

Sensemaking, safety, and cooperative work in the intensive care unit

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Abstract Making sense of circumstances and situations is critical to coordinate cooperative work. Especially in process control domains, we may expect that effective and reliable organizations will possess processes that develop, maintain, distribute, and, when necessary, repair this social understanding (sensemaking). Our research has focused on collective sensemaking process in an intensive care unit (ICU). Thus, sensemaking is most likely to be visible to researchers in high tempo, high uncertainty work settings such as hospital ICU, where complexity, criticality, and uncertainty are the main characteristics of the working activities and making sense of what is happening is one of the most important challenge of the team of physicians working in this context. The research demonstrates how workers create and distribute sense within small work groups and also how they use the results of these efforts to coordinate ongoing work activities.

Practitioners tradeoff the opportunity costs of formal, collective sensemaking (*sensemaking at intervals*) against the value that this preparation provides to sensemaking during high tempo work (*sensemaking on-the-fly*). Further study of this dynamic balance will provide insight about how practitioners construct platforms for action during future, uncertain, high stakes work.

Keywords Safety · Collaborative sensemaking · Intensive care unit work

1 Sensemaking and cooperative work

Dramatic failures of sensemaking are the basis for much of the research on sensemaking. Weick's re-analysis of the Mann Gulch disaster (Weick 1993) is the archetypal case. While fighting a forest fire at Mann Gulch, Montana, 13 men were burned to death by a fire that overtook them as they ran up a steep slope. Norman Maclean, an English professor at the University of Chicago, wrote an account of the fire (Maclean 1992) which shows that one firefighter comprehended the nature of the danger facing the team and devised and used a solution successfully. The rest of the team rejected the solution and tried to escape the fire, all but two dying in the process. Such cases are useful as a starting point for analysis of sensemaking in organizations precisely because they combine what seems to be a failure to make sense and graphic demonstration of what seem to be consequences of this failure. But the celebrated cases of sensemaking failures leave us to wonder how it is that people are usually able to make sense of the work world. What is the role of

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sensemaking in organizations? Is it only sometimes required, e.g., when critical situations arise? Can sensemaking itself be organized and modulated? More particularly, is it a mechanism to coordinate individual contribution in effective collective actions?

As Karl Weick stated (1995, p. 6) “Sensemaking is about such things as placement of items into frameworks, comprehending, redressing surprise, constructing meaning, interacting in pursuit of mutual understanding, and patterning.” Sensemaking is the action that permits the passage from a non-sense situation to a situation that makes sense for all the persons involved (R.I. Cook, personal communication). Because of its social nature, it is difficult to confine the sensemaking process to a unique definition, so Weick tries to clarify the concept by comparing it to others which are similar and by underling the differences. Sensemaking is more than interpretation, as interpretation is about meaning, while sensemaking is also about how the meaning is built and read. In addition, social sensemaking does not include merely a shared meaning; rather, it is possible to say that it is the experience of the collective action that is shared. To understand sensemaking is to pay attention to organizational and social elements that guarantee the coordination needed for action (R.I. Cook, personal communication). Sensemaking keeps action and cognition together.

In this paper we present a study of sensemaking in a natural context, “in the wild” (Hutchins 1995) and some consequences this inquiry may have for the understanding of what sensemaking is and how it contributes to the success of the cooperative work in highly uncertain settings. We studied a busy intensive care unit (ICU) in a large teaching hospital and the function of what the workers here call “rounds.” The study shows that sensemaking is a cooperative cognitive activity that focuses sharply on the plans, uncertainties, and possibilities of the near future.

2 The theoretical framework

We begin with apparently straightforward questions. How do practitioners cope with the complexity and uncertainty of the ICU? How do they manage to produce good results and avoid bad ones? Following Rasmussen in the analysis of natural contexts (Rasmussen 1995) we understand that safe systems are not necessarily error-free. Safety is a dynamic rather than static feature of systems (Cook and Rasmussen 2005). Safety is an emergent property of the ways in which the different properties of the system (technical, individual,

organizational, economic) collaborate or clash (Reason 1997). It is the product system characteristics, including sharp-end (Cook and Woods 1994) worker coping with the various demands and possibilities that arise. Ultimately, workers’ coping with complexity (Woods 1989) is expressed in tradeoffs. For example, each ICU attending physician must direct patient care (e.g., therapy, laboratory studies, investigations, procedures), the organization of work (e.g., allocation of new patients to residents, resident shift coordination), learning activities (e.g., what to teach to residents, when to do so). Devoting time and attention to one or another activity takes that time and attention away from all the others. These tradeoffs take place in a high hazard, time pressured setting under uncertainty. All this coping takes place in a notoriously ill-behaved domain. New patients can appear with little warning, old patients may suddenly deteriorate, and tempo of operations can go from *andante* to *allegretto* with little warning.

It is likely that real world practitioners have tools that allow them to make sense at a macro level of the complexity and organize their coping with it. Sensemaking (Daft and Weick 1984; Weick 1995; Manning 1998) is a candidate concept for the analysis of social coping under stress. The work of ICU teams involves many patients and many different activities in parallel. Work is distributed in ways that make it impossible for any individual to sustain a complete understanding of the situation. Although far from the dramatic situation of the firefighters at Mann Gulch, the conditions in the ICU must be challenging to workers and managers. Sustaining coordinated, purposeful activity on multiple fronts in a rapidly changing environment is unlikely to happen simply by chance. Instead, it seems likely a priori that some sort of ordinary sensemaking must be present in the ICU.

3 Methods

This methods used are the hybrid socio-technical approaches developed by Woods (1989) and Weick (1995). With institutional human subjects review board approval and consent of the workers, we examined work-in-context in an busy, ICU in a large, tertiary care, teaching hospital in the U.S. Field observations were conducted so that we could participate in all the unit activities and understand the complexity of the work done. We conducted repeated observations over 10 weeks. The focus of the observation was the work activities of physicians in the ICU unit. The ethnographic study included a combination of observations and interviews.

In addition to field notes, we recorded 300 h of verbal communications that took place in the ICU and analyzed 400 pages of transcriptions from those communications. The field observations focused on the work in the ICU, and particularly on moments where interactions among the participants were visible. These include the process of scheduled “rounds” (the term is slang in this work domain that refers to any process involving the sequential review of a group of patients by workers). The observations are centered on the medical team (residents and the attending) and on their daily working tasks. A grid was used to organize the field notes and tape recorded verbal communications. Portions of the recordings were transcribed to provide illustrations of the main findings. The behavioral protocol analysis method of Woods (1989) was used to structure the field notes.

4 Making sense in the intensive care unit

In the ICU under study, a single attending physician supervises a group of trainee physicians of varying levels of experience. The makeup of the group varies from day-to-day and week-to-week but attending staff typically remain “on service” for up to 1 week at a time. Other participants include fellows taking specialty training in intensive care, residents in surgery or anesthesiology, and students in their third or fourth year of medical school.

Morning rounds are variably formal. Presentations from medical students, residents, and fellows are made to the attending physician who interacts with the presenter and others. The group walks from patient to patient, stopping to conduct the formal portion of the rounds. Often one or more nurses and one or more pharmacists participate in some portion of the rounds.

When asked for a definition of the formal morning round, one attending physician said, “a round is a fundamental activity to point out what to do and to build a common mental model of it.”

Not surprisingly, the trainees view rounds somewhat differently. A resident pointed out the importance of round for identifying and sharing what matters for the action: “(...) that’s sort of where the plans set, so when you do it in the morning with everybody that kind of gets everybody kind of on the same page, so we’re all sort of aware of what’s happening with each patient... (...).”

It is clear that formal objective of morning rounds is to develop and make explicit the plan for the day. Practitioners’ tradition of rounds allows them to collaborate in making sense of the ongoing processes

and to prepare for the need to manage unpredictable but expected demands over time ranging from the next few minutes to many hours. A round is one of the most significant occasions where the clinicians develop a collective sense of the situation they are working in. And this sense is a precondition to accomplish of the actions that follow.

5 Inside of “rounds”: sensemaking at intervals

In the formal morning round, physicians present and discuss the different patients (often referred to as “cases”) sequentially. The case discussions have similar main moments that fit within a general scheme (see Fig. 1).

5.1 Case presentation

In the ICU under study, each patient is assigned to a trainee who is primarily responsible for that patient’s care. On rounds, patients are discussed in sequence. Trainees begin by presenting the case. The format for presentation is more or less fixed but the content varies with the characteristics of the patient’s condition. The presentation of the patient makes the trainee’s sense of

Moments of the case discussion:

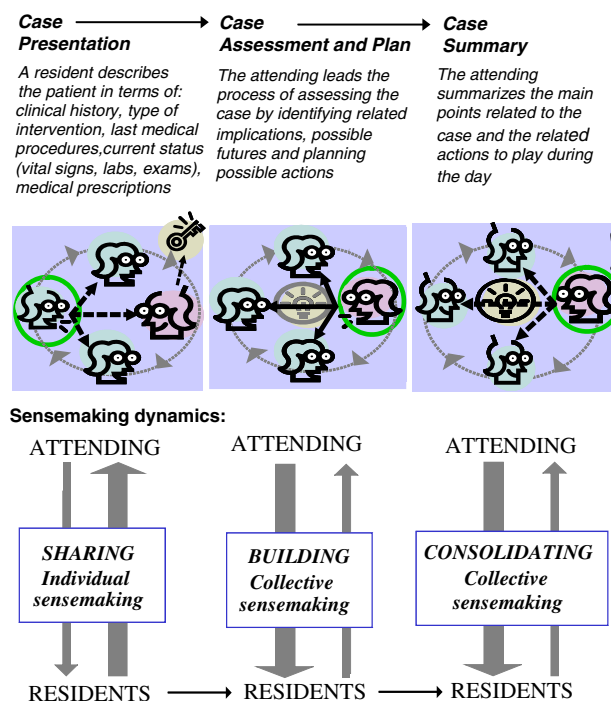


Fig. 1 Sensemaking at intervals inside a “round”

the case evident to the others who construct their own understandings of the patient's condition. Although all the group members hear the presentation, the speech utterances themselves are directed toward the attending.

Excerpt 1: Setting: Morning, 7.00 am, group gathered outside of the patient n.1's room

Dr C—Medical attending; Dr O—Male Medical resident; Dr A—Female Medical resident; Nurse

1. Dr C (attending)—I can't remember a thing about Mr X. Where's Dr O when you need him?
2. Dr O (resident)—I'm going to have to fill in I'm sorry. So this is Mr. C, he is our 68 year old gentleman who uhm is status post cabbage, like a few months ago actually, he was admitted from and outside hospital in cardiogenic shock and respiratory failure who had a vegetation on his mitral valve...
3. Dr O (resident)—Septic shock?
4. Dr C (attending)—septic shock, a he received a new porcine mitral valve on the 4th, tricuspid valve repair since then, he's had a trach complicated by a bleeder of his...
5. Dr O (resident)—tracheo-carotid fistula, tracheo-thyroid fistula
6. Dr C (attending)—tracheo-thyroid artery fistula, a and he now has a g-tube in place, this has all be complicated by persistent a-flutter, uhm, so there you but, that's his story
7. (inaudible)
8. Dr O (resident)—um no I'm stumbling though this...so yesterday he did a have his ultrasound, ultrasound of his left upper extremity and bilateral lower extremities (...) And overnight he remained tacky sometimes up to the 130's uh they gave him, uh lets see 250 of albumin once and then 50 of albumin twice,... (...)
9. Dr C (attending)—is it working?
10. Dr O (resident)—I would say equivocal
11. Dr C (attending)—is this the longest he's been off vasopressants so far
12. Dr O (resident)—yes, but we're also tolerating lower blood pressures, but it could be, yea, I mean
13. Dr C (attending)—okay
14. Dr O (resident)—I don't think its hurting
15. Dr C (attending)—okay
16. Dr O (resident)—yea...uhm neurologically, he is uhm.... you know sort of waxes and wanes I would say, but he is interactive, uhm he's able to move all of his extremities however strength in the left side is more like 4 out of 5 and the right side is like 1 out of 5. uhm, he is able to communicate,

uhm not verbally, but you know he...he talks, he requests cigarettes uhn. (...)

17. Dr C (attending)—great
18. Dr C (attending)—can't wait
19. Dr C (attending)—I will fill this in (referring to the plan)

In this instance, the patient is well known to the group. Dr C moves the presentation forward to the new information by quickly stating the history (Excerpt 1, line 4), effectively encouraging the presenter to get to the now-relevant details. The presenter quickly focuses on the relevant information (Excerpt 1, lines 8 and 16). Significantly, the attending physician is engaged in the presentation, interrupting the presenter and asking the presenter others questions. In this phase, the attending has two objectives: creating and reviewing his own understanding of the patient's condition and also understanding the presenter's understanding of that same condition. The attending physician is engaged in sensemaking about the patient and also in making sense of the presenter's own sensemaking.

5.2 Case assessment and plan

Following the presentation, the case discussion undergoes a subtle change as attention shifts from what has happened in the past to what is likely to happen in the future and what actions need to be undertaken.

Excerpt 2: Setting: Morning, 7.30 am—group gathered outside of patient n.2's room, after initial case presentation

Dr C—Medical attending; Dr X—Male Medical resident; Dr O—Female Medical resident; Nurse

1. Dr C (attending)—I'm not going to lie to you, but I'm going to make you sweat it...go look at his toes. Don't we need a GI consult for his toes? (background noise, talking)
2. (inaudible)
3. Dr C (attending)—Go look at his toes. Dr X, do me a favor, go press on his left lower quadrant, tell me what you think (background talking)
4. Dr C (attending)—What'd you think of his left lower quadrant?
5. Dr X (resident)—No tenderness, not lesions, ...I was not impressed. What did you think of it?
6. Dr C (attending)—It seemed a little tender to me yesterday afternoon
7. Dr O (resident)—You're worrying about diverticulitis aren't you?

8. Dr C (attending)—Does he have a lot of peripheral vascular disease in his feet bilaterally
9. Dr X (resident)—Yes, well, no, I mean, well actually, no, no, no from (inaud) from his duplex, um, he had some posterior tibial, but
10. Dr X (resident)—On the right side only
11. Dr.X (resident)—Yea, but, I mean, the perfera and the toes are
12. Dr C (attending)—Toes are from a consequence of...
13. Dr C (attending)—Hypotension and shock
14. Dr C (attending)—Vaso constrictors...right
15. Dr C (attending)—And his
16. Dr C (attending)—Do you think there might be other parts of his body that might look like that?
17. Dr O (resident)—Well, are you worrying about his gut?
18. Dr C (attending)—So if he had an, a watershed infarction and his colon looked like his toes, what would he look like? He would look like a guy whose on vanco, cipro, gents with a non recovering renal failure, smouldering hypotension, um,
19. Dr X (resident)—You would think that he wouldn't be tolerating his tube feeds...he'd have some, well I mean; he wasn't tender at all today.
20. Dr C (attending)—So what should we do, should we CT his abdomen? Get a GI consult? So I mean, if his colon looks pink when they look, we can be pretty confident. On the other hand if it looks dusky or worse, then it's a big change in plan in him, right?
21. Dr O (resident)—True
22. Dr C (attending)—So take it out

Here the focus of attention is on the anomalies rather than the consistencies and the plan emerges as the various issues are brought forward and examined. Questions are usually asked in order to be sure that the plan will be executed in the form it has been conceived. "I need to make sure that everyone will do what we decided to do. We need to get everyone on the same page to make things work on safety," a medical doctor who covers the attending role said, pointing out that questions are aimed at formulating the possible diagnosis and scenarios of evolution and the related expectations for the future but they are also useful to check once again the actions to take in terms of orders to be written, procedures to be done, consultations to be obtained. Significantly, some of the questions are about the future. By asking these questions, the attending is drawing attention to specific features of the case (Excerpt 2, lines 4, 8, and 16). By emphasizing which data matter and asking for their interpretation

the attending gives the trainees an opportunity to construct their own sense of the case and anticipate the future.

5.3 Summary

The summary works to revise and confirm the shared sense, incorporating the complex aspects into a single narrative. The summary is usually brief and recounts the relationship between the past data and the plans for the future, especially the specific actions to be taken by group members.

Excerpt 3: Setting: Morning, 10.00 am—Dr C—Medical attending—a group discussing the possibility to discharge patients

Dr C (attending)—So that, that's important, you need to understand that she's going tic, tic, tic, tic, tic...alright, so, do you want to write and order to start heparin, starting at four or five PM. And lets start her therosomide infusion at five and say at eleven or twelve. If her blood pressure goes down, stop that, or actually, I don't care about her blood pressure, I care about her mental status, if her mental status goes down, stop that piece. Alright so neurologically, wake up exercise to extubate, if she tolerates that well, we'll probably start turning down her nor epi and then her dobutimine, those are park driving her afib, to it may be that she will, be in sinus rhythm so we can get those guys off

Dr O (resident)—ok...all right...I will talk to a physiotherapist right away

The sensemaking that occurs during rounds we may call "sensemaking at intervals." Its most salient characteristic is that time is set aside for it and its conduct is formalized in ways that are tailored to the need to create shared sense amongst the participants to bring together information, expectations, and plans in ways that naturally result in coordinated assessments and actions.

6 Outside of "rounds": sensemaking on-the-fly

In the ICU, while carrying out daily activities, the moments dedicated to the discussion of what is going on and to the decision making process for the patients' care last few moments and seem more a review of the sense built during rounds and other meeting rather than a continuous creation of new interpretations, decisions and related plans. Instead, clinicians concentrate on how to perform the decisions they have already made. They dedicate to the technical content of the work.

Excerpt 3: Setting: Morning, 7.30 am—Cardiac surgery unit—out of the patient n.2's room—Day of observation 15

Doctor C—medical attending intensivist; doctor O—resident anesthesiologist

1. Dr C (attending)—and then what you can do is drape her with sterile towels and then when you're there, you're going to numb her a up here (inaud) chin
2. Dr O (resident)—yea
3. Dr C (attending)—okay, wire in the sheath, pour this out (inaud) glove, I'll be helping
4. Dr O (resident)—okay, alright
5. Dr C (attending)—this is the first stuff I can (inaud)
6. Dr O (resident)—right
7. Dr C (attending)—P15 are you comfortable? So what we're going to be here, we're going clean off your neck with some cold wet stuff, okay (...)
8. (background noise)
9. Dr C (attending)—(addressing to the patient) He's (the resident) just going to clean that off...that's all Special soap, that's all

Once rounds are complete, the remainder of the work day is handled “on-the-fly” (see Fig. 2). Sensemaking in real time takes place in parallel with process control activities, as practitioners work to keep pace with the tempo of operations. This real time sensemaking draws on the results of rounds and the success of rounds is measured, in part, by how well that

sensemaking at intervals anticipated the needs of practitioners through the day.

While working on-the-fly, clinicians are more concentrated on the definition of how to perform the decisions they have already taken. The focus is on the action (see Excerpt 3). Being woven into the continual work activities, most real time sensemaking is hidden from view. The relationship between the round and the work on-the-fly is not unidirectional. While performing the daily activities, each operator gets new information related to the ongoing situation. They review and update the sense of the situation built during the round according to this new information. The individual sense will be shared again during the meeting in the afternoon and the next round and will contribute to update the social sense.

7 Sensemaking, cooperative work, and patient safety

High reliability organizations are marked by an accurate, precise, and commonly held understanding about current operations and the relationship between those operations and potential accidents (Cook and Rasmussen 2005). A common understanding of the operating point produces effectiveness in coordination and communication processes and safer performances. The sensemaking processes create and nourish a common understanding of the current situation among the operators and support the cooperative work and successful performances. Sensemaking on-the-fly lets each actor maintain a view of how the situation is evolving over the time. Sensemaking at intervals, here in the form of the round, prepares the operators to cope with potential risks. The close relationship between the content of the round discussions and the workers sets up what Rasmussen (1995) calls “cooperative conditioning.” The combined attention increases the likelihood that the shared understanding of the situation is appropriate and accurate. This is one of the most important conditions for the realization of patient safety.

By preparing the conditions (knowledge and social cohesion) needed for sensemaking on-the-fly, these workers build a defense against future times, when work pressures may limit the sensemaking at intervals or when some members of the groups are no longer present. The trade off here is between the work pressures of today and investment in sensemaking that will be needed tomorrow, next week or next year.

Close examination of the interplay between sensemaking at intervals and sensemaking in real time can reveal domain features of interest. The balance

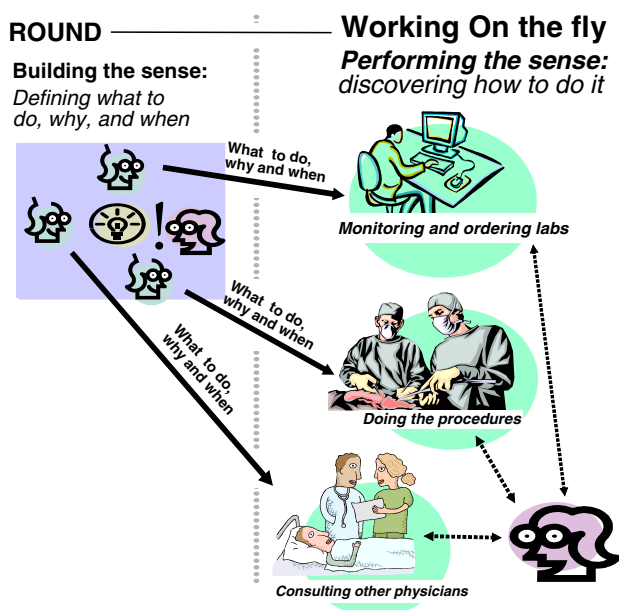


Fig. 2 Sensemaking “on-the-fly”

between these two types of sensemaking reflects, among other things, the amount of irreducible uncertainty in the workplace, the confidence of practitioners in their ability to achieve shared, collective understandings, and the need to balance effort directed toward immediate, short-, and long-term needs. These relationships have central relevance for risk management and patient safety (Laporte and Consolini 1994; Weick and Sutcliffe 2001; Cook and Rasmussen 2005).

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