

NEGOTIATION AND COORDINATION: A PRELIMINARY FIELD STUDY OF CONFLICT MANAGEMENT IN LARGE SCALE COLLABORATION

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Coordination of activities in many settings can be characterized by management of conflicts, potential and actual, because of resource limitations, high-stakes consequences, uncertainty, goal conflicts among stakeholders and hetero-hierarchical organizational structures. To understand coordination in such systems, we conducted a field study of management of surgical operating rooms. Although coordination efforts were focused on resolution of interdependencies, such as progress monitoring, scheduling and rescheduling, and prodding, coordinators managed a set of complicated conflicts, often through opportunistic means. They were very sensitive to potential conflicts, and used many different means to resolve the conflicts as reported in the literature. Additionally, they were very concerned with perceived fairness. The findings have direct implications to the deployment of information technology as it will change accuracy of information, barriers to access and means of information dissemination.

INTRODUCTION

Coordination is often characterized by multiple stakeholders with a need to work together yet often also with competing interests. According to the insight of Bannon and Schmidt (1991), competing interests (motives, perspectives, etc.) in organizations are perhaps more common than not. Consequently design of information and communication technology (ICT) to support coordination work requires an understanding of how coordination occurs as function of managing competing interests, in addition to management of interdependencies of tasks, as articulated by Malone and Crowston (1990). In healthcare, for example, introduction of large-scale ICT has met with resistance and failures (Aarts, Doorewaard, & Berg, 2004; Baldwin, 2003). Such failures remind us of the intricate nature of inserting ICT, as coordination in work settings is achieved by more than the mechanical articulation of individual activities; it also involves other social processes that interact with ICT.

Previous field studies on coordination (Seagull, Xiao, & Plasters, 2003; Seagull, Plasters, Xiao, & Mackenzie, 2003; Plasters, Seagull, & Xiao, 2003; Symon, Long, & Ellis, 1996) suggested the importance of management of conflicts and negotiation in coordination. Work processes are often negotiated and therefore different from formal procedures. Workers

choose to collaborate based on consideration of previous interactions and expectation of future interactions. There are several potential sources of conflicts.

Misunderstanding and miscommunication are two leading examples. Inherent organizational factors such as limited resources, different perspectives, “turf” and control, prestige, and incompatible personalities can also lead to conflicts. Managing these conflicts, we would argue, is an important feature of coordination and has direct implications on design and deployment of ICT.

In this paper, we report a preliminary field study on coordination work involved in the management of surgical operating rooms in a trauma center. Our focus was on strategies used to manage conflicts. Based on the findings, we then draw preliminary implications for use of ICT in coordinating work in such settings.

METHODS

The domain

Surgical suites in large hospitals consist of several to a few dozens of individual operating rooms (OR). In each OR, more than one surgical case is usually carried out each day. Successful surgery depends on a team of highly specialized care providers working effectively together: physicians from different subspecialties (e.g., neurosurgery, orthopedics, anesthesiology), OR nurses,

technicians, and housekeepers. Often specialized equipment and supplies are needed as well. Personal and financial stakes are high for the patients, the care providers, and the hospital. The needed expertise and resources have to be carefully coordinated to ensure safety and operational efficiency.

Intricate dependencies exist among the cases scheduled for a given day, among care providers, and among resources. Extensive long-term planning and scheduling efforts are designed to maximize efficiency and to determine staffing requirements and capacity levels (where are expressed as OR times: how many ORs are staffed for how many hours each day). Individual cases are scheduled according to available OR times. Despite these planning and scheduling efforts, much coordination effort is needed on the day of surgery for a number of reasons. New cases may be added as a matter of medical emergency or as patients' conditions change. Scheduled cases may be canceled or delayed because patients or staff are not ready at the scheduled time. Scheduled durations may turn out much longer or shorter than the actual (coefficients of variation of 25% (Strum, May, & Vargas, 2000). Hence, a dedicated role, usually called the charge nurse, is employed to "run" the ORs. A physician anesthesiologist (called the "charge anesthesiologist" or "floor runner") is often required in large surgical suites. These two roles will be referred to as coordinators.

Data collection

The study site was a 6-room trauma surgical suite as part of a busy trauma hospital. About 100 cases were performed each week, two thirds of which were scheduled before the day of surgery, and the remaining were either emergency or add-on cases. All cases on a day's schedule were handwritten on a large whiteboard ("OR board") centrally located (description of which can be found in (Xiao, Lasome, Moss, Mackenzie, & Faraj, 2001). The three groups of stakeholders (surgeons, nurses, and anesthesiologists) were organized by their profession and were in charge of their own staff scheduling.

To capture a wide variety of data, we planned an intensive two week study with three data collection methods (described below): shadowing with active observations, interviewing, and examinations of documents and artifacts. Data collection methods were approved by the Institutional Review Board. Although the duration was relative short for the preliminary study, previous studies of coordination in the setting had provided familiarity with the context and coordination challenges in general (e.g., Seagull et al., 2003). Data

collection efforts were guided by the following questions:

- (1) What are the sources and types of conflicts that coordinators have to manage?
- (2) How does consideration of fairness impact decisionmaking?
- (3) What are institutionalized procedures, practices, and traditions for avoiding and resolving conflicts?
- (4) How are presentation and communication of information influenced by consideration of fairness and conflict management?

Shadowing with active observation. Coordinators were followed from 6:15 to 9:30AM, and 1:00 to 3:00PM. The first period was to capture activities required to get cases started and lined up for all ORs, and the second to close down ORs towards the end of the day. When an assignment of cases, rooms, and staff was made (observable when changes were made to the OR board), the coordinators were asked for their explanation of how the assignment came about. The coordinators were also encouraged to think aloud about their coordination activities. Verbal permission was obtained for all audio recording of shadowing sessions.

Interviewing. We sampled nurses, surgeons, and anesthesiologists. The interviews were guided by open questions such as: "What does it take to be a charge nurse/charge anesthesiologist? What are the most challenging aspects of the responsibility? Can you provide examples of issues you find yourself troubleshooting on a daily basis? What negotiations do you find yourself employing daily in order to complete the cases scheduled for the day?"

Examining documents and artifacts. The coordinators were asked for samples of documents that they considered critical for their roles. Photographs of the OR board were taken periodically to document how scheduling information was presented in a shared information space.

Data analysis. Observational notes and transcripts from audio recordings were made. At the end of each day's data collection, major themes were identified through a group discussion among data collectors, as guided by the grounded theory approach (Strauss & Corbin, 1990).

RESULTS

Over the study period, 3 charge nurses and 4 anesthesiologists were shadowed. Five attending surgeons were interviewed. Data collectors spent estimated 60 hours in observation and interview. The preliminary results of the field study will be reported in two areas: sources of conflicts and strategies of

managing conflicts. We will then synthesize a set of tentative constructs from the field data.

Sources of conflicts. It was very clear from the field data that management of conflicts was an important part of being a coordinator. One document, prominently displayed, carried the title of “Rule of Engagement” (Table 1 for excerpts). The document was the results of experience in managing conflicts over the years and was intended to specify institutional rules to avoid conflicts. According to one charge nurse, the document was so displayed because when a surgeon questioned her decision making, she could refer to the document. Note the words “honestly” and “deceptive” in the document. Reported potential or actual conflicts were in following categories.

Emergency cases. When these cases were requested, the coordinators would have to “bump” other scheduled cases to vacate limited OR capacity to accommodate. Essentially the interest of one patient was judged against the interest of other patients and care providers. Since the concerned patients were often cared for by different groups of workers (indeed from different subspecialty, such as neurosurgery versus orthopedics), sometimes it was difficult for the coordinators to placate the surgeons whose cases were bumped. They may have promised their patients a specified time of surgery, and their staff had spent efforts in getting the cases scheduled and prepared. Compounding the situation was the possibility that a surgeon may declare a medical emergency when the patient condition might not warrant so to other care providers. In contrast, there were also situations in which cases were canceled and the coordinators were then able to accommodate last minute requests for OR time.

Staff shortage. This occurred several times when a worker was ill or had a personal emergency. The surgeons were unhappy about the delays caused by staff shortages, especially when they had scheduled other activities after finishing their cases.

Staggering rooms. As suggested by the term “cloning” in Table 1, one coordinator mentioned that surgeons would like to finish their cases efficiently to the point of wanting two ORs at the same time. One surgeon used the term “staggering” cases to describe the same behavior. In such situation, the surgeon may work on one case while another case is being prepared. On the surface there would be no conflicts as cases would be finished earlier. However, such arrangements may result in complaints from other surgeons and there may be implications for patient safety and efficiency for other clinicians.

Turf wars. It was possible for surgeons to take patients from a nearby hospital to the studied OR suite,

and such possibilities increased the competition for the limited OR times during day time. Surgeons would like access to OR at times of their choice. The coordinator complained several times about the fact that they had to be the messenger for “turf” wars. One surgeon complained that there was favoritism in allocating OR times, not based on patient’s welfare or OR efficiency, but on “who you are or who you know.”

Table 1. Posted procedure for resolution of conflicts

Rules of Engagement – Year 2002

1. **Authority:** The OR Charge Nurse is responsible for applying these rules, and for JUDGEMENT necessary to manage effectively in a rapidly changing environment. The Charge Nurse should seek assistance in resolving scheduling conflicts from (in order) The Anesthesia Charge Physician, The Trauma Team Attending, The OR Medical Director, and the Physician-in-Chief.
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- 5 **Bumps-** When selecting a case to be bumped, the Charge Nurse should begin with the bumping surgeon’s own cases, followed by any other cases belonging to that surgeon’s service, followed by (in order) add-on University cases, add-on Trauma cases, scheduled inpatient cases, and scheduled outpatient cases. A case which is bumped out of a room has priority over other cases in the same category when a room again becomes available.
- 6 **Communication-** If a case is assigned to a room but is not actually ready to go (surgeon unavailable, patient not cleared by Team, awaiting a test, in dialysis, etc.), another case will be assigned in its place. The original case will then “go to the bottom of the list” and will have the lowest priority in its category. To prevent this from happening the posting physician must honestly acknowledge any such constraints at the time the case is scheduled.
- 7 **Swapping Cases-** Case order and priority can be rearranged at any time if both of the attending surgeons involved agree to the switch. This also means that a single surgeon can rearrange his or her own scheduled and unscheduled cases as needed, among the priority slots assigned. (Example: a surgeon has 3 scheduled cases assigned to one room, and an add-on case that is third on the add-on list. He may switch the add-on to his second scheduled slot if desired, and move the last scheduled case to the third add-on slot.)
- 8 **Cloning-** No surgeon can be assigned a second room (either for simultaneous surgery or a “flip-flop”) unless there are no other available cases.
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- 12 **Ethics-** Repeated attending surgeon unavailability or other deceptive scheduling practices (such as posting a “phantom” to allow a later switch with a low-priority add-on) will be punished with loss of scheduling privileges, at the discretion of the OR Committee.

Strategies of managing conflicts. Coordinators described themselves variably as negotiators, ambassadors, and communicators, an indication of how much (or little) power they had in resolving conflicts. As a result, they deployed a number of strategies to avoid and minimize conflicts. The document in Table 1 was an example of the institution's attempt to manage conflicts. All coordinators were extremely concerned about "fairness." They sometimes articulated the patient's welfare as "making surgeons happy," and hospital's goal of efficiency as "making [OR director] happy." So in a sense their strategies were to balance various interests.

Stocking up favors. Since it was inevitable for coordinators to bear the bad news (e.g., "your case has been delayed") and to ask for flexibility (e.g., "could you do your case tomorrow"), coordinators reported ways to please others. One coordinator articulated the strategy as "stocking up favors." Another coordinator even offered a surgeon an earlier start, knowing in advance that that surgeon was not able to perform the surgery earlier, just to accrue a favor.

Keeping the score. Opposite to favors were perceived infractions accumulated by surgeons. The institution intentionally limited the number of nurses who could function as charge nurses as a method of insuring a consistent "institutional memory" of which surgeons broke rules. Infractions included manipulative requests, delays in performing their cases, and overly optimistic estimations of case durations or their ability to arrive at scheduled times.

Management of expectations. Although the "Rules of Engagement" document contained the specific disclaimer that a particular OR start time is not guaranteed for a scheduled case, surgeons nevertheless frequently expressed expectations, based on how their cases were placed on the OR board. One coordinator mentioned that she kept a mental order of cases to be carried out without putting the cases down in a definitive order, to avoid the perception of commitment of certain case orders.

Key constructs. A number of constructs emerged through analysis of the field data thus far. The first was fairness, as expressed by terms such as "equity," "priorities," "rules," "scores," "cheating," and "gaming." The second was negotiation, as expressed by the terms of "give and take," "favors," and "appeasement." The third was commitment, as expressed by terms of "expectation," "trust," and "entitlement."

DISCUSSION

Although a major component of the tasks of the OR coordinators is to implement planned surgical schedules, much of the coordinators' activities was to achieve the perception of fairness and to negotiate solutions. Rather than being unique, we believe that the domain of day-of-surgery management was a model to understand coordination in complex organizational context. If Strauss' conception of "articulation work" (1984) advanced our understanding of collaborative work, appreciation of conflicts may be another step in the same direction.

There are several implications for conflicts in terms of ICT system design. Since conflicts are nearly always present, whether or not manifested in full, collaboration in large socio-technical systems is always a coping process in resolving conflicts. For example, when two surgeons compete for the same operating room slot, at the end only one of them will use the slot. Temporary working documents (such as the case assignments on the OR board, annotated printouts of schedules, and staffing plans) are used in coordination. These documents often have the function of representing working solutions to conflicts ("at the sharp end"). These temporary documents do not have officiating identity but facilitate communication, workflow, and temporary arrangement. They are de facto resolution of conflicts yet do not carry the connotation of consent or agreement by all parties, and are not archived for future reference. They have a short working life and have a controlled audience. In contrast, data in information systems usually have a long working life and have multiple uses, including auditing and accounting. As a result, data appear on computer documents may give the impression of having official sanctioned status.

There has been much previous research on the topics of justices and fairness in the organizational behavior and human resource literature. Although the phenomena may be similar, fairness issues as associated with coordination are mostly of those "lateral" social influences (as opposed to supervisor-subordinate types). One interesting review article outlined a set of influence tactics used to achieve the so-called procedural justice, some of which have been reported in lateral relationships (Ambrose & Harland, 1995). In particular, "exchange/bargaining," "ingratiate/friendliness," and "deceit" are tactics that we could relate to the findings in our studies. Further exploration of the body of literature on procedural justice will likely produce insights into understanding of large scale collaboration.

The results of the preliminary study suggest several interesting research topics beyond the issue of perceived fairness mentioned above. Since negotiation was found to be a part of coordination, implementation of ICT may take away the ability of the coordinators in controlling and influencing how information is presented. Bannon and Schmidt (1991) described such consideration as “bounded transparency,” as opposed to the general accepted ideal of maximum transparency and awareness. When there are inherent conflicts of interests, it would be important to recognize the importance of controlling of information (Bannon & Schmidt, 1991): “A worker engaged in cooperative decision making must be able to control the dissemination of information pertaining to his or her work: what is to be revealed, when, to whom, in which form?” (p.12).

Similarly, in collaborative work settings workers often share information displays. One may study how such displays are manipulated to express commitment and expectation, and indeed how displays should be designed to accommodate subtle expressing needs (c.f., Xiao & Seagull, 2005). ICT to support coordination may improve information access, but may also bring the issue of trust about an institution’s expressed intention in implementing ICT: will the technology provide unfair advantages to certain stakeholders?

In summary, coordinators in the preliminary field study spent efforts to ensure the perception of fairness in often conflicting situations due to resource constraints and differing priorities from different stakeholders. These efforts included managing expectations, anticipating potential conflicts, controlling information access and presentation, negotiating solutions, and posturing. Implementation of ICT to support coordination should examine not only the mechanical articulation of activities from individuals, but also the companion social processes as part of coordination activities.

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REFERENCES

Aarts, J., Doorewaard, H., & Berg, M. (2004). Understanding implementation: The case of a computerized physician order entry system in a large dutch university medical center. *Journal of the American Medical Informatics Association*, 11, 207-216.

Ambrose, M. L. & Harland, L. K. (1995). Procedural justice and influence tactics: fairness, frequency, and effectiveness. In R.Cropanzano & K. M. Kacmar (Eds.), *Organizational Politics, Justice, and Support: Managing the Social Climate of the Workplace* (pp. 97-130). Westport, CT: Quorum Books.

Baldwin, F. D. (2003). Physician resistance arrests CPR system. *Healthcare informatics*, 34-36.

Bannon, L. & Schmidt, K. (1991). CSCW: Four characters in search of a context. In J.M.Bowers & S. D. Benford (Eds.), *Studies in Computer Supported Cooperative Work: Theory, Practice, and Design* (pp. 3-16). Amsterdam, Netherlands: Elsevier Science Publishers.

Malone, T. & Crowston, K. (1990). What is coordination theory and how can it help design cooperative work systems? In *Proceedings of the Third Conference on Computer-Supported Cooperative Work* (pp. 357-370). New York: ACM.

Plasters, C. L., Seagull, F. J., & Xiao, Y. (2003). Coordination Challenges in Operating-Room Management: An In-Depth Field Study. In (pp. 524-528). Proceedings of the American Medical Informatics Association Symposium, Washington DC 2003.

Seagull, F. J., Plasters, C. L., Xiao, Y., & Mackenzie, C. F. (2003). Collaborative management of complex coordination information systems: operating room schedule coordination. In (pp. 1521-1525). Proceedings of the Human Factors and Ergonomic Society 47th Annual Meeting, Denver Colorado.

Seagull, F. J., Xiao, Y., & Plasters, C. L. (2003). Distributed Planning Over Time and People: Balancing Sampling Effort and Information Accuracy. In (pp. 1772-1777). 2003 Proceedings of IEEE International Conference on Systems, Man, and Cybernetics.

Strauss, A. L. & Corbin, J. M. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage.

Strauss, A. L., Fagerhaug S., Wiener, C., & Suzcek, B. (1984). *Social Organization of Medical Work*. Chicago, IL: University of Chicago Press.

Strum, D. P., May, J. H., & Vargas, L. G. (2000). Modeling the uncertainty of surgical procedure times: comparison of log-normal and normal models. *Anesthesiology*, 92, 1160-1167.

Symon, G., Long, K., & Ellis, J. (1996). The coordination of work activities: cooperation and conflict in a hospital context. *Computer supported cooperative work: the journal of collaborative computing*, 5, 1-31.

Xiao, Y., Lasome, C., Moss, J., Mackenzie, C. F., & Faraj, S. (2001). Cognitive Properties of a Whiteboard: A Case Study in a Trauma Centre. In W.Prinz, M. Jarke, Y. Rogers, K. Schmidt, & V. Wulf (Eds.), *Proceedings of the Seventh European Conference on Computer-Supported Cooperative Work* (pp. 259-278). Bonn, Germany: Kluwer Academic Publishers.

Xiao, Y. & Seagull, F. J. (2005). Emergent CSCW Systems:The Resolution and Bandwidth of Workplaces. *International Journal of Medical Informatics (accepted for publication)*.