“Front-Stage” and “Back-Stage” Information Processes of Critical Discourse in Intensive Care Settings

Danny Ho, MS
Yan Xiao, PhD
Peter F. Hu, MS
Research in Patient Safety
dho001@umaryland.edu
yxiao@umaryland.edu
Phu@umm.edu

Vinay Vaidya, MD
John P. Straumanis, MD
Department of Pediatrics

Marcelo G. Cardarelli, MD
Pediatric & Cardiac Surgery
University of Maryland
School of Medicine
22 S. Greene St. T3R85
Baltimore, MD 21201 USA

Anthony F. Norcio, PhD
Dept. of Information Systems
University of Maryland
Baltimore County
1000 Hilltop Circle, ITE 404
Baltimore, MD 21250
norcio@umbc.edu

Ayse P. Gurses, PhD
Division of Health Policy and Management
University of Minnesota
D376 Mayo Memorial Building
420 Delaware Street S.E.
Mayo Mail Code 729
Minneapolis, MN, 55455
gurse001@umn.edu

Project website:
http://hfrp.umaryland.edu

Abstract
This paper presents an ongoing observational study to explore a “front-stage-back-stage” model of information processes during group discussions (multidisciplinary rounds) in the pediatric intensive care unit (PICU) of a large urban medical center. Participants were observed to collaborate on “front-stage” processes of presentations, discussion, and treatment planning, while in parallel they performed tightly-coupled “back-stage” information activities. The front-stage and back-stage information processes were interdependent to address the need for fluid, high time-pressured discourse with potential life-and-death consequences. We believe the front-stage-back-stage model adds to our understanding of collaborative information exchange and holds implications for computer supported cooperative work (CSCW) systems. For example, computing support may increase the efficiency and reliability of information transfer by enhancing the ability to "choreograph" front-stage and back-stage information processes during critical discourse such as medical rounds.

Keywords
Collaborative computing, healthcare, information management, CSCW, data collection, information systems
ACM Classification Keywords
H.4.1. Groupware, H.1.2. Human information processing, J.3 Medical information systems, H.5.3 Collaborative computing

Introduction
In high-tempo collaborative environments, effective information sharing and clear communication is vital. This is especially true in critical care environments, in spite of interruptions, multiple responsibilities, distractions, time pressure, uncertainty, and high consequences of decisions. [1] Although recommendations have been made for increased use of information and communication technology (ICT) to support communication in such environments [2;3], further understanding of collaborative activities is needed for effective systems design. [4] New concepts are needed to exploit increasingly ubiquitous computing and networked data infrastructure to dramatically improve the efficiency and effectiveness of communication. One form of communication in intensive care are discussions usually held daily to assess and plan collaborative patient care. The discussions are known as multi-disciplinary rounds because of multiple participants from a variety of disciplines and roles such as surgery, specialists, physicians, nurses, nurse practitioners, residents, and others. [2] Rounds occupy a significant portion of time in intensive care units (ICU) but they are key for all to share and discuss patient status and make treatment decisions. Time pressure is always present due to the need to discuss all patients in a unit and to make treatment decisions. [5] We build upon a recent framework of “information arena” that incorporates verbal as well as visual channels usually used in communication [6;7], and a recent study of information flow patterns through the use of common information space and personal space surrounding shift handovers. [8] In this paper, we report a model to capture the information processes in common and personal information spaces during group, face-to-face discussions.

Methods
An ethnographic study was carried out in a 10-bed pediatric ICU of an academic medical center. Discussion of each patient lasts 10-30 minutes and occurred near the patient’s bedside. The number of participants ranged between 5 and 20. The initial stage of the study was direct, non-participant observation by multiple researchers with an informant as a research collaborator. Categories of observed information activities were developed iteratively by examining field notes, artifacts used by care providers, short-interview notes, and photographs. A total of 5.7 hours for the discussion of 20 patients were observed. Care providers were interviewed for their perception of the roles of rounds in patient care. The initial stage was followed by audio-video recording of rounds with the approval of Institutional Review Board and consent of all participants. So far rounds for 5 patients were recorded with 17 consented round participants. Initial categorization of rounds was by apparent phases of each discussion: presentation of a case, discussion of significant development and assessment of treatment thus far, and plans for the next 24-48 hours. We also categorized the use of artifacts. [7] Audio-video recordings made it possible to examine parallel information processes through repeated video reviews (recording platform shown in Figure 1). A 170 degree lens was used to ensure adequate camera view. The first two authors reviewed the video recordings separately and together to develop constructs to capture the choreographing of discourse and interaction with information artifacts.
Timelines of verbal exchanges and use of artifacts by all participants were graphed to understand the multiple parallel processes.

**Front-Stage-Back-Stage Model**

Although previous studies of discussions during rounds were mostly focused on verbal exchanges [9], it was apparent in our observation that information processes were multi-threaded and overlapping. To extend the metaphor of “information arena,” we developed a front-stage-back-stage model to capture the information processes that are interdependent and are carried out by a number of participants (Figure 2). We defined those information processes as front-stage when they were part of verbal exchanges occupying the conversation “floor.” Back-stage processes were those not occupying the floor, mostly non-verbal but occasional side conversations or gestures. Below we illustrate the use of the front-stage-back-stage model in capturing the interactions between the multi-threaded information processes and discuss the model’s implications on designing computing support for the information arena.

Front-stage activities drive front-stage activities (#1). Many front-stage activities prompt still other front-stage activities. For example, a resident is presenting a data point that the attending regards as a good point for teaching and interrupts the presentation to launch into a didactic discussion.

Front-stage activities drive back-stage activities (#2). The most common example is for attending physicians to fill in their personal notes (back-stage) as the presenting resident reads the data values out loud to the group (front-stage).

Back-stage activities prepare for supporting front-stage activities (#3). One example may be that a resident on the computer is listening to the presentation and locates relevant patient data on the computer. The resident may interject to provide the latest value.

Back-stage activities drive other back-stage activities (#4). One example could be when a note-taking resident has difficulty keeping up with the presented data and confers with another participant nearby. They would quietly exchange information as the round proceeds uninterrupted in the front-stage.

According to this model, front-stage activities have received the majority of the research attention, especially...
those carried out in verbal channels. [9] Our observations, made possible with video analysis, were focused on the interactions between front-stage and back-stage (arrows #2 and #3): how activities in one stage drive or influence the other. We will then proceed to speculate on the implications for designing support for the interactions between the activities in the two stages.

The "Precious" Front-Stage
The front-stage clearly occupies "precious" time with a single conversation "floor." Participants may be reluctant to disturb the front-stage and resort to the back-stage. They also negotiate the use of the front-stage for discourse. In one instance, one senior nurse asked the presenter about the amount of protein supplement prescribed to the patient. The presenter proceeded to search for this information while all participants looked at her and waited patiently. After several seconds of searching, the surgeon asked simply if the value was 'maximized', indicating a reduced requirement for that data value, as long as the value is maximized. In another instance, an x-ray was requested but was not immediately available. After a three second wait, the resident announced 'Anyways...' and proceeded with presentation. In the mean time, another participant continued searching for the x-ray as a back-stage activity instead.

Parallel Back-Stage Processes
The predominant backstage process is note-taking as the front-stage is used for data presentation or announcement of decisions. We frequently observe physicians and nurses take notes for both personal references as well as part of official medical records. We also observed back-stage activities in the form of short side conversations. In another example, we observed a cardiologist check data on the computer during a case presentation, which prompted him to check a patient monitor while discourse was ongoing in the front-stage.

Back-Stage Preparation
Before rounds even began, we observed several back-stage preparation activities, such as preparing personal notes for reporting data values, and loading computer data (e.g., chest x-rays and laboratory data).

Expectations of Back-stage to Support Front-Stage
We observed a social expectation that someone would look up the most recent patient data while a resident presents a case (Figure to the left). Over time an expectation was developed for back-stage information processes to support front-stage processes. In the example in the left figure, the backstage information processes were driven by the front-stage and were timed to provide visual references for the front-stage information processes. In another example, when the x-ray was presented, an attending physician used the visual reference of x-ray to support his front-stage discourse (Figure 3).
Discussion

From our field observations, we have seen that back-stage activity interacts with the front-stage both as information contributor (e.g., during case presentation) as well as information receiver (transcription into personal notes). The interplay of the front-stage and back-stage processes may be influenced by traditions. For example, presentation of patient data may be enhanced by back-stage processes (e.g., through hand-outs). Since multiple participants are involved, use of the front-stage was designed for the lowest denominator: assuming everyone needs every piece of the data. In our observation of back-stage activity, some of this front-stage data sharing activity serves a very narrow back-stage information requirement. If that is the case, further study of back-stage information requirements can define the appropriateness of front-stage information exchange activities. It may be that some information may not be required to be shared, but transmitted directly from one individual to another. This is partially confirmed by witnessing many small group discussions immediately post rounds as individuals confirm their private back-stage organization over the course of the case presentation, discussion, and planning.

There is a potential to increase the “information density” of discourse. Newman and Smith observed a similar high requirement for ease of information access, beyond which people tended to disengage from the conversation [10]. We speculate that the use of the front-stage may be improved with computing tools to support back-stage preparation and visual presentation in the front-stage. In so doing, communication of precise information (such as data value or medication dosages) may be more reliable. A major role of the back-stage is then to assist in developing a common information space by packaging and organizing relevant information [11;12] for facilitating front-stage information exchange. These areas can be further addressed using a back-stage perspective on shared information spaces and information exchange.

We believe the front-stage-back-stage model provides useful guidance for both studies of critical discourse as well as for designing for supporting tools. Further research on the model is one way to enhance the efficiency and effectiveness of information exchange in collaborative critical discourse.

Acknowledgements

We thank the many participants involved in the study. We also recognize the support from Steve Seebode. The study was supported in part by National Science Foundation (#0534646). Opinions are those of the au-
thors and do not necessarily reflect the official position of the sponsor.

References