



How an institutional setting shape and limit the mitigation of accidents in complex work settings

Johan M. Sanne^{a,*}, Colin J. Pilbeam^b

^a IVL Swedish Environmental Research Institute & Luleå University of Technology Sweden

^b Cranfield University, Cranfield, Bedford MK43 0AL UK

ARTICLE INFO

Keywords:

Accident
Sensemaking
Technology
Language
Power
Institutions
Habits

ABSTRACT

Introduction:: Research suggests that accidents due to failed coordination arising from the disruption of everyday activity can be mitigated by empowered employees through sensemaking activities: observing or recognizing cues, voicing concern, and considering alternative perspectives. Unfortunately, the literature also observes limits to such activities due to the influence from technology, power, and language. However, there is negligible understanding of the mutual influence of these phenomena on (the failure of) sensemaking to prevent escalation. **Method::** Using an institutional and sociomaterial approach to sensemaking, we integrate the influence of technology, power, and language to investigate accident commission data (e.g., talk between different actors and interviews), from a railway accident in Sweden in 1987, showing how a minor disruption in everyday work escalated into a situation that exceeded the limits for effective sensemaking.

Results:: Technology, power, and language in institutional settings, expressed through actors' habitual repertoire, influence sensemaking and its outcomes. The findings indicate that actors' habits encourage the continuation of immanent sensemaking and that it takes strong, specific, cues to shift to deliberative sensemaking. Moreover, also deliberative sensemaking is influenced by actor's habitual repertoire, limiting its quality.

Conclusions:: The efforts to mitigate the escalation to tragedy in this case failed because of the mutual influences of technology, power and language operating within an institutionalized and heavily regulated work environment. This resulted in fragmented or minimal sensemaking that, in hindsight, did not match the complexity in the accident and the response that would have been required.

Practical Applications:: To enable sufficient articulation of concerns and collaborative problem-solving in complex safety-critical systems, there is a need to break with hierarchical relations, to create a shared language, and employees should be made aware of the potential misleading signals from technologies designed to ensure safety.

1. Introduction

In the early afternoon of November 16, 1987, two intercity trains collided at Lerum commuter station on the main route from Göteborg to Stockholm, Sweden. The high-speed collision (220 km/hour in combination) killed 9 and injured at least 120 people on both trains. In this instance professional communities within the railway industry (dispatchers, train drivers and two trades of railway technicians, specialized in signals and tracks respectively) operated at the scene, and although separated spatially, collectively used familiar, yet complex, technology. For the most part they worked independently from each other and were so immersed in the routine practices of their professional roles that they were apparently unable to engage in the necessary sensemaking

practices needed to mitigate the accident. Why? After all, one might expect skilled and concerned employees in safety-critical organizations to achieve successful sensemaking routinely, and that these organizations would support practices like heedful interrelating (Weick & Roberts, 1993). Indeed, there are well-known ways to prevent the inevitable interruptions to daily work from escalating into accidents through mindful sensemaking activities, such as observing or recognizing cues (Brown et al., 2015; Sandberg & Tsoukas, 2015), voicing concern (Barton & Sutcliffe, 2009), considering alternative perspectives (Barton & Sutcliffe, 2009; Goodbrand, et al., 2021; Weick, 2005), actively sharing key assumptions (Weick, 1993), sharing critical information (Jahn, 2019) and exploring different interpretations of the same terms (Stigliani & Ravasi, 2012). Failure to adopt these and other practices

* Corresponding author.

E-mail addresses: johan.m.sanne@ivl.se (J.M. Sanne), colin.pilbeam@cranfield.ac.uk (C.J. Pilbeam).

<https://doi.org/10.1016/j.jsr.2025.02.009>

Received 20 March 2023; Received in revised form 1 November 2024; Accepted 6 February 2025

Available online 1 March 2025

0022-4375/© 2025 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

that support sensemaking were evident in this case, as they were also in the fatal Air France (AF447) plane crash (Oliver et al., 2017). Exploring that accident, Berthod and Müller-Seitz observed that “problems seldom start as a discernible crisis: quite often insignificant events end up producing a crisis” (2018, p. 63). So, the possibility of minor unplanned events escalating to disaster is not unprecedented.

The not uncommon experience of failure in safety-critical organizations suggests that the mitigating practices noted above are shaped by the institutionalized context of these organizations in ways that prevent their effectiveness. In particular, the effects of power and language in different professional roles and the influence of technology may all influence sensemaking. However, reviews of sensemaking literature regularly indicate that there is negligible understanding of the mutual influence of these phenomena on (the failure of) sensemaking (e.g., Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2015).

The institutionalized context of the railway industry is replete with hierarchically arranged professional roles that interact with shared technologies in different ways and each with their own language (e.g., Sanne, 2008). Taking an institutional approach to sensemaking (Weber & Glynn, 2006) we seek to integrate the mutual influence of professions, power, technology and language evident in the investigation account of this accident. Through this we are able to theorize how the sensemaking process – creation and interpretation of cues and subsequent enactment – is shaped and limited in institutional contexts. More specifically, we provide insight into how, when, and why the ‘immanent’ sensemaking observed in routine, habitual practices fail to shift to ‘deliberative’ sensemaking (Sandberg & Tsoukas, 2020) and mitigate events escalating to tragedy. In this way, we are also able to further theorize the mutual influence of power, technology, and language in institutional settings, adding to the literature on how such settings influence sensemaking in relation to risk and safety and with what consequences.

2. Sensemaking as institutional practice

2.1. Sensemaking: types, processes and plausibility

Sensemaking is variously conceptualized (Sandberg & Tsoukas, 2020). While the focus of most studies is on deliberate episodic sensemaking where actors intentionally seek to restore an interrupted activity or make sense of a problematic situation, some authors (e.g., Introna, 2019) have drawn attention to ‘immanent’ sensemaking, recognizing that actors are always embedded in a socio-material world and often engaged in ongoing routine activities that are habitual and non-deliberative, in other words ‘absorbed coping’ (Sandberg & Tsoukas, 2011). Sensemaking in these situations, was characterized by Dreyfus (2002) cited in Sandberg & Tsoukas, 2015, p. 12 as “a steady flow of skillful activity in response to one’s sense of the situation,” and sensemaking in these circumstances has been largely ignored (Sandberg & Tsoukas, 2015).

Sensemaking consists of three interrelated processes. Creation, the noticing and responding to cues that indicate an interruption to an expected course of action, is the first of these. Interpretation then follows to provide a more complete account of the interrupted situation. Finally, in the enactment process, actors act on the fuller account in an attempt to restore the interrupted situation permitting ongoing activity. Where discrepancies continue the cycle is repeated. However, sense may not always be fully restored (Sandberg & Tsoukas, 2015). Maitlis (2005) in her longitudinal study of British Symphony Orchestras identified four outcomes (guided, restricted, fragmented, and minimal) dependent on the sensemaking efforts of the actors involved. Fragmented sensemaking, for example, produces narrow accounts of the interruption and the resulting actions are inconsistent and lack cohesion. In other circumstances, minimal or no sense is made of the situation and sometimes disaster ensues (Dunbar & Garud, 2009). However, these two latter outcomes, where sense is not restored and action limited, are less commonly explored (Sandberg & Tsoukas, 2015).

Critical to the outcome of these processes of sensemaking is the creation of a plausible account, but not necessarily an accurate one, that is sufficient to sustain action (Weick, 2005). Schildt et al. (2020) argue that plausibility derives from coherence, which is a function of consistency within the context of a wider system of beliefs and pre-existing goals. The necessary intersubjectivity of these wider systems makes the attainment of coherence difficult to achieve. Even when actors are experiencing the same thing, studies like the Mann Gulch disaster (Weick, 1993) show that a shared coherent account may not be achieved. Moreover, other studies (e.g., the Stockwell shooting, Cornelissen et al., 2014) show that coherence is vulnerable to the influence of both episodic and systemic forms of power (Fleming & Spicer, 2014). Episodic power initiated by self-interested actors, occurs in discrete episodes, whereas systemic power is embedded in the social, technological, and cultural bureaucratic systems that surround and shape the context within which actors work (Lawrence et al., 2012). The influences of systemic power in sensemaking have been largely overlooked in previous studies (Schildt et al., 2020; Maitlis & Christianson, 2014), although the influence of institutional artefacts, such as rotas and timetables, on sensemaking was evident in Weick’s analysis of the Tenerife air disaster (Weick, 1990).

2.2. Institutional sensemaking

Institutions may be defined as “systems of established and prevalent social rules that structure social interactions” (Hodgson, 2006, p. 2), and include for example language and professions. By imposing form and consistency on human activity, and creating stable expectations of the behavior of others, institutions both constrain and enable individual behaviors (Hodgson, 2006). Although, individuals are immersed and socialized into this system of rules and norms (Weick et al., 2005; Hodgson, 2007) studies of sensemaking have overlooked the influence of this larger institutional context, as highlighted by recent reviews (Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2015). An exception is the work of Weber and Glynn (2006) who acknowledged that sensemaking occurs in an institutional context that shapes roles and identities and provides templates and scripts for action. These prescribe ways of working and set expectations of performance and establish particular logics of organizing. Reasonably, these institutional contexts influence sensemaking and its outcomes.

As noted above, power can influence sensemaking. In an institutionalized environment systemic power found in hierarchical relationships between different job roles is common. These different roles with their differing job assignments and consequently different experiences shape perceptions and language (Taylor & Van Every, 2000) and permit the emergence of different cognitive frames that influence sensemaking (Strike & Rerup, 2016; Dunbar & Garud, 2009). Hierarchical relationships can also affect communication. In particular those in lower positions often fail to speak up to those in authority (Milliken et al., 2003; Tourish & Robson, 2006). While this may be out of fear of reputational damage (Blatt et al., 2006), it may also be out of deference to the expertise of others based on their status or simply on the assumption that those in higher authority have greater knowledge about what is happening (Barton & Sutcliffe, 2009).

Alternatively, rather than speaking up, subordinates may use indirect or polite language when addressing superiors. While this affords smooth cooperation, it can also lead to communication failure. Linde’s (1988) study of success in aircrew communication showed how indirectness as an expression of politeness sometimes caused the recipient, often the captain, to miss the message with fatal consequences.

Professional roles, which also may be hierarchical, establish predetermined social interactions that shape sensemaking. Cornelissen (2012, p. 131) observed that the “sensemaking that takes place is conditioned by the individual’s commitment to a situated activity, as part of their professional role, as well as by the salient views of relevant others to whom the individual feels accountable,” and further that

“individuals will accept, a definition of a situation as a guide and constraint to their actions when it is based on routine codes, or conventions, or has been established by authoritative others.” Individual identification with a particular role, especially one perceived to be important, encourages the role holder to resist challenge, as this is a perceived threat to their identity (Weick, 1990).

Different professions develop different languages based on the various discourses they use regularly, and these influence the processes of interpretation and enactment integral to sensemaking. Moreover, while these local jargons are highly efficient among peers, they can cause conflicts (Thurlow & Helms Mills, 2009) or require translation or other bridging efforts when communicating across different professional communities (Scott & Trethewey, 2008). Competing accounts of an event, arising from different professions, shape actors' sensemaking and challenge collaborative action (Jørgensen et al., 2012; Madigan et al., 2021).

The social world of institutions (including professions and language) is imbricated with the material or technological world (Orlikowski, 2007; Leonardi, 2012), shaping actors' sensemaking. People respond not only to each other but also to the constraints and affordances offered by technology (Leonardi & Barley, 2010). Familiarity with technology and the way it is intended to operate through imbrication enable an immanent sensemaking, where recurring and expected cues indicate normal practice (Berthod & Müller-Seitz 2018).

However, the response to specific technologies varies depending on the people involved and the specific circumstances (Leonardi, 2011). Different professional roles will use different technologies in regularized and routine ways that structure daily work practices (Orlikowski, 2000). Different professions may respond to a common technology in different ways, deploying it in a way that fits their practice and makes sense to them in their role. Technology not only increasingly depicts reality to which actors respond, but also is used to enable communication between dispersed actors. For example, in the Stockwell shooting (Cornelissen et al., 2014) police officers at the tube station were in radio communication with senior officers located at a distance. The affordances of the technology shaped the communication between actors, which influenced the sensemaking processes. However, while technology is constitutive of everyday life (Orlikowski, 2007), its influence on sensemaking has not been examined in detail (Sandberg & Tsoukas, 2015).

Thus, each institutional setting is shaped by features, such as power, professional roles, language and technology, creating a stable work arena that allows actors to “go on doing things they routinely do without deliberately thinking about how they do them” (Sandberg & Tsoukas, 2015, p. 25). However, when technology functions in an unexpected way, this disrupts the ongoing flow of normal work practices triggering deliberate sensemaking (Orlikowski, 2007; 2009). In their examination of the sensemaking process by pilots in the fatal AF447 flight, Berthod and Müller-Seitz (2018) discuss the pilots' response to the unexpected signals from the instruments designed to ensure safety, noting the difficulty experienced in shifting to deliberative sensemaking. Weber and Glynn (2006) also suggest that enactments sometimes deviate from institutionalized expectations. This creates surprise and demands explanation of others' behavior (Kudesia, 2017). These result in either plausible and therefore acceptable accounts, or implausible accounts requiring further justification. Both drive enactment. The institutionalized setting shapes what it takes to create surprise and the quality and effectiveness of the subsequent enactment of mitigation. In other words, influences within a safety-critical institutional environment might impede the production, reception, and action towards signals of danger (Pidgeon & O'Leary, 2000).

2.3. Research question

The literature on institutional sensemaking indicates that actors' ability to mitigate untoward events that require deliberative sensemaking, across professional communities, is shaped by their immersion

in socio-material practices. Immersion creates stable frames that guide sensemaking, with expected cues, interpretations and enactments, that ease coordination within professions of practice but might complicate coordination across them. Immanent sensemaking is expected to be prevailing and deliberative sensemaking, which is the exception, requires a sufficient trigger. In deliberative sensemaking actors will use the same repertoire (tools, practices, and language) they learnt through their immersion in their socio-material practice. This suggests the following research question:

How does a highly regulated institutional setting shape and limit sense-making and with what consequences?

In answering the research question through an analysis of the railway accident in Lerum, Sweden in 1987, we will explore what shapes immanent sensemaking, what it takes to shift to deliberative sensemaking, how actors' institutionalized repertoire shape both processes and with what outcome.

3. Methods and data

3.1. The setting and the various communities of practice

The railway is a highly regulated institutional setting, where both historical and contemporary sources offer rich insights into how technology, power, and language shape sensemaking processes (e.g., Has-selberg, 2001; Lindvall 1980; Edelman, 1997; Peterson & Wingqvist, 1982; Farrington-Darby et al., 2005; Sanne, 2010). The railway technology in 1987 at Lerum was basically similar to that found today, as is the division of labor. A number of serious accidents prompted the Swedish state railway company to install a fail-safe Automatic Train Control (ATC) system in 1980, in which radio transponders along the tracks exchange data with receivers on-board trains. The ATC system is used to pre-program routes for each train and to indicate to dispatchers via their monitors the state of play in the system at any moment. The points on the railway track are also equipped with sensors that indicate how they are laid, determining if a train will continue on its current track or change track.

The work setting is distributed, engages various occupations with different tasks, using partly the same technology, although from different perspectives, which influences their understanding and their language. Railway technicians support safe and timely transport by maintaining the railway infrastructure. They specialize in one of four different trades (high-voltage, signals, tracks, or telecommunications). To do their work, they balance their own safety against other organizational requirements such as safe and on-time trains, time limits, and economic limits, achieved partly through corporate resources such as planning and procedures, but also largely by relying on occupationally based practices, skills, and values. Train dispatchers, often working remotely in train control centers, monitor pre-programmed train routes and perform manual routing when this is needed or desirable to achieve a smooth and punctual traffic flow. Dispatchers also coordinate train traffic flow with concurrent work on or near the tracks.

The work of these different occupations is governed through separate departments with different tasks and roles but is also coordinated and mediated through the different technologies (e.g., signals, monitors, relays, tracks). Occasionally, they need to communicate, either over landlines or two-way radios to coordinate action. However, this is only by exception and is usually routinized, through the use of shared terms for points or for regular procedures (Author et al., 2010) for similar and repeated purposes, such as agreeing access to tracks for technicians.

3.2. Data Source

Data were obtained from the records of the government committee Kommissionen för undersökning av allvarliga olyckshändelser (Katastrofkommissionen), in the Swedish National Archives. These include a transcript of the safety critical communication that contributed to the

Lerum accident, as well as the police interviews (performed in conjunction with committee members), records of meetings with the committee and experts, train performance data, etc. (YK 4121, vol 48–49). For the purposes of this paper, 233 pages of records have been analyzed. The communication data between three groups of actors amounts to 24 pages and stretches from 13.08 to 14.33.59 h on the day of the accident. Unfortunately, the audiotape of the communication is unavailable, so we have been unable to discern the finer temporal qualities of the original conversation. This precludes a fine-grained analysis that, for example, might indicate when a response from another person was expected, or the potential emotional qualities in actors' talk.

3.3. Data analysis

Our analysis followed the approach adopted by [Cornelissen et al. \(2014\)](#) where emerging theoretical ideas were refined alongside increasingly detailed empirical analysis and comprised three stages. In the first stage, the data from the committee records were used to compile a timeline of the event. This was structured, or bracketed ([Langley, 1999](#)), into five episodes based on the record of logged conversations between different groups of actors. Each episode maps the duration of the activity, the actors involved, the significant action and the outcome providing a narrative account of what was occurring.

In the second stage we used the lenses of technology, power, and language individually and in combination to illuminate the creation, interpretation, and enactment processes of actors' sensemaking in each episode. Each lens in turn was laid over the account of each episode in an attempt to explain the sensemaking of the actors in that episode. The technology lens focused on the role of materiality in providing cues ([Orlikowski, 2000; 2007](#)) that were unexpected, and how these directed and shaped individual or collective interpretations, often based on prior experiences with the same technologies ([Leonardi, 2011](#)). Technological artefacts used in the enactment process in particular episodes were also identified. The power lens focused on two things: first, the hierarchical relationship between different roles and how this affected communication between actors (e.g., [Tourish & Robson, 2006; Linde, 1988](#)) and with what effect on the sensemaking processes; second, the influence of systemic power ([Fleming & Spicer, 2014; Schildt et al., 2019](#)) through the pressures inherent in the expectations of different job roles, and how this influenced the enactment process ([Cornelissen, 2012](#)). The language lens focused on the words and expressions used in the various communications between actors. We concentrated on how these directed attention to things that the speaker perceived as salient to the situation and how this shaped interpretation and subsequent action.

The veracity of our analysis of the actors' sensemaking through these lenses is assured in three ways. First, we have only used data where actors were asked to describe what happened, how they made sense of that, and how they functioned as a consequence. Secondly, we have used the interviews and communications directly as data, and not the committee records, to allow us to get closer to the actors' own reasoning. Finally, a professional English-native interpreter translated the dialogue. Specific railway terms were checked through a railway dictionary and by professionals in the field.

In the third stage of our analysis, we re-examined the literature on sensemaking noting the distinction between immanent and deliberative sensemaking ([Introna, 2019](#)), and the likely importance of the former in institutional settings where habitual and routinized ways of working structure interactions and expectations and cue role enactments and behaviors ([Berger & Luckmann, 1966; Weber & Glynn, 2006](#)). We further reflected on the importance of technology, power, and language (both separately and mutually) in institutionalized contexts, including the railways (based on earlier experiences of the first author – see below). This resulted in the inductive development of a simple theoretical model of the influences of technology, power, and language on the processes of sensemaking in an institutionalized environment as

observed in this event ([Fig. 1](#)).

3.4. Data corroboration

The data were also compared with more than four months of ethnographic data among railway professionals in the relevant occupations, and more than 80 instances of communication between dispatchers and technicians previously collected by the first author and associates, all separate from the data in this article. That work shows the salient influence of technology, power, and language and their interdependence in shaping sensemaking and practice in ways that helped us to analyze actors' sensemaking in the Lerum accident. For example: technological artefacts are used by technicians as substitutes for prescribed ways of achieving occupational protection and as props for making sense in troubleshooting ([Sanne, 2014](#)); occupational communities shape e.g. notions of responsibility as well as adequate occupational risk protection ([Sanne, 2008](#)) and; communication is shaped by safety discourse but also by artefacts at hand such as signals, points, forms, schedules etc. ([Andrén, Sanne, & Linell, 2010](#)). Those accounts helped to reveal sensemaking processes typical of similar situations and so ground the analysis of the real-time data in this case. In this way, we have been able to overcome the problem of indexicality ([Blommaert, 2007](#)), that is, actors' taken-for-granted assumptions, procedures, and professional jargon as well as their inference from preceding instances of interaction ([Kjeldskov & Paay, 2010](#)) that otherwise make the data opaque to the researcher.

3.5. Data presentation and reporting

We have followed the suggestion from [Berends and Deken \(2021\)](#) to use a "conceptualized composition," for writing up process research when the intention is to develop existing theory. In this case, the problem or mystery ([Alvesson & Kärreman, 2007](#)) is how experienced professionals working in a safety-critical industry failed to achieve shared understanding and thus reorient action to avoid the pending disaster. We have used the existing theorization of sensemaking as three processes (create, interpret, and enact) and three dimensions (technology, power and language) to construct a framework that we use for structuring the presentation of the findings. [Table 1](#) provides a summary of the actors and their sensemaking actions in each of the five episodes.

When presenting the communication data, professional discourse, often performative, is put into single citation marks, whereas other data is put into double citation marks. Moreover, actual talk is italicized, and procedural words are in bold, both within double citation marks. Quotes and information taken from the police interviews are marked with PI, from the dispatcher's report DR and data from the committee report is marked as AC. We anonymized the identity of the involved people, calling the dispatcher Dahlberg, the signal technicians Svensson and Sandin and the track technician Tengvall.

4. Findings

4.1. Episode 1. 07:00–13:30. Setting the scene

Three occupational groups worked separately but in parallel to each other on Monday morning, November 16, 1987. Around 07:00, a supervisor at SJ (the integrated railway state company) assigned two signal technicians based in Göteborg, Sandin and Svensson, to preparatory work close to Lerum station, on the double-track line between Stockholm and Göteborg. Although this particular setting was new to Sandin, they were both experienced technicians. They were assigned to lay signal cables alongside and underneath the track in preparation for the installation of additional electric drives (required to make the points change position so that trains may change tracks) later that year. These extra drives would enable a more reliable functioning of the points, reducing the risk that they would become stuck if snow and ballast got

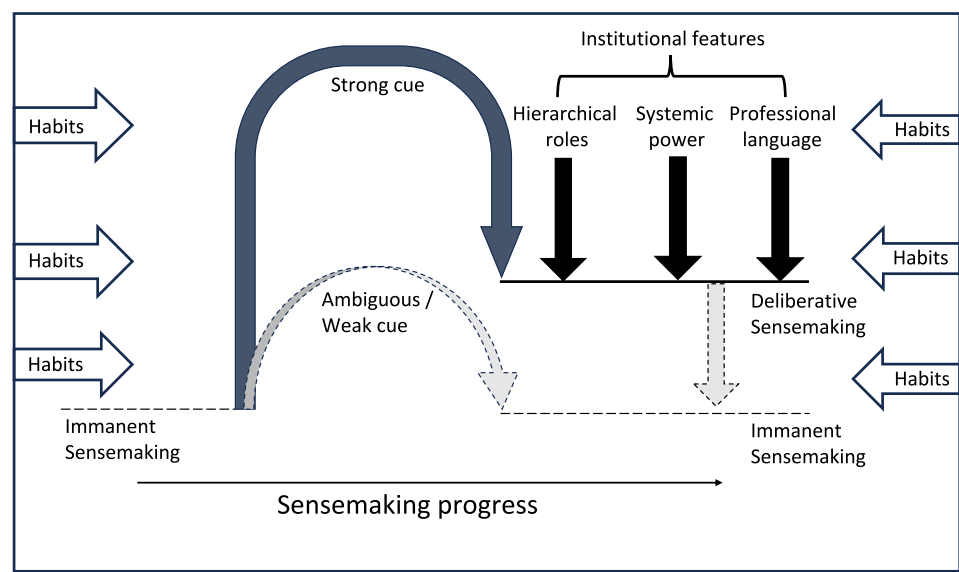


Fig. 1. How institutions shape and limit sensemaking.

Table 1
Sensemaking processes by different actors in the episodes of the Lerum case.

Episode	Actor(s)	Create (from cue)	Interpret	Enact
'Normal Trouble'	Dahlberg	Notices stationary express train on monitor	Points out of control	Manual manipulation – but ineffective
	Dahlberg	Conversation with driver of train 138 –people on / near track –working with cables	Disbelief – inaccurate reporting by driver Consternation Suggests torn cables It is possible to move	Check records. Continue conversation. Gather more information
	Driver of train 138	Points visibly in alignment		Seeks to move
	Signal technicians	Notice level crossing gates open and stationary train then moves	Problems with points	Nothing – preoccupied with own tasks'
'Fix It!'	Tengvall	Dispatcher asks him to find out what's happening'	Dispatcher and Signal Technician should talk	Brings phone to Svensson
	Signal Technicians	Dahlberg remarks that the point is out of control'	Know what to do based on experience	Seek to fix problem
Trouble Shooting gone wrong.	Signal Technicians	Discussion shows points are out of control for an unspecified reason	Explore three possible solutions	Use default procedures in order. Realize cable problem
	Signal Technicians	Loose cables	Cause of problem with points	Re-attach cables – but incorrectly
	Dahlberg	Monitor image indicates that points are completely normal	Points are under control'	Resume work as normal
	Dahlberg	Discussion with Tengvall	Everything under control	Re-activate pre-programmed train routes
Failure to control the repair.	Signal Technicians	Movement of points to seemingly incorrect position	Points still out of control.	Contact Dahlberg to seek local control
	Signal Technicians	Communicate with Dahlberg	Everything is OK	Nothing – assume Dahlberg has control

sucked in when the planned high-speed trains passed. The supervisor had also hired three men, with many years' experiences of track-related work, to excavate the embankment, two by hand and one using an excavator (PI).

The preparatory work at Lerum station, included excavating the ground in some places beside the tracks, lifting lids on top of cable trays running alongside the tracks where the existing cables lay, laying plastic tubes inside the trays through which the new cables would run, and lifting poles beside the tracks where the existing cables from the drives and the points were connected to the train routing system (PI). The existing poles had to be displaced somewhat since the new poles would be situated at the same spot.

According to safety regulations, 'A-work' is needed when work on the railway is deemed safety-critical requiring track closure for specified periods and must be coordinated with and approved by dispatchers. In

this case, even though the poles were to be lifted, the old cables would stay connected, thus not interfering with the functionality and safety of the train routing system. Moreover, this work was not taking place within 2.3 m of the middle of the track. Thus, there were no foreseeable safety issues for trains or people, and so neither the supervisor nor the technicians considered there was a need for 'A-work' (PI). Consequently, the dispatcher working that morning, Dahlén, had no information about the planned work and thus no cue towards any safety-critical issues (PI).

The technicians used the nearby level crossing installation as protection against approaching trains (PI, [Sanne, 2014](#)). When a train approaches the level crossing, a bell goes off, warning road traffic (and in this case the technicians) that the gates will be lowered and thus about the approaching train.

After morning break, around 09.30, the five men started their work at the station near point 21A (PI). This point, situated in the North end of

the yard, close to a bridge and a level crossing installation, connects the tracks on the double-track line from Göteborg to Stockholm so that trains entering Lerum station can either continue on different tracks or change tracks as required. The five men lifted the old pole off the ground, laid down the plastic tubes and pulled the new cables through the embankment. Then they turned to work on the adjacent point 21B, repeating the same procedure. This time, as they moved the pole, the seven-thread cable fastened to a plinth inside the pole, loosened. However, no one noticed (PI).

4.1.1. Materials, power, and language

No one noticed anything out of the ordinary at Lerum station until 13:30 (PI). Train drivers were provided with the expected signal aspects in time when passing through. Dispatcher Dahlén did not notice anything unusual on his monitor or graphical timetables, nor over phone or two-way radio. Likewise, Svensson and Sandin experienced nothing out of the ordinary. Cues were institutionally primed towards ‘immanent’ sensemaking and the continuation of an embedded socio-material practice.

4.2. Episode 2. 13:30–13:34. “Normal Trouble”

The normal discharge of routine activities in episode 1 was disrupted at the beginning of episode 2, triggering deliberate sensemaking. An express train, Number 138, from Göteborg to Stockholm was stationary at Lerum station, when it should have been able to pass straight through without stopping, with no further information provided to the driver (AC).

Dahlberg had arrived on shift as a dispatcher at the remote-control center in Göteborg. He took over from Dahlén just before 13:30 (PI). During the handover they noticed on the monitor, the unexpected stationary express train, and the display visually indicating that point 21B was ‘out of control,’ meaning that sensors in the point could not tell how the point was positioned, and thus whether traffic passing the point would continue on the same track or divert (PI). Using a common trick of the trade, Dahlberg tried to move the point manually back and forth a couple of times to see if he could regain control, but in vain. At 13:31:28 the phone rang and the driver of the express train 138 spoke to Dahlberg, who asked the driver to “wait and see,” anticipating that the problem would resolve itself. However, the driver also made Dahlberg aware that there were men wearing company clothes laying cables both on and near the track at point 21B (PI). Dahlberg’s initial disbelief, because there were no records of expected work available to him, despite checking, turned to consternation and he suggested, “have they torn something off maybe,” but he remained unable to “figure out what’s going on.” Conscious of the need to let the train, which had already been delayed, continue, Dahlberg indicated that he “can arrange the station locally.” The driver had already observed that the point was positioned “in place” (it will lead the train through the required route) to let the train pass even though the monitor in the control center indicated that it was ‘out of control.’ Dahlberg permitted the driver to slowly pass signals set at stop aspect (slow enough to recognize any obstacles and stop the train in time).

Meanwhile the signal technicians had noted the stationary train and the open level crossing gate (PI). They were surprised to see the train move forward with the gates still raised, suggesting to them that there were problems with the gate that they as signal technicians might need to address, but they did not intervene. Sandin argued that they were “pre-occupied with their own tasks” and they thought that the troubles should be assigned to a team assigned with troubleshooting, as usual (PI).

4.2.1. Creation, interpretation, and enactment

The display monitor indicated to the dispatcher that the point 21B was ‘out of control.’ His response, to manipulate the controls, proved ineffective (PI). A second cue reinforcing the first cue, occurred when

the phone rang, and the driver of a stationary train reported the presence of workers on the track. The dispatcher suggested that they had “torn something off maybe” as an explanation for the ‘out of control’ point. However, this interpretation resulted in no action from the dispatcher. He later explained that technicians (the experts) had previously told him that this was only one possible reason for the problem (PI). Moreover, had the technicians been involved in safety-critical work, he argued (PI), they would have asked for A-work. The lack thereof, thus signaling to him a trivial case.

Furthermore, when the driver added that the point was “in place,” the dispatcher interpreted that things at trackside were okay. In order not to delay the train further, he allowed the train to move forward at slow speed (as well as three more trains later) (PI), thereby enacting the environment that matched his interpretation.

Meanwhile the signal technicians noticed both when the train was stationary and when it moved, but against an open gate. While surprised by this movement, they interpreted it as indicating a problem with the gates (PI). Pressures of their own work meant that they took no action (PI).

4.2.2. Materials, power, and language

Several material objects, including a display monitor, a stationary train, aligned points, and raised gates, created cues for sensemaking to the different actors in this episode. The disruption of the train routing system triggered the technicians, dispatcher, and train driver’s deliberate sensemaking. Based on prior professional experience they interpreted these cues as indicating that there were technical troubles, although their immersion in different socio-material practices allocated the problem to different objects. This shaped their different responses.

However, the trouble triggered only momentary deliberate sensemaking: only limited efforts to account for it were made until actors stabilized sense. Subsequently, they continued with their work independently, adhering to a previously defined schedule and division of labor. The systemic power of the time-oriented objects directed their actions away from responding to the tangible, yet ambiguous cues provided by the monitor, the points and the train. The dispatcher allowed the train to pass against stop, to adhere to production goals, before investigating the reason for the trouble. Likewise, the signal technicians awaited stronger cues.

The communication between the train driver and the dispatcher was initially a high-quality one, allowing different perspectives to shape a collective sense of the situation. However, as the dispatcher argued (PI), this was such a normal problem, and because he had done all that he could do there was no point in further discussion. He could let the train pass by against stop and look for expertise to solve the problem, after the train had passed.

Originating from the design of the technology, the terms ‘out of control’ and ‘in place’ visually describe the accuracy of its performance and govern subsequent human action. The terms are also performative, providing information about the unexpected stop signal, and legitimizing the permission to pass by, despite a signal set at stop aspect.

4.3. Episode 3. 13:34–13:45. Fix It!

Episode three, lasting 11 min saw Dahlberg engaging with others situated on site to understand better the nature of the problem and to request the signal technicians to fix it. Dahlberg so arranged the routing of a railway maintenance truck from Göteborg to stop in a side-track at Lerum station in front of a signal close to point 21B (PI). This prompted the truck driver, track technician Tengvall, to call the dispatcher, allowing Dahlberg to ask him to discover the cause of the problem. At 13:45:25, Tengvall brought his radio to Svensson allowing a conversation between the dispatcher and those most likely to be able to fix the problem. Each party indicated what they knew of the situation. Dahlberg reported that there were people “laying cables under the points.” But he did not repeat his previous suggestion that the cables might be

torn off. Svensson commented on his earlier observation that the level crossing gates did not come down when the express train passed by and asked why. Then Dahlberg told him that the point was “out of control.” This reference to a well-known problem provided a short-cut to mutual understanding (PI). Consequently, they did not engage in detailed trouble shooting together, rather Svensson, based on his training and experience, agreed to fix the problem at Dahlberg’s request.

4.3.1. *Creation, interpretation, and enactment*

Following the surprising report of workers on the track in the previous episode, Dahlberg had checked his records which revealed nothing (PI). Continuing to respond to this unexpected cue, he arranged the signals and points so that a maintenance truck would stop at Lerum station (PI). This unexpected delay caused Tengvall to call the dispatcher, from whom he received the request “to find out what’s happening.”

The dispatcher and the signal technician talked over the radio and reported to each other the various observational cues noted in episode 2 that independently they had interpreted differently. This allowed them to identify the problem, but not its cause. At Dahlberg’s request, Svensson agreed to fix it. Dahlberg reported that he was not familiar with the signal technology (PI), neither was he interested in the details. They were not relevant for his work. In a letter to the commission, Svensson complained about dispatchers’ hurrying technicians and, in the police interview that dispatchers were neither interested in technicians’ perspectives nor in helping to secure the safety of the infrastructure. The first author (Sanne, 2010) recalls technicians talking about dispatchers that see themselves as “kings” that lack interest in technicians’ work and safety concerns.

4.3.2. *Materials, power, and language*

The positions of the dispatcher and the signal technicians regarding the railway infrastructure provided them with different cues as to the trouble. However, they shared enough common knowledge to allow an instant-shared sense through use of the “out of control” phrase without much need for explicit sensemaking. The signal technicians accepted the dispatcher’s request to fix the problem, without hesitation. This seemed obvious to them, given that they were there and knew how to do it. Primed by their institutional belonging, it was a natural part of their professional identity and the hierarchy of roles.

4.4. *Episode 4. 13:45 – 14:22. Trouble shooting gone wrong*

Episode 4 is the longest of the four while Dahlberg was on duty. The prior discussion with Dahlberg had indicated to Svensson that there was a problem with point 21B. Working with Sandin, they followed a default trouble shooting procedure used for unspecified problems (PI, AC) (Sanne, 2010).

Opening the pole from the top, they noticed inside that the seven wires in the cable from the drive had been torn from their fastening (PI). This was not visible from the outside. The cause of the ‘point out of control’ was now obvious to them. Svensson fastened each of the wires on Sandin’s instruction. Unfortunately, the wires were not labelled and five of them were black. Consequently, the signal technicians confounded the position of two of the black wires (AC). This incorrect re-wiring meant that the apparent position of the point on Dahlberg’s monitor was the opposite of its actual position. So, when the points appeared in the minus position on the monitor, which would force trains to change tracks, they were in fact still in the plus position, allowing trains to continue on their original track.

At approximately 14:20, Dahlberg noticed on his monitor that a train had successfully passed through Lerum, and that the point was “completely normal” meaning ‘in control’ (i.e., indicated as in either position) (DR). He assumed that the last train passing by during the repair work had resolved the problem, as sometimes happened (PI). In reality, the signal technicians had completed the repair, but had not

informed him (PI). Seeing the points were under control, he resumed normal work (PI).

4.4.1. *Creation, interpretation, and enactment*

The shared conclusion of the previous episode was that there was an unspecified problem with the points. From their training, Svensson and Sandin knew there were three possible alternative solutions, and so they followed the default procedure to discover the cabling problem. They interpreted the observation of the loose cable as the cause of the ‘point out of control,’ and then reconnected the wires according to the wiring diagram, albeit incorrectly. Subsequently, Dahlberg noticed on his monitor that a train had passed through Lerum station. He inferred that the point was ‘in control’ due to the train’s passing and that he could resume work as normal.

4.4.2. *Materials, power, and language*

The loose cabling and the visual display on the monitor provided critical cues for subsequent interpretation and consequent actions, thus priming sensemaking along parallel lines for the two groups of actors. The detached cables provided the signal technicians with a credible explanation (account) for why the points were behaving oddly. This interpretation suggested a course of action that was given explicit direction through existing default procedures and wiring diagrams. Likewise, the passing of trains at slow speed during repair work, indicated to the technicians that the point was still “out of control.”

Similarly, the indication of the point “in control” on the dispatcher’s monitor suggested that things were normal again. This interpretation drove his resumption of normal working. Power relations were in this episode subsumed as part of the normal division of labor within the integrated railway company. The parallel but independent working of the two groups meant coordination and communication between them was not required.

4.5. *Episode 5. 14:22–14:25. Failure to control the repair*

The final episode was the shortest of them all, a mere three minutes. In order to ‘control’ (verify the correctness) of the apparent repair to the points as required by safety procedures, the signal technicians needed to get ‘local command’ of the point from the dispatcher (PI). So, they asked Tengvall to call Dahlberg (PI). He did so at 14:22:33. In their conversation, Tengvall indicated that the technicians were “not really sure” whether they had fixed the point. However, Dahlberg reported that according to his monitor, “it was back under control.” Moreover, he did not want to make the passing express trains between Stockholm and Göteborg (numbers 129 and 140) wait and was anxious to reactivate the pre-programmed train routes. All he had to do, he said, was “position the point,” because the monitor indicated that the point would force the train to change tracks. The signal technicians did not overhear this conversation (PI). After this conversation, Dahlberg moved the point so that, according to his monitor, the trains would pass through the station in opposite directions on different tracks (PI). In reality, with this positioning of the points, the train from Stockholm would divert into the same track as the train in the opposite direction from Göteborg (PI).

Still on the track, Sandin noticed the movement of the point, which could only be done by the dispatcher, not through their repair (PI). This puzzled him, and at 14:24:13, Sandin called Dahlberg to make him aware of the incorrect positioning of the point. In addition, he requested local command to control the repair. He asked Dahlberg if he had “control in minus” (i.e., if Dahlberg had control of the points and had intentionally laid the points in minus, so the trains would change tracks). This he knew was problematic because trains should pass each other in opposite directions (PI). Dahlberg responded, “I have control in both plus and minus here now **over** and the routes lie through on both up track and down track because there are two express trains coming now **over**.” Sandin replied, “I see, then we’re satisfied with that **over and out** so far.” Aware of the incorrect positioning of the points he did

not follow up on this in his response, assuming instead that the dispatcher might have reasons for this anomalous positioning of which he and Svensson were unaware (PI). Moreover, he expected Dahlberg to run the trains slowly against signals at stop aspect as he had done previously that day (PI).

The conversation continued. Dahlberg asked if the technicians would like to have ‘local command’ once the trains had passed. Sandin agreed, accepting the offer, “we can do this once the trains have passed, move the points back and forth a few times and if it works, we’ll give clearance for the points.” Continuing the call, Dahlberg asked Sandin for the reason for the point out of control, but Dahlberg did not react to the information he was given. From his point of view, the problem was not his responsibility, and he was just interested in whether the problem might re-occur (PI). He had the point in control: ‘two nice green lines all through’ on his monitor (PI). The responsibility to ensure it was safe lay with the technicians, who had not signaled safety-criticality through a request for A-work, he argued (PI).

A few minutes later, the express train from Stockholm was forced to change tracks due to the incorrect positioning of the points. It met the express train from Göteborg head on at high speed with fatal consequences (AC).

4.5.1. Creation, interpretation, and enactment

There are several identifiable sensemaking events within this short period. To the signal technicians, the repair of the cable fastening was an intervention on a safety-critical component, which required the enactment of a safety protocol to secure the proper functioning of the infrastructure. Therefore, Tengvall, in his conversation with Dahlberg reported that the signal technicians wanted to “check their repair.” Based on observed train movements through Lerum station on his monitor, Dahlberg made the interpretation that everything was under control and dismissed this cause for concern. He was anxious to reactivate the pre-programmed train routes. He also noted that the point on his monitor was apparently incorrectly positioned and so he moved it to the apparently correct position.

The signal technicians observed these movements and realized the point was incorrectly arranged for trains to continue on separate tracks, and so contacted Dahlberg to seek ‘local command’ to investigate the correctness of the repair. In the conversation with Dahlberg, Sandin was unable to convince him of the incorrect positioning. Moreover, he assumed Dahlberg had control and would only allow the trains to pass slowly over the points as previous trains had done. Dahlberg’s commitment to continued enactment overruled the technician’s attempt to make him consider alternative interpretations. Sandin and Svensson took no further action.

4.5.2. Materials, power, and language

The display monitor and point both provide important but contradictory cues in this episode. This discrepancy between the dispatcher’s remote view and Sandin’s trackside view was not resolved. Both sets of cues were interpreted apparently accurately and drove the actions of both sets of actors, but in an uncoordinated fashion.

The dispatcher was anxious to resume normal service and stick to the pre-planned schedule. When the repair was completed, a train had recently passed. To Dahlberg, it seemed as if the point was back “in control” again, although the monitor indicated that it was set to force the trains to change tracks. In reality, the point was positioned to allow trains to remain on the same track.

The repair work primed the technicians to seek local control of the functionality of the point, according to safety protocols. Moreover, they assumed the dispatcher would also understand this and agree to their request for ‘local command’ as a means to ‘control’ their repair. Consequently, they contacted the dispatcher, first through Tengvall with no success. He used a more colloquial term, “check,” to convey their request for ‘local command.’ Being a track technician, he was not familiar with the safety-critical significance of these terms. Therefore,

the dispatcher was not properly alerted. While they were trying to reach Dahlberg directly, the dispatcher changed the point to a position, which he thought would allow the trains to pass on separate tracks. This was clearly a worrying anomaly to the technicians, triggering them to ask Dahlberg whether he really intended the point to be in the observed position.

After some discussion, the technicians accepted the anomalous positioning of the point. They assumed the dispatcher, because of his role, had particular knowledge of the local circumstances and a routing plan unknown to them, and they accepted his decision. Thus, power in the sense of assumed overview and expertise hindered them from articulating a strong enough signal. This failure is mainly due to the language they used and how it was interpreted. Unequal power relations likely influenced language use in this second call of the episode. The way Sandin asked Dahlberg to confirm the correctness of the positioning of the point was highly indirect: “do you have control in minus?” is far from “is it really your intention the point should be positioned in minus?” The phrasing of the question leaves an opportunity for Dahlberg to save face but also an opportunity for misinterpretation.

Moreover, technology also influenced language use and sense-making. These calls took place over a two-way radio, requiring the use of procedural terms. In the second call, Dahlberg tells Sandin that “I have control in both plus and minus here now **over**,” where **over** prompts Sandin’s turn. However, Dahlberg immediately adds, “and the routes lie through on both up track and down track because there are two express trains coming now **over**,” probably as a means to underline the legitimacy of his decision to delay the request for “local command.” Dahlberg’s second phrase provides important information, as up track and down track are the major tracks passing through the station. That, “routes lie through” indicates that the monitor shows that train routes pass by all the relevant points on both the main lines. It seems surprising that Sandin did not react to this apparent disjunction from what he saw. However, provided with the first **over**, Sandin’s attention was perhaps turned to the implications of the first turn, and therefore he may not have noticed the significance of Dahlberg’s second phrase. In fact, Sandin recalled that Dahlberg confirmed he had control in minus and nothing else (precisely what Sandin saw on the ground) (PI): thus, Sandin concluded that Dahlberg had chosen the minus position to divert the train, for a reason that Sandin did not know.

Also, in this second call, Dahlberg confused procedural and safety-critical terminology. Sandin used the phrase “over and out” (in Swedish “klart slut”), indicating end of conversation, which Dahlberg interpreted as clearance for unrestricted route through the point. To the signal technicians, they had not provided ‘clearance’ (in Swedish ‘klar-tecken’), which is the safety term. Thus, the different socio-material worlds influenced their language use. Dahlberg saw the point was “in control” and that “routes lie through” and he used that to indicate that normality was restored, whereas Sandin saw that it was “in minus” and used that as an argument for controlling the repair according to safety regulation: “you don’t leave a point like that,” as he later argued in the police interview. Thus, Dahlberg used the discourse of production (timetable imperative) as a powerful reason for letting the trains pass by now that everything was back to normal, whereas Sandin used a language that to him signaled the need to address the safety discourse (‘control’ and ‘clearance’), a language that Dahlberg confused with procedural words used in two-way radio talk. Moreover, systemic power in the form of an assumed overview and unknown routing plans on Dahlberg’s part caused Sandin to set aside his doubts.

4.6. Synthesis of findings

The prominent feature of the five episodes is immanent sensemaking. Throughout, individuals engaged in activities that were routine and habitual as part of their professional roles. This was especially evident in episodes 1 and 4. With hindsight, we can see that deliberative sense-making was required to prevent the accident occurring. Although

attempts were made to shift from immanent to deliberative sensemaking they failed because cues provided by the technology were ambiguous and open to plausible explanations based on prior experience. Moreover, the limitations of language used, the hierarchy of professional roles and the systemic power of acknowledged role responsibilities sustained habitual ways of working and were sufficient to impede the shift from immanent to sustained deliberative sensemaking (Fig. 1).

Familiar technologies provided unexpected cues, notably in episodes 2 and 5. For example in episode 2 the screen displayed a stationary express train to the dispatcher, and the signal technicians observed that a gate remained open while a train passed. These cues were ambiguous and weak, and based on their prior experience each actor could provide a satisfactory account for their occurrence. However, these accounts differed between the actors, and each responded in accordance with their own interpretation. The dispatcher allowed the train to move, albeit slowly, despite the ‘out of control’ point, in order to adhere to the timetable, while the technicians assumed the gate would be fixed by others. This suggests that where cues are weak, or susceptible to plausible pre-existing explanations immanent sensemaking continues without the need for deliberative sensemaking. The pull towards immanent sensemaking was further demonstrated in episode 3. Although unaccounted for people working on the track functioned as a cue to the dispatcher to investigate further, pursuing deliberative sensemaking, the use of a phrase ‘out of control’ familiar to both actors, discouraged further deliberative sensemaking between dispatcher and signal technician allowing them to revert to immanent sensemaking. They quickly foreclosed on a known solution to a known problem, which provided a plausible account for the cues and furthermore directed action according to accepted professional roles, permitting the continuation of immanent sensemaking. Cue directed action that did not evoke deliberative sensemaking was shaped by the particular concerns of the different professional roles as demonstrated in episode 5. The dispatcher was concerned with operational performance and timely movement of trains, while the signal technicians were concerned with assuring the safety of the infrastructure. In this episode the technology provided different cues to the different actors and their separate interpretations drove different actions. The technology indicated to the dispatcher that the points were back ‘in control,’ allowing him to revert to normal practice, adhere to the timetable, and resume immanent sensemaking. The misplaced points indicated to the technicians a problem that needed to be investigated, demanding deliberative sensemaking. However, their inferior hierarchical position and the use of indirect language provided insufficient challenge to the dispatcher, who already possessed a plausible account of the situation based on the cues available to him, preventing his engagement with deliberative sensemaking.

5. Discussion

The influence of institutionalized settings on sensemaking, and in particular how they shape and limit the processes of creation, interpretation, and enactment, has typically been overlooked in previous studies (Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2015). Addressing our research question to the case study we shed light on this influence, indicating why well-known ways to prevent the inevitable interruptions to daily work from escalating into accidents might fail in these settings, and incidents occur.

We argue that technology, power and language in institutional settings, expressed through the habitual repertoire of actors, influence their sensemaking and its outcomes. The findings indicate that actors’ habits encourage the continuation of immanent sensemaking, and that it takes strong, specific, cues to shift to deliberative sensemaking. Moreover, we find deliberative sensemaking is also influenced by actors’ habitual repertoire. This limits the requisite variety in relation to the problem (Dunbar & Garud, 2009; Weick, 2005) impairing the quality of deliberative sensemaking and influencing its outcome.

These findings provide an opportunity to contribute to the

theorization of the sensemaking process (Sandberg & Tsoukas, 2015) and to theorize the mutual influence of technology, power and language in institutional settings, adding to the literature on how such settings influence sensemaking in relation to risk and safety.

5.1. Theorizing the sensemaking process

Successful sensemaking requires the completion of full cycles of creation, interpretation, and enactment (Sandberg & Tsoukas, 2015). In the following, we elaborate the influence from actors’ habitual repertoire on these three processes and how it may adversely affect sense-making outcomes, potentially leading to disaster.

5.1.1. Creation

Actors’ habitual repertoire shape and limit how they notice and respond to cues that indicate an interruption to an expected course of action (Hodgson, 2007; Berthod & Müller-Seitz, 2018). In situations where actors are focused on the skillful performance of their work tasks, they are primed to continue their work as planned (Weber & Glynn, 2006). An engagement with work described by Sandberg and Tsoukas (2011, p.344) as absorbed coping, “whereby actors are immersed in practice without being aware of their involvement in it.” The occurrence of weak or ambiguous cues in these circumstances does not interrupt the immanent sensemaking integral to these habitual ways of working, failing to prompt reflective problem solving (Farjoun & Mahmood, 2023), or deliberative sensemaking.

Other cues that indicate a need to shift from immanent to deliberative sensemaking might not be enough to trigger the subsequent required sensemaking processes. For example, in this case the raised gates, noticed by the technicians in episode 2, dampened technicians group-level sensemaking: they briefly considered the potential issue but decided to postpone action because the cue was not perceived to be sufficiently important to warrant the creation of signals of danger (Morrison, 2014) (see Fig. 1).

Contrarily, in the same episode, the dispatcher’s observations of the point out of control and the stationary train, and where the possibility of wires torn off was suggested following the driver’s observation of men by the tracks, were all framed by the dispatcher’s expectations of normal material function (Orlikowski, 2007). These observational cues prompted a shift to deliberate collaborative sensemaking between the dispatcher and the train driver because they benefited from sharing disparate information, although only briefly until they found a temporary solution, suggesting that the quality of deliberative sensemaking was constrained by the institutional setting. Moreover, the point out of control and the loose wires unequivocally triggered technicians’ group-level deliberate sensemaking, as designated by the institutional order in the railway company, although restricted it to a standard routinized practice for trouble shooting.

5.1.2. Interpretation

Interpretations may be incoherent and so implausible, or plausible but inaccurate (Schildt et al., 2019), and in both cases lead to adverse outcomes. Some interpretations are readily at hand through actors’ immersion in their specific community of practice: the point out of control served as a plausible and sufficient account for actors’ further enactment shaped by their professional identities as defined by their institutional setting (Weber & Glynn, 2006), their role in it (Weick, 1990) and their relation to a certain technology (Leonardi, 2012). Other interpretations are more difficult to achieve, prompting collaborative sensemaking, such as making sense of the signal at stop in episode 2, and points laid in unexpected positions in episode 4.

In these cases, the technology designed to afford safety created strong cues (Fig. 1) beyond the normal envelope of experience, surpassing actors’ habitual sensemaking capacity (Berthod & Müller-Seitz, 2018). However, collaborative troubleshooting and the production of plausible and intersubjective accounts were dampened by actors’

distributed access to various cues (Cornelissen et al., 2014; Weick, 2005), their different roles in the system and notions of sufficiency and assumed expertise (Barton & Sutcliffe, 2009). The passing of trains at low speed against signals set at stop indicated to technicians that the dispatcher would continue this practice until they had provided clearance for the repair, while the dispatcher interpreted the “lines through” on his monitor as operations were “back to normal.”

The attempts at collaborative interpretations in episode 5 after the failed repair were also influenced by institutionalized asymmetric power relations, such as failure to speak up due to deference to authority (Barton & Sutcliffe, 2009; Tourish & Robson, 2006), and the use of both indirect language that prevented effective signals to be produced or received (Linde, 1988) and different professional languages that prevented understanding across professions (Scott & Trethewey, 2008). Additionally, institutionalized systemic power apparent in the dispatcher’s eagerness to adhere to the timetable (Lawrence et al., 2012), encouraged him, once he believed he had control, to postpone the further examination of the points out of control and delay action.

5.1.3. Enactment

Following interpretation, enactment may be delayed, incomplete or not sustained resulting in unfavorable outcomes. Enactment is also guided by actors’ habits, limiting the efforts to mitigate escalation. After a brief discussion between the dispatcher and signal technicians in episode 3 over the cause of raised gates, the technicians agreed to fix the point. Even if the consideration of the point out of control in this episode suggested collective sensemaking there was a foreclosing of the process based on the actors’ roles in the institutionalized setting. The actors had so thoroughly internalized their institutional realities, establishing strong habits, that they were unable to make sense beyond these resources (Kudesia, 2017; Maitlis & Christiansson, 2014). Actors found no need for further coordination and therefore resumed immanent sensemaking as part of their routine work.

Schildt et al. (2019) noted that intersubjective interpretations need to be sufficiently coherent to create a plausible account that drives action. Here, in episode 5, the actors held different pieces of information, and none had a complete picture. These were not collectively evaluated sufficiently to diagnose the problem and create a coherent interpretation that would drive concerted action, and so achieve the collective cognition necessary for sensemaking (Kudesia, 2017). Weick (2005) noted that in dispersed settings reciprocal interdependence is needed to assemble the different pieces of information and provide a meaningful diagnosis of the situation and direct appropriate action. The institutionalized and standardized ways of working in this case precluded the mutual adjustments necessary for effective sensemaking.

5.2. The mutual influence from technology, power and language in institutional settings

As noted, technology, language, and power are integral to institutionalized environments and based upon the findings we argue that separately and in combination they limit and shape not only ‘immanent’ sensemaking observed in routine, habitual practices, but also ‘deliberative’ sensemaking (Sandberg & Tsoukas, 2020). Moreover, they impact the shift from one to the other as well as the ability to respond to the unexpected. These habitual practices resulted in fragmented or minimal sensemaking (Maitlis, 2005) that, in hindsight, did not match the complexity in the accident and the response that would have been required (Snook, 2000; Weick, 2005).

Institutional settings are characterized by well-established organizational structures, cultures and technologies that create habits (Farjoun & Mahmood, 2023), that is, acquired dispositions (Hodgson, 2007). These filter experience, providing the basis for intuition and interpretation, and subsequently for action (Cohen, 2007; Hodgson, 2007). As people are immersed over time in these environments in specific roles and communities of practice, they develop particular habits that shape

both their immanent and deliberative sensemaking. In this case, the actors had been immersed in the institutionalized and regulated railway industry for a long time (experiences ranged from 7–35 years), becoming habituated to the dispositions of others in different professional roles in the organizational hierarchy, to the typically structured nature of interactions between them through formalized language, as well as to the material artifacts and tools associated with the performance of their particular role (Hodgson, 2007). In these settings, habits therefore appear to mediate the influence of power, language, and technology on work activity.

This helps to understand the difficulty many institutions show in recognizing and responding to ‘weak’ signals of danger (Pidgeon & O’Leary, 2000; Vaughan, 1996). Dekker (2014) noted that institutional settings, in particular where roles are highly formalized by rules and procedures, are less susceptible to weak signals, thereby making the response to ambiguous and equivocal cues less likely.

We suggest that the institutional settings and the habits that they impose on organizational actors enable those actors to continue immanent sensemaking effortlessly even in relatively complex work situations (Berthod & Müller-Seitz, 2018), with no need to go on “deliberately thinking about how they do them” (Sandberg & Tsoukas 2015, p. 25). Paradoxically, such habits hamper institutions’ ability to respond to anomalies such as enactments that deviate from the expected (Weick, 2005; Snook, 2000) reducing the requisite variety needed, and thereby reducing their resilience towards unwanted events. Immanent sensemaking may provide the processual understanding of how such inabilities (such as normalization of deviance) are produced and how they are shaping the response to the unexpected. For example, habits dampen the recognition of cues that indicate a need to shift to deliberative sensemaking as well as limiting the quality of such sensemaking (see Fig. 1). Habits also narrow down institutions’ response repertoire when learning from disaster (e.g., Sanne, 2012 ; Pidgeon & O’Leary, 2000), due to the influence from institutionalized risk objects and associated improvement schemes, leaving opportunities for continued vulnerability.

5.3. Generalization, limitations and future work

This single case study is set within a highly regulated institutionalized context, which sets boundaries to its generalizability. Nevertheless, there are opportunities for naturalistic generalization (Melrose, 2009) to other institutionalized workplaces, and in particular to those settings where technology, power and language engender habitualized, or routinized, ways of working. The analysis indicates that habits can both shape and limit the processes of sensemaking. This suggests that the influence of habits on sensemaking merits further investigation not only in institutionalized settings where systemic power and language have particularly strong influences but also in settings characterized by mundane repetitive work where absorbed coping may be prevalent. The study also shows that technology has agency and the resultant cues from a shared technology may be interpreted and acted upon differently by different groups. How these differences are resolved also merits investigation, especially in safety-critical industries where failure to do so can have catastrophic consequences.

5.4. Managerial implications

Maintaining control and preventing the escalation of normal routine activities into major unplanned events is a vital managerial activity. However, the case indicates that in institutionalized workplaces this may not be simple or straightforward. Established ways of working, or habits, created by the structuring of work and the regular use of common technologies lessen the receptivity to weak signals and preclude the collective cognition necessary for sensemaking, making failures more likely. Aspects of the institutional environment that form the focus of the paper provide opportunities for improving managerial practice.

Systemic power, manifest in timetables, work schedules, and job roles, create pressures that may negatively impact sensemaking and curtail employee discretion, which is often locally important for maintaining safe operations. Professional language, understood by those within the professional community, may not be understood by those outside, creating opportunities for miscommunication and misunderstanding, which may not be recognized widely. Developing a shared language, like the phraseology used in air traffic control for example, may alleviate this problem. Similarly, the use of indirect language should be discouraged when attempting to voice concern.

6. Conclusions

The influence of institutionalized settings on sensemaking, and in particular how they shape and limit sensemaking's constituent processes of creation, interpretation, and enactment, has typically been overlooked in previous studies. Through an institutional and socio-material approach to sensemaking we show why well-known ways to prevent the inevitable interruptions to daily work from escalating into accidents might fail in institutional settings, and why incidents occur. Here we argue that institutionalized settings, through their technologies, power structures, and languages create habitual ways of working that encourage immanent sensemaking. Furthermore, these habits hamper the shift from immanent to deliberative sensemaking, and impair the quality of the latter, thus restricting the development of coherent interpretations necessary for effective problem-solving. Ultimately, this reduces organizational resilience to unexpected events and leaves them vulnerable to future failure.

CRediT authorship contribution statement

Johan M. Sanne: Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Colin J. Pilbeam:** Writing – review & editing, Writing – original draft, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Alvesson, M., & Kärreman, D. (2007). Constructing mystery: Empirical matters in theory development. *Academy of Management Review*, 32(4), 1265–1281.
- Andrén, M., Sanne, J. M., & Linell, P. (2010). Striking the balance between formality and informality in safety-critical communication: Train traffic control calls. *Journal of Pragmatics*, 42(1), 220–241.
- Barton, M. A., & Sutcliffe, K. M. (2009). Overcoming dysfunctional momentum: Organizational safety as a social achievement. *Human Relations*, 62(9), 1327–1356.
- Berends, H., & Deken, F. (2021). Composing qualitative process research. *Strategic Organization*, 19(1), 134–146.
- Berger, P. L., & Luckmann, T. (1966). *The social construction of reality. A treatise in the sociology of knowledge*. Penguin: London.
- Berthod, O., & Müller-Seitz, G. (2018). Making sense in pitch darkness: An exploration of the sociomateriality of sensemaking in crisis. *Journal of Management Inquiry*, 27(1), 52–68.
- Blatt, R., Christianson, M. K., Sutcliffe, K. M., & Rosenthal, M. M. (2006). A sensemaking lens on reliability. *Journal of Organizational Behavior*, 27, 897–917.
- Blommaert, J. (2007). Sociolinguistics and Discourse Analysis: Orders of Indexicality and Polycentricity. *Journal of Multicultural Discourses*, 2(2), 115–130.
- Brown, A. D., Colville, I., & Pye, A. (2015). Making Sense of Sensemaking in Organization Studies. *Organization Studies*, 36(2), 265–277.
- Cohen, M. D. (2007). Reading Dewey: Reflections on the study of routine. *Organization Studies*, 28(5), 773–786.
- Cornelissen, J. P. (2012). Sensemaking under pressure: The influence of professional roles and social accountability on the creation of sense. *Organization Science*, 23(1), 118–137.
- Cornelissen, J. P., Mantere, S., & Vaara, E. (2014). The contraction of meaning: The combined effect of communication, emotions, and materiality on sensemaking in the Stockwell Shooting. *Journal of Management Studies*, 51(5), 699–736.
- Dekker, S. W. A. (2014). The bureaucratization of safety. *Safety Science*, 70, 348–357.
- Dreyfus, H. L. (2002). A phenomenology of skill acquisition as the basis for a Merleau-Pontian non representational cognitive science. Unpublished manuscript, Department of Philosophy University of California, Berkeley.
- Dunbar, R. L. M., & Garud, R. (2009). Distributed knowledge and indeterminate meaning: The case of the Columbia shuttle flight. *Organization Studies*, 30(4), 397–421.
- Edelman, B. (1997). *Shunters at work: Creating a world in a railway yard*. Stockholm: Almqvist & Wiksell International.
- Farjoun, M., & Mahmood, N. (2023). On habit and organizing: A transactional perspective relating firms, consumers, and social institutions. *Organization Science*, 35(3), 1157–1176.
- Farrington-Darby, T., Pickup, L., & Wilson, J. (2005). Safety culture in railway maintenance. *Safety Science*, 43, 39–60.
- Fleming, P., & Spicer, A. (2014). Power in management and organization science. *Academy of Management Annals*, 8(1), 237–298.
- Goodbrand, P. T., Deng, C., Turner, N., Uggerslev, K. L., Gordon, J., Martin, K., & McClelland, C. R. (2021). Exploring safety knowledge sharing among experienced and novice workers. *Journal of Safety Research*, 79, 125–134.
- Hasselberg, Y. (2001). Fara eller frihet? Sakerhetstänkandet inom bantrafik och vägtrafik 1858–1968: en jämförande studie [Danger or freedom? Safety thinking in rail and road traffic 1858–1968: a comparative study]. Working Papers in Transport, Tourism and Information Technology 2001, 2, Borlänge, Högskolan Dalarna.
- Hodgson, G. M. (2006). What are institutions? *Journal of Economic Issues*, 40(1), 1–25.
- Hodgson, G. M. (2007). Institutions and individuals: Interaction and evolution. *Organization Studies*, 28(1), 95–116.
- Introna, L. D. (2019). On the making of sense in sensemaking: Decentred sensemaking in the meshwork of life. *Organization Studies*, 40(5), 745–764.
- Jahn, J. L. S. (2019). Voice enactment: Linking voice with experience in high reliability organizing. *Journal of Applied Communication Research*, 47(3), 270–289.
- Jørgensen, L., Jordan, S., & Mitterhofer, H. (2012). Sensemaking and discourse analyses in inter-organizational research: A review and suggested advances. *Scandinavian Journal of Management*, 28(2), 107–120.
- Kjeldskov, J., & Paay, J. (2010). Indexicality: Understanding mobile human-computer interaction in context. *ACM Transactions in Computer-Human Interactions*, 17(4), 14–28.
- Kudesia, R. S. (2017). Organizational sensemaking. *Oxford Research Encyclopedia of Psychology*. OUP: USA.
- Langley, A. (1999). Strategies for theorizing from process data. *Academy of Management Review*, 24, 691–710.
- Lawrence, T. B., Malhotra, N., & Morris, T. (2012). Episodic and systemic power in the transformation of professional service firms. *Journal of Management Studies*, 49(1), 102–143.
- Leonardi, P. M. (2011). Innovation blindness: Culture, frames, and cross-boundary problem construction in the development of new technology concepts. *Organization Science*, 22(2), 347–369.
- Leonardi, P. M. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they different? Do we need them? *Information and Organization*, 22(3), 127–140.
- Leonardi, P. M., & Barley, S. R. (2010). What's under construction here? Social action, materiality and power in constructivist studies of technology and organizing. *Academy of Management Annals*, 4(1), 1–51.
- Linde, C. (1988). The quantitative study of communicative success: Politeness and accidents in aviation discourse. *Language and Society*, 17, 375–399.
- Lindvall, K. (1980). Från banvakt och banarbetare till besiktningsman och maskinoperatör [From lineman and track worker to inspector and machine operator], in Fataburen, Nordiska museets och Skansens årsbok, pp. 101–119.
- Madigan, C., Johnstone, K., Way, K. A., & Capra, M. (2021). How do safety professionals' influence managers within organizations? – A critical incident approach. *Safety Science*, 144, Article 105478.
- Maitlis, S. (2005). The social processes of organizational sensemaking. *Academy of Management Journal*, 48(1), 21–49.
- Maitlis, S., & Christianson, M. (2014). Sensemaking in Organizations: Taking stock and moving forward. *The Academy of Management Annals*, 8(1), 57–125.
- Melrose, S. (2009). Naturalistic generalization. In A. J. Mills, G. Durepos, & E. Wiebe (Eds.), *Encyclopaedia of Case Study Research*. Thousand Oaks, CA: Sage Publications.
- Milliken, F. J., Morrison, E. W., & Hewlin, P. F. (2003). An exploratory study of employee silence: Issues that employees don't communicate upwards and why. *Journal of Management Studies*, 40, 1453–1476.
- Morrison, E. W. (2014). Employee voice and silence. *Annual Review of Organizational Psychology and Organizational Behavior*, 1, 173–197.
- Oliver, N., Calvard, T., & Potočnik, K. (2017). Cognition, Technology, and Organizational limits: Lessons from the Air France 447 disaster. *Organization Science*, 28(4), 729–743.
- Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, 11(4), 404–428.
- Orlikowski, W. J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies*, 28(9), 1435–1448.
- Orlikowski, W. J. (2009). The sociomateriality of organizational life: Considering technology in management research. *Cambridge Journal of Economics*, 34, 125–141.
- Peterson, R., & Wingqvist, B. (1982). *Olycksfallsrisker vid banarbeten – en arbetsmiljöstudie [Accident risks during track work – a work environment study]*. Göteborg: Göteborg SJ Företagshälsövärd.
- Pidgeon, N., & O'Leary, M. (2000). Man-made disasters: Why technology and organizations (sometimes) fail. *Safety Science*, 34(1–3), 15–30.

- Sandberg, J., & Tsoukas, H. (2011). Grasping the logic of practice: Theorizing through practical rationality. *Academy of Management Review*, 36(2), 338–360.
- Sandberg, J., & Tsoukas, H. (2015). Making sense of the sensemaking perspective: Its constituents, limitations, and opportunities for further development. *Journal of Organizational Behavior*, 36, s6–s32.
- Sandberg, J., & Tsoukas, H. (2020). Sensemaking reconsidered: Towards a broader understanding through phenomenology. *Organization Theory*, 1, 1–34.
- Sanne, J. M. (2008). Framing risks in a safety-critical and hazardous job: risk-taking as responsibility in railway maintenance. *Journal of Risk Research*, 11(5), 645–658.
- Sanne, J. M. (2010). Making Matters Speak in Railway Maintenance. In M. Büscher, D. Goodwin, & J. Mesman (Eds.), *Ethnographies of Diagnostic Work: Dimensions of Transformative Practice* (pp. 54–72). Houndmills, Palgrave Macmillan.
- Sanne, J.M. (2012). Learning from Adverse Events in the Nuclear Power Industry: Organizational Learning, Policy Making and Normalization, *Technology in Society*, Volume 34, Number 1, pp. 239–250.
- Sanne, J. M. (2014). Vulnerable practices: Organizing through bricolage in railroad maintenance. In Hommels, A., Mesman J., Bijker, W. E., Quartz, J., Shah, E. (Eds.), *Vulnerability in Technological Cultures: New Directions in Research and Governance* (199–216). MIT Press.
- Schildt, H., Mantere, S., & Cornelissen, J. (2020). Power in Sensemaking Processes. *Organization Studies*, 41(2), 241–265.
- Snook, S. A. (2000). *Friendly fire: The accidental shootdown of US Black Hawks over northern Iraq*. Princeton University Press.
- Scott, C. W., & Trethewey, A. (2008). Organizational Discourse and the Appraisal of Occupational Hazards: Interpretive Repertoires, Heedful Interrelating, and Identity at Work. *Journal of Applied Communication Research*, 36(3), 298–317.
- Stigliani, I., & Ravasi, D. (2012). Organizing thoughts and connecting brains: Material practices and the transition from individual to group-level prospective sensemaking. *Academy of Management Journal*, 55(5), 1232–1259.
- Strike, V. M., & Rerup, C. (2016). Mediated sensemaking. *Academy of Management Journal*, 59(3), 880–905.
- Taylor, J. R., & Van Every, E. (2000). *The emergent organization: Communication as its site and surface*. Mahwah, NJ: Lawrence Erlbaum.
- Thurlow, A., & Helms Mills, J. (2009). Change, talk and sensemaking'. *Journal of Organizational Change Management*, 22(5), 459–479.
- Tourish, D., & Robson, P. (2006). Sensemaking and the distortion of critical upward communication in organisations. *Journal of Management Studies*, 43, 711–730.
- Vaughan, D. (1996). *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. University of Chicago Press.
- Weber, K., & Glynn, M. A. (2006). Making sense with institutions: Context, thought and action in Karl Weick's theory. *Organization Studies*, 27(11), 1639–1660.
- Weick, K. E. (1990). The vulnerable system: An analysis of the Tenerife air disaster. *Journal of Management*, 16(3), 571–593.
- Weick, K. E. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly*, 38(4), 628–652.
- Weick, K. E. (2005). Managing the unexpected: Complexity as distributed sensemaking. In R. R. McDaniel, & D. J. Driebe (Eds.), *Uncertainty and Surprise in Complex Systems: Questions on Working with the Unexpected* (pp. 51–78). Springer-Verlag.
- Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly*, 38, 357–381.
- Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science*, 16(4), 409–421.

Johan M. Sanne, is Associate Professor in Science and Technology Studies, based at Swedish Environmental Research Institute, and Adjunct Professor in Work Science, Luleå University of Technology, Sweden. His research concerns managing large, complex system toward organizational and social sustainability, focusing issues of sensemaking, mobilization, language and power.

Colin J. Pilbeam, is Professor of Organizational Safety, based in the Cranfield Safety and Accident Investigation Centre, Cranfield University, UK. His research focuses on how organizational structures, processes and practices influence safe working and organizational safety performance.



DSPACE

<https://dspace.org/>

How an institutional setting shape and limit the mitigation of accidents in complex work settings

Sanne, Johan M.; Pilbeam, Colin

2025-07

Elsevier

<https://doi.org/10.1016/j.jsr.2025.02.009>

Sanne JM, Pilbeam CJ. (2025) How an institutional setting shape and limit the mitigation of accidents in complex work settings. *Journal of Safety Research*, Volume 93, July 2025, pp. 229-240