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# Collaborative Sensemaking: A Field study in an Emergency Department

**Sharoda A. Paul**

College of IST, Pennsylvania State University  
323 IST Building  
University Park, PA 16802 USA  
[spaul@ist.psu.edu](mailto:spaul@ist.psu.edu)

**Madhu C. Reddy**

College of IST, Pennsylvania State University  
321J IST Building  
University Park, PA 16802 USA  
[mreddy@ist.psu.edu](mailto:mreddy@ist.psu.edu)

**Christopher J. deFliitch**

Penn State Milton S. Hershey Medical Center  
Department of Emergency Medicine  
Hershey, PA 17033 USA  
[cdefliitch@psu.edu](mailto:cdefliitch@psu.edu)

**Abstract**

Sensemaking is the process of understanding an unfamiliar, unstructured, information-rich situation. While sensemaking research has been conducted at the individual and organizational levels, there is little understanding of how sensemaking occurs in groups. In this paper we examine findings from an ethnographic study of collaborative sensemaking among healthcare providers in an emergency department. In particular we focus on two aspects of collaborative sensemaking: the role of awareness and the role of digital and non-digital aids in supporting sensemaking activities.

**Keywords**

Sensemaking, collaborative sensemaking, ethnography, emergency department, ICTs

**ACM Classification Keywords**

H5.3. Group and organizational interfaces: collaborative computing, computer-supported cooperative work.

**Introduction**

The emergency department (ED) provides care to critically ill and injured patients and is the 'safety net' of the healthcare system [1]. Work in the ED is information-intensive and requires rapid response to dynamic and novel situations. Providing care to patients

in the ED requires collaboration between physicians, nurses, technicians, special consults and administrative staff. *Collaborative sensemaking* occurs when multiple actors with different thoughts about the world engage in the process of understanding 'messy' data or information [2]. Given the variety of patients coming to the ED, the time-criticality of action, the unavailability of information and the need for collaboration among providers with different backgrounds, collaborative sensemaking is an important aspect of work in the ED.

The process of how groups make sense is not clearly understood. Weick [3] provided a rich description of the nature of sensemaking in organizations. Russell et al. [4] defined sensemaking as cyclic processes consisting of searching for external representations and encoding information into these representations to reduce the cost of tasks to be performed. However, few studies have examined the *process* of collaborative sensemaking in groups and the role of existing information and communication technologies in aiding collaborative sensemaking.

### Field-study

We conducted an ethnographic study at HMC, a 500-bed teaching hospital in sub-urban Pennsylvania with about 50,000 ED visits a year. The hospital is serviced by emergency medical services (EMS) consisting of medically-equipped helicopters and ambulances. The ED at HMC uses an electronic medical record and a computerized provider order entry system, FirstNet, which interfaces with the electronic medical record. FirstNet is available on all ED computers and is primarily used to order tests and medications for patients. The FirstNet interface lists patient information in a spreadsheet-like view and lists for each patient her

bed number, triage level, chief complaint, nurse, physician, resident, events, lab results, radiology results, comments, and length of stay in the ED (figure - 1). The ED is organized as three teams - the red, white, and blue teams; each team is headed by a physician and has 4-5 nurses assigned to it. The charge nurse is the head nurse in the ED at any time and is responsible for assigning nurses and beds to patients. The nurse assignments are done via a whiteboard (figure - 2) placed in the central area of the ED.

We conducted observations, informal interviews, shadowing, and artifact collection to understand how sensemaking takes place in the ED and what aids are used. We analyzed 100 hours of data via a grounded theory approach [5]. We started by identifying types of collaborative work in the ED and examining the role of sensemaking in collaborative work.

### Collaborative work and sensemaking

Based on McGrath's [6] group task circumplex, we found that care providers collaborate on four kinds of tasks in the ED - planning tasks, intellectual tasks, decision-making tasks, and performance tasks. We found sensemaking to be an integral part of these collaborative tasks. Below is an example of sensemaking during a planning task. A nurse was trying to find a bed for an incoming trauma patient; trauma patients are the most critically ill patients brought to the ED and need immediate attention.

*Nurse asks the charge nurse (CN): "Do you have a bed for this trauma?" CN looks through FirstNet trying to see if she can free up a bed.*

*CN: "I don't have any discharges coming up. So it'll have to be the clock bed or a hallway bed or*



**figure 1.** The FirstNet interface being used on an ED computer.



**figure 2.** The whiteboard showing magnets for room numbers assigned to each nurse.

*something." Then she talks to some other nurses and is able to find a room for the trauma.*

*CN (to nurse): "23 will be for the old trauma as soon as it is cleared up."*

*Nurse: "We have a new trauma coming in?"*

*CN: "Yes."*

Here, the nurse (who only knows of one incoming trauma patient) does not have all the information that the charge nurse (who knows of two different incoming trauma patients) has. This leads to the need for the nurse and the charge nurse to collaboratively make sense of the situation.

The next example shows sensemaking occurring during an intellectual task. An intellectual task is solving a problem where there is only one correct answer [6].

*EMS has brought in a trauma transfer. Since the charge nurse (CN) is not at her computer, a nurse is trying to call her to find out where this patient is supposed to go. But the nurse isn't able to get in touch with the CN. She asks the physician if he knows which room the patient has been assigned.*

*Physician: "It's up on the board." He looks at the FirstNet overheard display and tells the nurse that the room is "trauma A". The nurse conveys this information to the EMS personnel.*

In both examples multiple actors with different thoughts about the world engage in understanding a "messy" information domain [2], i.e. sensemaking occurs. In both cases, FirstNet plays a key role in aiding group members' sensemaking. Similarly we found instances of sensemaking in decision-making tasks

(solving problems with a preferred answer) and performance tasks (psychomotor tasks performed against an objective). Along with FirstNet, paper and the whiteboard were frequently used in sensemaking activities

### **Role of awareness**

We found that both situation awareness and activity awareness play important roles in collaborative sensemaking. In the examples in the previous section, group members shared information as part of accomplishing a collaborative task. However, we found that group members frequently shared information not as part of collaborative tasks, but to raise the awareness of other group members. Situation awareness is the perception of the elements of the environment, comprehension of those elements and projection of their future states [7]. We found that group members often shared information – about the status of beds, incoming patients, and resource availability – to raise the situation awareness of other group members. For instance, the charge nurse asked a nurse, *"Hey, how is 8 doing?"* The nurse proceeded to tell the charge nurse about the patient's blood pressure, vital signs and reaction to the medications that had been administered. The charge nurse did not need this information for performing any task; she was increasing her awareness of the situation.

Collaborative work requires group members to maintain an understanding of the activities of others, which provides a context for their own activities [8]. We found that group members frequently shared information about their activities not with the aim of accomplishing explicit shared goals but to increase others' awareness of their activities. For instance one of the nurses

needed to leave the ED to take her patient to another unit and she announced loudly to everyone: *"I'm taking my patient to the MICU. Just like to let you people know where I'm at."* In this case too, the nurse was not sharing information to accomplish a specific collaborative task; she wanted to make others aware of her activities. In both the examples above, the information sharing enhanced the sensemaking of group members.

### **Artifacts and external representations**

It has been seen that people, when faced with vast amounts of information, create external representations [4] like diagrams, maps, and tables to organize information and make sense of it. We found that in collaborative sensemaking, common or "group" representations are used to organize information that is critical to the functioning of the entire group. In the ED, these group representations are provided by the whiteboard and FirstNet. We found that in spite of these group representations, "gaps" occurred in collaborative sensemaking. A gap was the inability of group members to collaboratively make sense of a situation using the information and communication tools available.

We observed one such gap during shift change between charge nurses. The outgoing charge nurse was briefing the incoming charge nurse about each patient in FirstNet. This crucial information exchange was frequently interrupted by phone calls and both charge nurses were feeling frustrated; this finally led to miscommunication of information. The outgoing charge nurse told the incoming charge nurse that a patient was 8 months pregnant whereas in reality she was 8 weeks pregnant. The correct information was available in

FirstNet but not in the main interface (figure – 1) and would have required several clicks to find. The outgoing charge nurse did not have the time or patience to find this information and so drew upon her memory.

Another gap was seen when an EMS member asked a registration associate about a patient she had brought in a little while ago, *"Do you know what the trauma number is for the patient that just came in?"* The registration associate looked through FirstNet and could only see one record with the "TRAUMA 750XXXX" number. She asked, *"Is that the one? Came in about 30 minutes ago."*

EMS: *"No, this just came in a few minutes ago. 17-year-old motor vehicle accident."*

The registration associate searched FirstNet again and could not find any other "TRAUMA 750XXXX" patient number. So, the EMS member went off with this patient number even though no one was sure if this was indeed the patient being sought.

### **Representation shifts**

We found that gaps in sensemaking occur when individuals are not able to fit their task-specific or role-specific information into available group representations. Thus, the spread-sheet view of patient information offered by FirstNet is not detailed enough for the charge nurse to access and convey information about every patient to the incoming charge nurse during shift change. Also, registration staff is not able to disambiguate trauma patients based on the information encoded in FirstNet.

Russell et al. [4] noted that "sensemakers change representations either to reduce the time of overall

tasks or to improve the cost versus quality tradeoff.” (p. 272). Our study found that in collaborative sensemaking, representation switch can occur when group representations do not support task-specific encoding of information, i.e. when gaps occur in sensemaking. Group members, whose tasks are not supported by group representations, create alternate representations for sensemaking. Since different representations are supported by different information and communication tools, representation shift often leads to switch in tools used for sensemaking.

If the tool allows flexibility to modify representations, then group members make small changes to group representations to fit their individual tasks. For instance, charge nurses leverage the flexibility of the whiteboard in different ways to suit their tasks, as seen from the variety of annotations on the whiteboard (figure - 2). If the tool does not allow flexibility, i.e. group representations cannot be easily adapted to suit individual tasks, sensemakers often switch to paper or even verbal communication. The FirstNet interface, for instance, cannot be modified and so charge nurses are often unable to use FirstNet to encode or view information in a way that supports their tasks. This is when they resort to using paper or stickies for encoding information required for their sensemaking activities.

## Conclusion

We are interested in discussing with workshop participants several questions arising from our findings:

- Why is awareness an important aspect of collaborative sensemaking?
- What happens when gaps occur in collaborative sensemaking and individual members abandon common

representations to create their own representations for sensemaking?

- How can interfaces be designed to prevent gaps in collaborative sensemaking?
- How can interfaces provide “group” representations that are still flexible enough to support individual members’ task-specific information encoding?

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