, forthcoming.

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