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Equipping Organizational Reliability: Between Organization and Situated Activity, the Contribution of Situational Approaches

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Abstract

Research on high-reliability organizations (HROs) studies how organizations subject to significant risks manage to maintain their reliability. In such work, reliability is not based exclusively on an organization's ability to anticipate and prevent problems but is the product of inter-actions between actors adjusting to unexpected events every day. By focusing primarily on communicative and cognitive processes, HROs neglect the role of equipment in supporting the construction of organizational reliability. We argue that this pitfall arises from the unit of analysis considered by HRO literature, which led us to shift our focus from structure (rules, prevention systems) to situated interactions. We suggest that this should be complemented by a situational analysis framework exploring the theoretical potential of the 'situation' concept as an intermediate analysis unit between situated activity and organization. From in situ observation sequences in two operating rooms of a private clinic, we distinguished three types of situations. Here, the entwinement of human activities with equipment that builds reliability takes different forms: standard, bounded, and extended situations. Finally, our research highlights three contributions of a situational approach to thinking about organizational reliability: (1) as an intermediate notion between the given and the created, the situation enables us to study the tangible and intangible equipment supporting reliability; (2) as an intermediary notion between singularity and regularity, it allows us to highlight the influence of context on reliability maintenance activities; and (3) as an intermediary notion between instantaneity of action and permanence of the organization, it lets us identify reliability maintenance trajectories.

The coronavirus disease 2019 (COVID-19) crisis put hospitals under pressure and raised the issue of organizational reliability in the healthcare and medico-social sectors. Research on this subject (e.g., Dumez & Minvielle, 2020) shows that healthcare organizations managed to maintain the quality and safety of care in this context of major uncertainty by relying on team creativity, the adaptation of rules and decisions, and resilience in the face of the unexpected.

Our research does not focus on major crisis situations such as that of COVID-19 but instead looks at how high-risk organizations, particularly in healthcare, maintain the reliability of their systems under 'normal' conditions. It is therefore in line with work on high reliability organizations (HROs) (Roberts, 1989; Weick & Sutcliffe, 2001), which studies how organizations subject to high risks (nuclear industries, aircraft carriers, air traffic control, and more recently, hospitals) manage to maintain the reliability of their systems. Reliability will

be understood here as the ability of a complex organized system to maintain its status quo, without failure or dramatic consequences, despite a very high accident potential (Cantu et al., 2020; Roberts, 1989). The concept of reliability links two imperatives, namely safety and economic efficiency (Bourrier, 2003), found, from the earliest HRO studies, to create an area of tension requiring management (e.g., Rochlin et al., 1987). In these works, reliability is based on the 'resilience' of organizations, which we will define here as the ability to absorb unforeseen events – which inevitably occur regardless of the defenses put in place – and to learn from these disruptions in order to emerge stronger (Wildavsky, 1988). According to HRO theory, resilience is the product of interactions between individuals. In these works, reliability is built through cognitive and communicative activities based on five key principles (Weick & Sutcliffe, 2001). However, in the HRO movement, these principles of action are not embodied in concrete equipment (Lorino, 2005; Nicolini, 2011).

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We argue that this gap can be explained by the focus of analysis considered by HRO research, which is situated inter-action. From organization to 'organizing' (Weick, 1979), there is a high risk of underestimating the structuring elements of a situation, with organization seen as the exclusive result of interactions. The present article proposes to shift the analytical focus from the situated interaction to the 'situation', exploring the theoretical potential of situational approaches to contribute to HRO work on reliability, considering the gap depicted. The research question to be explored in the article can thus be formulated as: How can situational approaches (Girin, 1983, 1990a; Journé & Raulet-Croset, 2008, 2012; Nicolini, 2011; Schatzki, 2005) contribute to thinking about the equipment of human activities at the underpinning of organizational reliability? Under the term 'situational approaches', our intention is to group together works that mobilize the concept of the situation in terms of its theoretical scope, that is, an intermediate unit of analysis between situated activity and organization. Situational approaches will enable us to study the embedding of individual and collective reliability-maintaining activities and the equipment that supports them, in a unit of time and place.

From an empirical point of view, this question will be investigated through the study of two operating rooms in a private clinic. Operating rooms, which are particularly affected by the combination of efficiency and safety issues (Tonneau & Lucas, 2006), are ideal places for studying organizational reliability.

After presenting the main HRO principles underpinning reliability, we will outline the situational analysis framework used in this article. We will then describe the research methodology. Based on our empirical material, we will then present three typical situations for maintaining organizational reliability: standard situations, bounded situations, and extended situations. On the basis of this typology, the fourth part of this article will compare the HRO approach with situational approaches. In response to our research question, we will present three theoretical contributions of taking a situation-based approach as an intermediate unit of analysis between the situated activity and the organization. This will shed light on the problem of operational reliability and enhance the existing approach developed by HRO research, which focus on situated interactions. Firstly, we will show how the situation, as an intermediate concept between the given and the created, provides access to the study of tangible and intangible equipment supporting the communicative and cognitive mechanisms highlighted by HROs. Secondly, we will show that the situation, as an intermediate notion between singularity and regularity, highlights the influence of the type of context (Schatzki, 2005) on reliability support activities. Finally, we will show that a situational approach, as an intermediate unit of analysis between the instantaneity of action and the

permanence of the organization, reveals the temporal dynamics at work in supporting reliability and outlines trajectories of reliability support in which situations fit together or separate. This study of organizational reliability also enables us to enrich our understanding of situations through two contributions: the first focuses on the 'actor-pivot' concept introduced by Journé and Raulet-Croset (2008) and the second concerns the status of the problem in the situation. We conclude by considering the managerial implications of our research.

Equipping organizational reliability: From the study of situated interactions to situational approaches

Reliability in high-risk organizations has long been based on technical systems and rules. However, these solutions prove inadequate in real-life activities, which are characterized by the unexpected. Work on HROs therefore suggests focusing on organizational resilience to maintain system reliability. Adopting a situated interaction approach (Schatzki, 2005), this work neglects the role of objects and artifacts in resilience. We suggest complementing this work by using a situational analysis framework that pays attention to the context in which these interactions take place (Girin, 1983; 1990a; Journé & Raulet-Croset, 2008, 2012; Nicolini, 2011; Schatzki, 2005), thus enabling us to study the equipment (Sandberg & Dall'Alba, 2009) of human activities that keep organizations reliable.

Organizational reliability through organizational resilience: Contribution and limits of HRO theory

If reliability can be understood as the ability of a complex organized system to maintain its operation, without failure or dramatic consequences, despite a very high accident potential (Cantu et al., 2020; Roberts, 1989), how can organizations develop this capacity? Work on HROs suggests moving beyond an approach to risk management based on anticipating and preventing problems to develop the organization's resilience in the face of the unexpected, which, by definition, cannot be foreseen. However, as Boin and Van Eeten (2013) point out with regard to HROs, 'we do not really know what causes resilience or how it is achieved' (p. 430). In the remainder of this article, we will argue that this gap is due to the unit of analysis studied in HROs: situated interaction,[1] which leads to a neglect of the active role

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[1.] In this sense, the HRO approach is concerned with situated activities and with reliability in the process of being achieved. The situated activity approach brings together a wide variety of work (activity theory, situated action, distributed cognition, etc.) in which equipment plays a more or less important role (Licoppe, 2008). Situated activity is understood here in the sense of HRO work, that is, with social interactions at its core.

played by equipment in supporting reliability. We will begin by reviewing the contribution of HRO work that develops the concept of resilience and by formalizing five key principles that support reliability. We will then examine the focus of analysis on HROs to show how this leads to the dilution of the organization in situated interactions.

Organizational resilience: Definitions

There are many definitions of resilience. For example, Pettersen and Schulman (2019) distinguish between precursor resilience (monitoring operations to act quickly when an unforeseen event occurs, so as to contain the crisis), restoration resilience (acting quickly to resume operations after a disruption), and recovery resilience (restoring damaged systems and learning from a crisis to improve system reliability). According to Boin and Van Eeten (2013), these definitions center on two conceptions: (1) the capacity of organizations to react to the unexpected and return to a 'normal' state of order; (2) the ability of organizations to learn from managing these unforeseen events to improve the reliability of their systems. It is this second definition that is used in work on HROs. Current research focuses on organizations facing major risks, whose system reliability is crucial, firstly given the potential damage that could result in case of failure, and secondly, in view of the fields of activity of these organizations, which require them to maintain smooth running, whatever the disruptions they face (Laporte & Consolini, 1991; Roberts, 1989). Early HRO work focused on nuclear power, air traffic control, and military aviation (Roberts, 2009). As Cantu et al. (2020) note, since 2001, increasing attention has been paid to healthcare organizations described as highly reliable (see, e.g., Chassin & Loeb, 2013; De Bovis et al., 2011; Roberts et al., 2005; Shapiro & Jay, 2014). Work on HROs has also been transposed to mainstream businesses, which do not show HRO characteristics, but do have to deal with complex and turbulent environments (Cantu et al., 2020).

Five principles of resilience

Current research on HROs defends the idea that reliability is the product of interactions between actors who adjust to the real work situations they face on a daily basis. Confronted with the unexpected, individuals face a collapse of sensemaking (Weick, 1993) that affects both the situation (what is happening?) and the decision of how to manage it (what should be done?). Organizational resilience is therefore based on a process of sensemaking, supported by interactions between individuals who have to find new solutions to the problems they face, which implies bricolage and improvisation (Weick, 1993). The study of highly reliable organizations has revealed five foundational principles supporting this reliability (Weick & Sutcliffe, 2001).

These principles involve, firstly, monitoring small failures, that is, unforeseen events emerging in the course of action (being aware of the organization's vulnerabilities, being concerned about failure, not resting on one's laurels but remaining vigilant, and encouraging the reporting of undesirable events or incidents). The second principle involves managing the complexity of situations by reluctance to simplify, which implies combining diverse views, divergent perceptions on problems, and encouraging the confrontation of ideas (cultivating 'requisite variety', Weick et al., 1999; developing Schulman's, 1993, 'conceptual slack'). Thirdly, it involves developing and maintaining a high level of sensitivity to operations, that is, paying attention to the actual situation as it is happening while maintaining an integrated 'big picture' of operations ('having the bubble', Weick et al., 1999, p. 43). The fourth principle is to encourage management to develop and maintain a commitment to resilience, which means accepting that the unexpected is inevitable in the system. Effective management does not simply anticipate problems in order to eliminate them, nor does it confine itself to bouncing back from past events. Resilience is about organizing the management of unforeseen events to respond to and contain them as they occur, by supporting organizational improvisation. Organizational resilience is particularly based on the flexibility of the system and its ability to reconfigure itself according to the situations encountered, which presupposes slack resources[2] (Vogus & Sutcliffe, 2007). Finally, the fifth principle supporting organizational reliability is deference to expertise. This means putting the person who knows best what to do about a problem in charge of the relevant decisions (the person with the necessary competence whose credibility is recognized by the group), even if this means stepping outside the organization's formal hierarchy.

From structures to situated interactions: An analytical focus that neglects the importance of equipment for action

The HRO approach to reliability invites us to shift focus from the structural dimensions of the organization (the plan, the rule) to situated activity, understood as what actors do on a daily basis to build and maintain reliability. From an interactionist perspective, the unit of analysis studied in HROs is above all that of interactions[3] between individuals (Schatzki, 2005). This focus on interactions has led HRO authors to overlook or downplay the active role played by artifacts and objects in maintaining reliability (Jansson et al., 2020; Lorino, 2005; Nicolini,

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[2.] Resource slack refers to the resources (temporal, human, material, etc.) available to absorb problems. It is one of the dimensions of organizational slack (Schulman, 1993).

[3.] Weick (1993) places respectful interactions at the core of organizational resilience; Weick and Roberts (1993) say that reliability is the result of collective mind based on heedful interrelations.

2011). From a processual perspective, the organization is not seen as a stable entity, but as one constantly being reconstructed by these interactions, a process that Weick (1979) refers to as 'organizing'. In this work, the organization is only studied implicitly (Bourrier, 2001). We should therefore ask what then are the artifacts, objects, and material arrangements (Nicolini & Monteiro, 2017; Schatzki, 2005, 2019) that individuals rely on, in support of their interactions, to improvise, make sense of what they are experiencing, construct the big picture, remain attentive to failures, etc. This observation can prove problematic for management researchers, who are concerned with managerial action. How then can we develop and support organizational reliability from a situated approach, without falling back into a structural approach?

Our aim here is to study the 'equipment' of reliability, a concept adopted from Sandberg and Dall'Alba (2009) to refer to the material and immaterial non-human elements involved in and intertwined with the work activities, such as the physical workspaces, management tools, and rules used, etc.[4] In this article, we propose to shift the focus of analysis from situated activity (used here in the HRO sense, i.e., situated interactions) to situations of reliability maintenance by exploring the theoretical potential of situational approaches to contribute to organizational reflections on reliability. These approaches are highly coherent with the HRO literature in the sense that HRO authors are interested in human action and its fundamental role in the construction of structures (Feldman & Orlikowski, 2011). However, situational approaches look at organizations not only as the result of interactions but also as the structural condition of practices (Nicolini, 2012), which can support or constrain them.

Considering the equipment of organizational reliability: The potential of situational approaches

Although omnipresent in managerial literature, the situation remains largely neglected (Goffman, 1988; Journé & Raulet-Croset, 2008), in the sense that it forms the background to human activities in this literature, without being the subject of theorization. However, in recent years, a number of works have explored the theoretical potential of the situation to explain social phenomena, particularly in French-language management literature (Girin, 1983, 1990a). Without being exhaustive about situational approaches that give the situation a real theoretical

status in analysis, we will present the work on the situation developed by the practice-based approach, in particular through the notion of site (Nicolini, 2011; Schatzki, 2005), before describing the way in which Girin (1983, 1990a) and later authors (Journé & Raulet-Croset, 2008, 2012) contributed to theorizing the situation by placing it within the field of managerial action.

The situation in the practice-based approach

In recent years, the practice-based approach has gradually entered a wide range of organizational research topics (strategy, knowledge management, institutional studies, and technology). In particular, several recent works have called for such a focus to complement the HRO literature (see, e.g., Jansson et al., 2020, or to address the subject of healthcare institutions, Hultin & Mähring, 2017). While this 'practice turn' does not present itself as a unified theory (Feldman & Orlikowski, 2011; Nicolini, 2012; Reckwitz, 2002), all works agree on several common features. Firstly, practice is never a complete invention or repetition: the whole point of this level of analysis is to encompass the tension between routine form[5] and uniqueness (Feldman & Orlikowski, 2011). Secondly, the practice-based approach emphasizes the importance of the body, language, and material things in practices (use of objects, artifacts, etc.) (Nicolini, 2012). Language alone cannot explain organizational reality: individuals, with their discourses and knowledge, and 'non-humans' elements are intertwined in the world of practices (Sandberg & Dall'Alba, 2009). It is in this sense that we will focus our attention on reliability equipment.

In the practice-based approach, however, not all studies avoid the risk already pointed out with regard to HROs: while the material dimension of action is at the core of the analysis, this materiality is sometimes studied as a consequence of practices, rather than as a structuring condition of them (Sandberg & Dall'Alba, 2009). In doing this, there is a risk of diluting the organization in the practices, which makes it impossible to think about their equipment. This is why several works in the practice approach have stressed the importance of the contexts in which these practices take place, which shape them and make them possible (Feldman & Orlikowski, 2011; Nicolini, 2011, 2012; Sandberg & Dall'Alba, 2009; Schatzki, 2005, 2019).

Schatzki (2005), a pioneer of situational approaches in the shift toward practice in the literature, introduced the concept of site ontology. A site is an arrangement of interacting heterogeneous elements that refers as much to individuals and the way they interact with each other, as to material arrangements (artifacts and objects), rules, the spatiotemporal extension of

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[4.] In these works, equipment is characterized less by its intrinsic characteristics than by its usefulness in carrying out human activities. Defined in this way, the notion of equipment also has resonance with the work of Vinck (2006), who focuses on the instrumentation of action in both its material and immaterial dimensions (e.g., actors' conceptual baggage). With the concept of 'equipment work', he defends the idea that equipment is not a simple artifact or resource available to actors, but that it is reappropriated and transformed by actors in the course of action.

[5.] With Reckwitz (2002), practice can be defined as 'a routinized type of behavior which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, ''things'' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge' (p. 249).

action, or its ends. Studying the way in which these different elements combine, Schatzki defines the site as a type of context, revealing forms of regularity in these combinations. This idea is reflected in the work of Orlikowski (2006), for example with the metaphor of scaffolding. Scaffolding underlines the importance of the material dimensions of practices (in the broadest sense, embracing spatial contexts, physical objects, artefacts, rules, etc.), which combine with each other and with social dimensions in configurations that are specific, thereby creating different types of context.

The situation as addressed by management science

The practices approach seeks to understand and explain social or organizational phenomena based on practices (Nicolini, 2012). In so doing, it does not directly address the question of managerial action at the core of our research. Conversely, Girin's work (1983, 1990a) on the management situation and additional work by Journé and Raulet-Croset (2008, 2012) make it possible to position the situation in the field of managerial concerns by bringing it closer to performance issues (Journé & Raulet-Croset, 2008), of which organizational reliability is one dimension (Hollnagel et al., 2009).

'A management situation arises when participants are brought together and must carry out, within a given time, a collective action leading to a result subjected to external judgment' (Girin, 1990a, p. 142). This definition outlines four dimensions of the situation (Journé & Raulet-Croset, 2012), which we summarize in Table 1 and which will be used in this article to explore the equipment of reliability. The first dimension is a social one: the situation brings together actors-participants who interact with each other (Girin, 1989). This is the main dimension of the HRO study, which focuses on interactions between professionals. The participants all develop a subjective point of view on the situation. Moreover, they only partially share the same objectives. As Journé and Raulet-Croset (2008)

emphasize, participants do not all have the same status in the situation: the authors thus introduce the concept of the 'pivot-actor', which designates an actor who will structure the situation from his or her own point of view (i.e., the one around which the sense-making process is organized), and who exercises (partial or total) responsibility for the situation. The second dimension is physical (what Girin, 1989, calls 'spatial extension'): it refers to the place(s) in which the situation takes place, and to the material objects used, called upon in the situation. The third dimension is temporal: the situation has a beginning, an end, and an unfolding. The fourth dimension is institutional: the outcome of the situation is always the subject of a judgment, more or less direct and immediate, and this judgment influences the actions of the participants in the situation. This judgment can be made by actors who are outside the situation (e.g., shareholders and managers), but also those inside it (participants judge the result obtained by working together). The institutional dimension of the situation is thus an absent third party that implicitly influences the situation. This dimension brings the situation into the field of managerial concerns.

These dimensions are to be considered in a dynamic way. On the one hand, since the situation is by nature fluctuating (Girin, 1990a), these four dimensions evolve and structure themselves progressively: participants enter the situation while others leave it, new tools are called upon, new spaces are used, and so on. On the other hand, it is not easy to separate them within the situation, as they are so closely intertwined (e.g., the institutional dimension is frequently embodied in management tools that refer to the physical dimension of the situation). However, it is precisely in the interlinking of these dimensions that the concept of situation is interesting: in their intertwining, these dimensions present structuring effects for the activity taking place there (what tools and spaces are available to teams, what results are evaluated, etc.). Thus, for Girin, the organization has its own

Table 1. The four key dimensions of a management situation

Key dimensions	Features of each dimension
Social dimension	Refers to the participants involved: the situation is always collective, constituted by interactions between actors and, at the same time, subjectively experienced by each participant. The collective thus constituted, which is always evolving, potentially transcends organizational boundaries (department, company, etc.)
Physical dimension	Refers to the immediate physical environment of the situation: workspaces, material objects, and tools used
Time dimension	Refers to time boundaries (start and end) and the structure of time between these two boundaries (extension, expansion, interruption, etc.)
Institutional dimension	Refers to the macrostructures that influence the definition of the situation, and which are sometimes invisible when the situation is observed: formal or informal norms, evaluation criteria, injunctions from the hierarchy or external stakeholders (regulators, clients, etc.), which are absent from the situation, but whose expectations nonetheless have an impact on the behavior of those involved in the situation

Source: Own elaboration.

existence outside the situation: it produces resources and constraints, which structure the situation (1990b) and thereby enable, support, or conversely, constrain activities[6]. At the same time, these dimensions are structured by collective action: for example, actors may modify planning or distort it from its initial function (e.g., see Suchman's, 1987, work on planning), bypass certain rules or choose to input certain reporting tools only partially. The management situation is a constantly unique combination of participants, objects and events in a given space-time, which is built around uncertainties or problems. Through inquiry (Dewey, 1993), actors structure the situation (What is the problem? Which participants are involved? Which tools are relevant? etc.): Girin (1983) thus indicates that 'a good part of the activity of agents interacting in a management situation consists […] in trying to determine which are the appropriate contexts for understanding and dealing with it'. Finally, like Journé and Raulet-Croset (2008), we can say that 'the organization produces situations which in turn modify it' (p. 27).

With the concept of the management situation, we return to the double movement observed in the literature on practices, in the entwinement of equipment and human activities: equipment both shapes and is shaped (Sandberg & Dall'Alba, 2009). Finally, the situation is an intermediate unit of analysis between micro and macro levels, between the given and the created, and between situated activity and organization (Girin, 1990a). Organization is therefore seen as a 'response given to one or more management situations possessing a certain permanence, at the same time as a rigidification of the means taken to deal with them' (Girin, 1990a, p. 144). This reflection on the relationship between situation and organization, between the singular, volatile, ephemeral nature of the situation and the rigid, permanent nature of the organization, was continued by Journé and Raulet-Croset (2008), who saw this relationship as a field of tension as much as a managerial lever.

This earlier work incited us to continue exploring the theoretical potential of situational approaches. It is from this perspective that the present research project examines the contribution of a situational approach to the problem of organizational reliability. We will thus seek to answer the following question: How can situational approaches contribute to thinking about the equipment of human activities that support organizational reliability? Equipment will be explored here through the prism of the four dimensions of the situation. In the rest of the article, we will study situations involving organizational reliability in two operating rooms of a private clinic.

This situational approach leads us to pay close attention to the social, temporal, physical and institutional dimensions of each situation studied in order to identify how the human activities that maintain the reliability of operating rooms become entwined with the concrete equipment.

Research methodology

Our research is based on an embedded case study (Yin, 1994), carried out in two operating rooms (orthopedics and cardiology) of a French private clinic. The material was collected as part of a doctoral project between 2009 and 2011. The PhD thesis (defended in 2012) focused on operating room coordination mechanisms in the context of care rationalization. It articulated three qualitative methods of data collection: interview, non-participant observation, and document analysis.

Data collection

In keeping with the situational approach we adopted, this article is based exclusively on the main material of the thesis: observational data. A number of studies have demonstrated the benefits of such a methodology for studying complex organizational phenomena in situ (Arnoud & Peton, 2020; Journé, 2005). Moreover, observation is a research methodology particularly well suited to the study of materiality in organizations (Royer, 2020). A total of 110 h of observation were carried out in the two surgical units (60 h in the orthopedic/ophthalmology unit, 50 h in the cardiology unit), supplemented by 9 h of observation in the scheduling unit and 5 h in a hospital stretcher-bearer's work (see Table 2). Observations were based on the observation method proposed by Journé (2005), articulating variable and fixed observation perimeters. The following spaces were observed: operating rooms, corridors, orientation, or control rooms in the centers of surgical units. The shadowing technique (Czarniawska, 2018) was used with the nurse managers of the two surgical units and with the nurse coordinators, because it appeared that they played an important role in the organization of the operating rooms. These observations were combined with in situ 'conversations' with the actors who were the protagonists of the observations, which enabled us to capture the cognitive activity of these actors (beyond the 'traces' accessible to the observer: actions and dialogues) (Théron, 2020) and to obtain explanations on the context of the observed activity.

Data analysis

We coded our observations abductively (David, 2000), going back and forth between data and theory. Our analytical approach was as follows:

[6.] The challenge therefore is not to lose sight of the activity that takes place in these situations, the way in which actors use equipment and thus help to shape it, at the risk of presenting a disembodied approach that is inconsistent with the spirit of HROs (Dumez, 2008).

Table 2. The observation system used

Orthopedic unit	60 h	Fixed position in orientation room: 9.5 h Nurse coordinator shadowing: 24.5 h Nurse manager shadowing: 26 h *Large operating room: the most appropriate observation system is shadowing*
Cardiology unit	50 h	Fixed position (corridor and control room): 34 h Nurse coordinator shadowing: 7 h Nurse manager shadowing: 9 h *Smaller operating room: the most appropriate observation system is a fixed position in the control room*
Scheduling unit	9 h	Manager shadowing: 2 h Team member shadowing: 7 h
Stretcher-bearer	5 h	Shadowing: 5 h

Source: Own elaboration.

1. Separation and numbering the various situations, so as to identify situations that were fragmented in time and space. A total of 1,403 situations were analyzed.
2. Characterization of each situation: disrupted/non-disrupted; when disrupted, identification of the object of the disruption (several objects were initially identified in our data: patient, personnel management, material management, space management, etc.; groupings were then made, see point [4] below).
3. Analysis of reliability-maintaining activities within each situation: HRO principles implemented; situation structure, based on the four dimensions identified in the conceptual framework: spatial dimension (nature of spaces mobilized), temporal dimension (temporal horizon of activities, fragmentation of situations), physical dimension (nature of tools: telephone, paper and computer) and modalities of use of these tools, social dimension (what corresponds to interactions observed by the HRO approach: verbal or non-verbal interactions, forms of communications observed), and institutional dimension (formal and informal rules/norms). Appendix 1 shows an extract from our coding table.
4. Production of intermediate analysis documents enabling us to observe redundancies in the combinations of activities/equipment observed (temporality of the situation, space for managing the situation, type of tool mobilized and its use, forms of communication, etc.), depending on the nature of the situation (undisrupted or disrupted), and then on the object of the situation (see Appendix 2). Quantitative processing of the qualitative coding was carried out at this stage, in order to observe the contribution made by each item of equipment to the overall situation studied. This work enabled us to objectify the differences in equipment observed in each situation. Situations presenting redundancies were grouped together, enabling us to identify two 'types' of disrupted situations: medically disrupted situations and organizationally disrupted situations.

In all, 532 disrupted situations were analyzed (369 organizational situations and 163 medical situations). None of these had any measured impact on system reliability. The case thus places us in a precursor approach to resilience (Boin & Van Eeten, 2013; Pettersen & Schulman, 2019) as defined above.

The case study

The research was carried out in a French private clinic with 700 employees and a capacity of around 500 beds. This clinic is concerned by the economic rationalization changes that have been affecting the healthcare sector for several decades. For example, it has set up a scheduling department and implemented IT coordination tools, such as operating room scheduling and real-time patient flow monitoring (called the 'supervision tool'), to limit unnecessary communication. Operating rooms get special attention from management. They represent a major cost, but at the same time an essential element of revenue, directly related to the surgical activity carried out (Tonneau & Lucas, 2006). The search for efficiency in the operating room has led to the implementation of a 'room rotation' system, which optimizes 'productive' operating time by reducing 'unproductive' time spent setting up and tidying the room and preparing the patient. This system foresees the opening of additional operating rooms in relation to the day's schedules, enabling some surgeons to carry out their shift in two operating rooms instead of one. It requires the presence of one or two additional nurses, not assigned to an operating session, to set up and tidy the rooms. The room rotation schedule is drawn up by the manager, in advance of the surgical activity. Additionally, a nurse coordinator is in charge of regulating the system in real time (reallocation of rooms and staff). Operating room usage indicators have also been developed by the scheduling unit (particularly room occupancy rates). This search for efficiency has to be balanced with the imperatives of reliability, to which the clinic is of course subject. Care activities are subject to major risks, the

Box 1. Observation extract from a habitual situation (ophthalmology)

9:35 a.m. In the operating room. The scrub nurse prepares the operating assistant's table, taking care not to touch the sterilized instruments. Here, we observe the need to work quickly between procedures. The surgeon and scrub nurse check the day's operating schedule. […] They bring the patient from the locoregional area, where he has been prepared. 9:38 a.m. The patient is taken to the operating room. The scrub nurse asks the patient to confirm that he is not allergic to iodine. She applies antiseptic solution to his right eye. She then fills in the digital traceability sheet and completes the patient file. Standing at the entrance to the operating room, arms outstretched, the surgeon and operating assistant wait for the scrub nurse to come and 'dress' them. They don't speak, knowing that the scrub nurse will do her job as soon as she has filled in the digital tools, which she does. Once dressed, the surgeon declares: 'Well, it's 9:43 a.m.'. […] The surgeon and assistant now lay out the surgical drape. The scrub nurse fills in the operating room patient security checklist: with the surgeon, she validates the patient's identity and the side on which he will be operated. The operation is about to begin. […] 10:00. The operation has ended. The operating assistant tidies up her table and the surgeon removes the surgical drape. The scrub nurse puts the side rail up on the gurney and puts the dressing on the patient. The operating assistant goes to the locoregional area to pick up the next patient on the operating schedule. She returns to the operating room and tells the scrub nurse: 'The next one isn't ready yet!'

consequences of which can be dramatic since human lives are at stake. Healthcare establishments are thus now rightly identified as HROs (Roberts et al., 2005; Shapiro & Jay, 2014).

Results: A typology of management situations

Observations show that activity in the operating rooms studied is constantly disrupted by unexpected events that threaten the reliability of the organization. These disruptions call into question the pre-established organizational framework. To manage them, the teams investigate, adapt and reorganize operating schedules in real time. These activities, which help maintain organizational reliability, are entwined with the equipment we are now going to look at. While disruptions are always singular, research has revealed some common features in reliability maintenance activities, which are largely due to the nature of the equipment mobilized, and the way in which it is used. Three 'typical' situations emerge from the analysis, which we will present in turn: the habitual[7] ('non-disrupted') situation, the medically disrupted situation, and the organizationally disrupted situation.

Habitual (undisrupted) situation

Observations reveal the existence of a first typical situation: the habitual situation. We will now look at how reliability is maintained in this type of situation using an observation extract (see Box 1).

This extract is typical of the habitual situations we observed: the number of participants is small (in this case, three), the situation is localized within a well-defined space (in this case, the operating room and locoregional room) and there is a short temporality (an event occurs quickly – the next patient is not ready yet – turning the situation from habitual to disrupted). Verbal communication between the health professionals is limited. Activities are carried out in accordance with the surgical schedule: this tool lists the

patients to be operated on during the day and formalizes the start and end times for each operation, the team of professionals assigned, and the operating room allocated.

In habitual situations, maintenance of reliability depends essentially on technical and organizational equipment: tools (e.g., the surgical schedule); rules (e.g., in this case, compliance with hygiene and safety rules: table set-up, patient questionnaire, traceability of procedures via the traceability sheet) and protocols (e.g., in this case, dressing of the surgeon and his assistant); division of labor (in this case, the surgeon, scrub nurse, and operating room assistant know the roles they have to play in this situation). There is little evidence of alternative readapted use of this equipment.

This equipment supports the vigilance of the health professionals, encouraging them to remain alert for possible deviations in the situation (e.g., the operating area checklist is used to confirm that the patient's identity is correct, that the operating site is correct, etc.). The division of labor and the tools specific to each job organize the redundancy of control activities (e.g., the nurse who admits the patient completes a questionnaire that checks that the patient's identity is correct, that the documents required for the operation are present, that preoperative care has been carried out, and so on; the operating room scrub nurse, via the operating room patient security checklist, will repeat a number of these checks before anesthetic induction, and before and after surgery). Teams also pay constant attention to the big picture, supported by the equipment they use; for example, by observing the operating rooms (through glass doors) and by regularly checking the progress of other teams' operating sessions. This attention is also supported by the 'supervision' tool that provides real-time information on patient trajectories (which department each patient is in and what procedures are being performed).

Management works dynamically with support departments to make operating schedules more reliable. For example, a working group including operating room nurse managers and the scheduling unit works to formalize operating times by type of procedure; the IT tool now programs operating times automatically, rather than depending on the scheduling doctor.

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[7]. Here, we use the term 'habitual' to refer to a non-disrupted situation that conforms to the 'plan', echoing the work of Faraj and Xiao (2006) who distinguish between habitual and problematic patient trajectories.

Table 3. Structure of the habitual situation

Dimension of the situation	Main features
Social	Few verbal interactions; communication is essentially instrumental (instructions, transmission of information). Well-established division of labor (everyone knows and plays his or her role)
Physical	Central dimension of the habitual situation. Compliance with tools, rules and procedures. No alternative readaptation in their use. Localized situation within a well-defined space
Time	Easily identifiable temporal boundaries (start time, end time), short duration (an unexpected event occurs rapidly). Continuous, uninterrupted situation. Well-defined boundaries, no overlap with other situations
Institutional	Efficiency imperatives: optimization of surgical time (to operate as much as possible), room occupancy rates, etc. Safety imperatives: standardization of procedures to guarantee the quality and safety of care, traceability of procedures (times of the various operative steps, participants, etc.), which also serves the search for efficiency (enabling the extraction of valuable information to supply the management indicators mentioned above – measurement of the gap between real and scheduled)

Source: Own elaboration.

Box 2. Excerpts from observations of medically disrupted situations (cardiology).

Situation 1. 8:48 a.m. A patient undergoing coronary angiography is admitted to the post-operative recovery room. He has a hematoma that needs to be evacuated quickly, as the situation could lead to an aneurysm rupture. The doctor has recommended a specific procedure: 'compression' of the puncture site. The nurse coordinator will take care of this (she was in the process of preparing the management of an emergency that was ultimately referred to the – university teaching hospital). 'For the moment, the most urgent thing is compression. The major risk is hematoma. So, it is more imperative to compress than to put away the equipment prepared for the emergency. We proceed in order of urgency' (nurse coordinator).

Situation 2. 5 p.m. In operating room 1. The operation, a coronary angiography, begins. The surgeon requests a '5F' introducer sheath. […] The sheath requested by the surgeon does not fit through the patient's vessel. He asks for a smaller diameter, a '4F', to be able to 'make the way'. The scrub nurse opens the operating room door and gets the sheath requested by the surgeon, which is stored in the corridor. […] 5:44 p.m. The operation is over. In the post-operative recovery room, the scrub nurse passes on the information to the recovery room nurse (patient identity, history and course of the procedure). 'We couldn't see everything because we had difficulty inserting the probe'. As she tries to clarify her remarks to the recovery room nurse, she realizes that there is a hematoma […] The scrub nurse immediately returns to the control room. She turns to the doctor who is doing his report: 'Mr. Belloir,[8] could you come and take a look at the radial, I think it's swelling?' The doctor grumbles but gets up and goes to the recovery room, the nurse behind him. He says, 'You'll have to redo the dressing'. The scrub nurse replies: 'I'll get what I need' (she fetches materials from the operating room and the recovery room area). She then asks the doctor: 'Should I do it with Solène (an 'extra' nurse not assigned to an operating session), or will you do it with me?' The doctor replies: 'With Solène'. She returns to the recovery room and redoes the dressing.

Table 3 summarizes the main characteristics of these habitual situations.

Medically disrupted situation

Observations reveal a second typical situation: the medically disrupted situation. In Box 2, we present two corresponding situations and then analyze their main characteristics.

The extract reveals several characteristics of the medically disrupted situation: the situation is 'bounded' and well demarcated in its social (few participants are involved), spatial (small spaces), and temporal (short time, emergency logic) boundaries. Although the situation presents interdependencies with other situations (e.g., here, finalizing the management of another situation by putting away the equipment taken out to handle an emergency), the arbitrations required are not discussed: the order of priority is clearly defined and integrated

by the whole team (here, giving priority to the patient). Communication is essentially prescriptive from the doctor to the other participants involved in the situation.

In these situations, maintaining reliability relies on the expert, in this case, the doctor, who possesses the medical knowledge and whose responsibility is engaged by the nature of the unexpected event to be managed. The doctor is the pivot-actor in the situation. The situation is structured through his point of view: he makes the diagnosis and prescribes not only the objective of the work to be carried out (in this case, redoing the dressing, applying compression) but also the organization of the work to be done (who is going to act, according to what timeframe, and what material resources are to be mobilized).

The equipment most present in these situations is that which facilitates the involvement of the expert (telephone, shared workspaces, and glass doors enabling the doctor to be quickly located). Management of the situation is further facilitated by the existence of 'slacks' in the operating room, a principle itself embodied in concrete equipment: additional

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[8.] For reasons of confidentiality, all first and last names given in these extracts have been changed.

Table 4. Structure of the medically disrupted situation

Dimensions of the situation	Main features
Social	The situation is organized around the doctor-expert. As the pivot-actor, this doctor will structure the situation from his or her point of view and knowledge. Short, prescriptive verbal exchanges from the doctor to the other medical staff. Division of work designed for efficiency, adapted to absorb disruptions (coordinator, 'extra' nurse)
Physical	Shared workspace for doctors and nurses to facilitate face-to-face coordination (coordination is more difficult without shared spaces), glass doors to help visual coordination, and local storage space for rapid mobilization of additional resources. Boundaries of the situation are well-defined and little subject to change (here on the scale of the operating room)
Time	Emergency logic: situation unfolding in a very short space of time
Institutional	Informal norms underlying the situation: in the event of the unexpected, the logic of safety takes precedence over the logic of efficiency. The patient's family is an absent third party (as also is the patient, although in a different way, since asleep). The doctor's legal responsibility is to engage in the event of problems and legal action by families. Evaluation systems focused on the consequences of contingencies (e.g., death statistics). Attention is paid to serious adverse events, which professionals are required to report using a tool

Source: Own elaboration.

materials are immediately available to teams so that they can react quickly to any medical complications that could arise; in the division of labor within the operating room, a nurse coordinator and a so-called extra nurse are not assigned to an operating session, giving flexibility for the absorption of disruptions. In doing this, their role is diverted from its primary function, that of optimizing the functioning of the operating room. When the slack is fully used up, teams divert human, spatial or material resources to other situations: for example, on several occasions, equipment originally intended for another operation is requisitioned, or a nurse or operating room normally allocated to another program is mobilized.

In these typical situations, the difficulties identified concern coordination with the expert when the facilities for the activity had not been designed with this in mind: for example, regulating this type of disrupted situation was more difficult in one of the operating rooms studied that did not have a shared nurse/doctor workspace.

Table 4 summarizes the various dimensions characteristic of this second kind of typical situation.

Organizationally disrupted situation

Observations reveal the existence of a third type of situation: the organizationally disrupted situation. Let us take a look at some of the situations corresponding to this type, before highlighting the main features (see Box 3).

These extracts reveal that the first fundamental feature of organizationally disrupted situations is that they are highly interdependent with other situations. Their boundaries are elastic and shifting, spatially, temporally, and socially (participants involved). They take place over a longer, more fragmented period than the previous types of situations presented. They more frequently lead to going over past

situations or projecting into the future. They are less spatially localized (e.g., in this case, care services and stretcher-bearers are implicated) and involve a larger number of participants.

In such situations, maintenance of reliability depends first and foremost on building up a local and global picture of the operating room's activity: a precise and evolving vision of the disrupted situation, but also a representation of its entanglements with other situations. Based on this big picture, the teams imagine solutions to deal with the disruptions faced. These situations are characterized by a high level of communicative activity (inquiries to help understand the situation and its interconnections, construction of scenarios, etc.), sometimes involving conflict. Unlike the previous type of situation, the organizationally disrupted situation requires arbitration, which is far from clear-cut. For example, is it more legitimate not to keep the patient waiting (which affects service quality, but also potentially, in the long term, care safety), or to allow a surgeon to rotate between two rooms (which affects efficiency)? The discussion thus focuses particularly on the institutional dimension of the situation: informal and formal work norms are debated within the teams.

Maintaining reliability depends on a number of factors. Firstly, the division of labor. In our case, the nurse coordinator is the pivot-actor around whom this overall vision is built: because of this person's formal mandate, he/she is the key contact for the operating suite, which is equipped with a telephone. He/she is also identified by the satellite services as the entry point to the operating room, which enables them to integrate the constraints and points of view of these services in the construction of an overall vision. Another actor who frequently plays a role in organizational situations is the operating suite nurse manager. The organizational situations observed systematically call on one and/or the other of these

Box 3. Excerpt from observation of an organizationally disrupted situation (orthopedics).

S1 The starting point: a medical situation	12:10. The nurse coordinator is asked by an operating room to bring in extra equipment for a femoral neck fracture that is taking longer than expected. The scrub nurse – Ingrid – takes the opportunity to inform her that the surgeon working in the room – Dr. Laurent – is about to perform an emergency operation on a patient suffering from a bimalleolar fracture. […] Back in the orientation room, she passes on this information to the two nurses present (the nurse in charge of materials and an 'extra' nurse) and asks them to prepare the room for the operation. Consulting the paper version of the day's operating schedule (which she annotates and updates in real time), she announces: 'That'll be in room 4'. […]
S1 impacts S2 The medical situation generates an organizational situation	12:30. Several nurses are gathered in the orientation room, taking a break between procedures. They comment on the femoral neck fracture procedure. One of the nurses suddenly realizes that the scrub nurse (Ingrid), held back by doing this procedure, will not be available to start the operating session of another surgeon, Dr. Alain, as planned (Dr. Laurent's program should, in theory, have ended at 12:00). […] 12:40. The incoming team enters the orientation room to relieve the morning team. […] Speaking to one of the afternoon's 'extra' nurses, the nurse coordinator tells her: 'You're going to replace Ingrid in room 4'. In this way, Ingrid will be freed up to start Dr. Alain's session as planned, even though it is already running a little late: the morning sessions having overrun, they have saturated the operating rooms
S2 Evolution of the organizational situation: new disruption	Ingrid enters the orientation room, very annoyed. She says that she had called to take down Dr. Alain's first patient, but the stretcher-bearer had already taken him down without waiting for her call. With the program running behind schedule, the patient will wait for quite some time in the unsurveilled operating suite reception area before being taken down
S2 impacts S3	The shift change handover meeting is interrupted by the telephone. The morning nurse coordinator picks up. It is Doctor Taillé's scrub nurse asking them to set up the next patient. Doctor Taillé is one of the surgeons entitled to 'rotate'[9] today. The evening nurse coordinator, consulting the paper operating schedule, asks: 'In room 5?' […] Ingrid overhears the conversation, joins in and gives her opinion: she suggests that they install the patient in the same room where Dr. Taillé is now (so he wouldn't rotate). The scrub nurse says her patient has been waiting in the operating suite reception area for half an hour, so she'd like to move him to room 5

two actors. Secondly, tools play a key role in these practices. Their use reveals a dynamic of appropriation by the teams. For example, the operating schedule is diverted from its primary functions: updated in real time with information considered relevant to the situation, it enables actors to coordinate and collectively construct scenarios for reorganizing the operating room (reallocation of rooms, reassignment of nursing staff, and reordering of patients). Thirdly, the design of workspaces supports these practices. For example, the orientation room, in the center of the operating suite, is where nurses gather between operations. The equipment in this room (nurse coordinator workstation, paper and computerized operating schedule) supports the regulatory work of professionals in these organizational situations, positioning it as a true space for discussion about work 'on-the-spot' in the center of the action (Gentil, 2012).

In addition, concern for efficiency in the operating room helps to provide teams with 'slack' in the face of disruptions: room rotation for the sake of efficiency – authorized for some surgeons – can then be called into question to absorb a disruption (delay to a program, addition of an emergency, for example, in this case reducing a patient's waiting time). However, these typical situations raise the question of the room for maneuver available to nursing staff and their management, regarding doctors: 'If a surgeon asks to rotate and it's not his day, he'll have the last word' (operating

room nurse); 'When the surgeon […] calls to […] ask to take the patient down […] 'it's no use sir, the recovery room is full,' the surgeon replies "I don't want to know"' (operating room care assistant). However, doctors do not have the global vision required to regulate this type of disruption: 'When they're in their own room, they're in their own world, they don't care what's going on next door' (operating room nurse).

Table 5 summarizes the various characteristic dimensions of this third typical kind of situation.

Summary: Three types of reliability maintenance situations

The case study enabled us to identify three types of reliability maintenance situation in which the HRO principles take different forms (Table 6).

What are the key characteristics of these three typical situation types? Moreover, based on these characteristics, how can they be qualified to increase their generality and contribute to the reliability of other at-risk organizations beyond healthcare?

The habitual situation: A standard situation

The habitual situation corresponds to a form of undisturbed situation, which proceeds in accordance with the way it has been organized. In these situations, the maintenance of

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9. The 'room rotation' system used in this clinic's operating suite is described in the Research methodology section.

Table 5. Structure of the organizationally disrupted situation

Dimensions of the situation	Main features
Social	Nurse coordinator as pivot-actor in the situation. Their authority is often contested by doctors. Extensive communication (inquiries, scenario building, arbitration and so on). Solutions requiring complex arbitration; major conflicts. Shifting boundaries: several situations intertwine, some participants enter, and others leave
Physical	Spatially dispersed situation (elasticity of space); boundaries extending beyond the operating suite (satellite services). Resources enabling a global view of the situation and its entanglements: shared workspace between nurses, paper operating suite schedule (appropriation of tools). Resources that provide teams with slack to manage disruptions: division of labor (nurse coordinator, 'extra' nurses), room rotation system. Diversion of these resources from their primary functions
Time	Fragmented situation over time (time elasticity): enriched throughout the day, decisions over a long period. Role of institutionalized (shift change handover meeting) or informal transmission between operations
Institutional	Formal and informal work norms debated (e.g., attention to care – patient comfort must be given priority – importance of teamwork and mutual aid, participation in the pursuit of efficiency, etc.)

Source: Own elaboration.

reliability is based on the rules and management tools that have anticipated and prepared for failures. What characterizes the maintenance of organizational reliability in this type of situation is the low level of communicative activity and compliance with rules and plans. In this sense, we propose to qualify this type of situation as a 'standard situation'.

The medically disrupted situation: A bounded situation

The medically disrupted situation corresponds to a well-defined form of situation, clearly delimited in both time and space, with only slight interdependencies with other situations. In this sense, we propose to refer to this type of situation as a 'bounded situation'. What characterizes this type of situation is the logic of urgency: the disruption immediately puts reliability at stake. The aim is to react quickly, temporarily putting the big picture in the background. The impact of decisions will only be explored and managed at a later stage. In this type of situation, maintaining reliability relies on the expert, who is the pivot-actor of the situation, as defined by Journé and Raulet-Croset (2008). It is the expert who imposes his or her subjective point of view in the construction of the meaning of the situation and activates/calls upon the necessary resources (e.g., in our case, the doctor establishes the diagnosis and prescribes the actions to be taken to continue the investigation or manage the disruption). At the same time, he/she has a responsibility for the situation, which is recognized by the other participants. As in the work of Faraj and Xiao (2006), the expertise at stake in this type of situation is clearly established by the organization and does not give rise to discussion.

The organizationally disrupted situation: An extended situation

The organizationally disrupted situation corresponds to a form of complex situation that is intertwined with other situations, fragmented in time and dispersed in space. In this sense, we propose to call this type of situation an 'extended situation'. In this type of situation, maintaining reliability relies on building a precise representation of the local situation, while maintaining a global vision of the big picture (Weick et al., 1999), considering the different points of view. Activities thus have a strong dialogical content, giving rise to arbitration and negotiation processes. Management of the situation is organized around a pivot-actor, who, in our observation extracts, is the nurse coordinator. Nurse coordinators have a vision of past and future situations since they are in charge of relief work. At the same time, they are only partially involved in each of these situations, which gives them a form of neutrality recognized by the different operating suite health workers. These situations frequently involve using management tools to support the construction of an overall vision and the exploration of solutions.

In reliability maintenance, each situation that emerges is ultimately a specific combination of human activities and equipment (Sandberg & Dall'Alba, 2009). Three types of situations, giving rise to three different forms of reliability maintenance, are identified in this study. In the following section, we extend these reflections by examining the contribution of this typology of situations to thinking about organizational reliability.

Discussion: A situational approach to organizational reliability

The presentation of this empirical case allows us to discuss the contribution of situational approaches to the issue of organizational reliability. In this final section, we will explain how a situational approach can help us to think about reliability equipment. We will also show how the dialogue between situational approaches and an HRO theoretical framework can enrich our understanding of the concept of situation.

Table 6. HRO equipment by type of reliability maintenance situation

	Habitual situation: a standard situation	Medically disrupted situation: a bounded situation	Organizationally disrupted situation: an extended situation
Monitoring small failures	Vigilance here is largely based on technical devices* (objects and management tools): the material dimension takes precedence over human action. These tools encourage the traceability of medical and paramedical acts, facilitating the inquiry process in the event of any deviation from the situation	Vigilance is first and foremost individual (and is that of the participant(s) who raise(s) the alarm, then that of the pivot-actor who organizes the inquiry process)	Vigilance relies on the collective, which shares information and combines points of view (Did you think about …? Did you get the information that …?) to explore the interlinking of the different situations, and thereby trace the contours of this organizational situation. It is supported by the nature of the situation's equipment (e.g., workspaces that may or may not facilitate meetings between professionals)
Reluctance to accept simplification and high sensitivity to operations ('having the bubble')	These principles are underpinned by management procedures and tools, as well as by the division of labor: medical and care protocols (e.g., procedures for setting up a room, for welcoming a patient), quality and care safety tools (e.g., traceability sheet, OR checklist) enable the confrontation of points of view and the redundancy of practices (e.g., verification of the patient's identity and side to be operated on is carried out several times by different professionals who gravitate around the patient); other inter-service coordination tools provide a global view of the organization (e.g., real-time monitoring of the patient's trajectory)	The challenge is to rapidly reduce the important variables that will make sense of the situation, in order to make it secure. While sensitivity to ongoing operations is still very much present in medical situations, consideration of the big picture is temporarily relegated to the background. Once the medical situation has stabilized, inquiry work resumes to explore the consequences of the solution adopted. These medical situations frequently lead to organizational situations	Fundamental principles for maintaining reliability in these situations. In the operating room, every professional recognizes the importance of sharing information in real time. This principle is supported by the operating suite's spatial equipment (e.g., the orientation room, a meeting place for nurses in the heart of the suite, where they can keep informed of the situation throughout the suite – status of other programs – and share information on the progress of their current operating program). This sharing of information is also supported by the paper operating schedule that the teams have adopted, which is updated throughout the day by the nurse coordinator.
Commitment to resilience: organizational slack and bricolage	In habitual situations, the slack, which in our case takes the form of redundant resources (rooms and staff), is used for efficiency purposes. The aim is to optimize surgical time, in a context where healthcare establishments are financed on a fee-for-service basis	The slack is used to manage the unexpected. Consumption of this slack is not discussed by the participants in the situation. When no more slack is available to manage the situation, the most frequently observed solution is to draw on resources allocated to other situations (e.g., use of materials allocated to another operation). At the moment, these solutions do not give rise to discussion, as priority is given to managing the medical emergency	Slack supports the organizational improvisation required of participants. It is subject to arbitration. Organizational improvisation is supported by tools (e.g., paper operating schedule) that enable the construction of action scenarios
Deference to expertise	The expertise required here essentially concerns the knowledge of procedures and tools: the nurse manager (and higher hierarchical levels) and support departments (e.g., quality and pharmacy) are the experts most frequently called upon in these situations	A principle at the core of reliability maintenance activities in these situations. The expert here is the doctor. He/she is the pivot-actor. The nature of the contingency to be managed engages his/her responsibility	The expert is the one who has both a local vision (of the disrupted situation) and a global vision (of the interrelated situations that are impacted). In our case, this is the nurse coordinator and/or the nurse manager

Note: * We also find the cultural dimension highlighted in HRO research (awareness that the situation can change at any moment) (Weick & Sutcliffe, 2001), although we did not focus on this aspect.
Source: Own elaboration.

Contributions of situational approaches to HRO literature

The literature on HROs promotes a situated approach to organizational reliability. Reliability is thus the product of interactions between actors who, on a daily basis, operationalize five HRO principles underpinning organizational resilience (Weick & Sutcliffe, 2001). These principles, which are supported by cognitive and communicative processes (Nicolini, 2011), remain ambiguous and difficult to translate into concrete practices (Cantu et al., 2020). This gap can be explained by the level of analysis considered in HRO research, situated interaction, which leads these authors to neglect the importance of context in the maintenance of reliability (Schatzki, 2005). Our research follows on from these findings and explores the theoretical potential of the concept of situation for thinking about the equipment of organizational reliability as an intermediate unit of analysis between situated activity and organization. Three contributions regarding the situation will be discussed here: (1) as an intermediate unit of analysis between the given and the created, the situation enables us to study the equipment supporting the five HRO principles; (2) as an intermediate unit of analysis between singularity and regularity, the situation reveals the influence of the type of context (Schatzki, 2005) on the form taken by these five HRO principles; finally, (3) as an intermediate unit of analysis between the instantaneity of action and the permanence of organization, the situation has a temporal depth whose analysis reveals different trajectories for maintaining reliability.

The situation as an intermediate unit of analysis between given and created: Studying equipment as a resource for organizational reliability

Defining the situation as an intermediary notion between situated activity and organization (Girin, 1990a) means that activity is in the organization (because the organization is reconstructed by activities) just as much as the organization is in the activity (as equipment). Thus, the situation, as an intermediary notion between the given and the created, provides access to the study of the equipment of action as resources for maintaining organizational reliability. Situational approaches, by paying attention to the four dimensions of the situation, enable us to avoid the pitfall noted in HROs: where HRO literature has essentially focused on the social dimension of the situation by paying attention to situated interactions, the concept of management situation calls into analysis the physical, temporal, and institutional dimensions (Journé & Raulet-Croset, 2012). A double movement thus takes place between equipment and human activities (Figure 1).

On the one hand, following the 'reliability in the making' approach of HROs, situational approaches explore the way in which equipment is shaped by human activities. Confronted with events that are always singular, teams involve equipment in the situation and appropriate it for themselves. In our empirical study, as in Suchman's study of plans (1987), the operating program, for example, is used in very different ways from one situation to another, from compliance with a vigilance and traceability tool (standard situation) to the exploration of possible impacts and solutions to manage an organizational disruption (extended situation). Their status as action equipment is thus conferred by the way professionals use them in the situation (Sandberg & Dall'Alba, 2009).

On the other hand, the situational approach reveals the enabling and constraining effects (Lorino, 2005) of equipment, which are not simply a consequence of action, but also help to structure it (Sandberg & Dall'Alba, 2009). Our empirical study highlights the active role played by management tools such as the operating schedule, the influence of workspace configuration (doctor-health worker interaction areas, presence of glass doors in operating rooms, etc.) and the impact of organizational rules and choices such as division of labor for reliability maintenance activities. Although vigilant interactions (Weick &
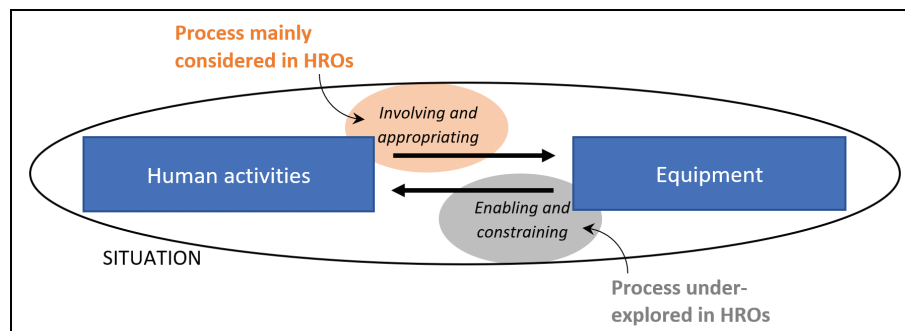
Figure 1. Double movement between human activities and equipment in reliability maintenance situations.
Source: Own elaboration.
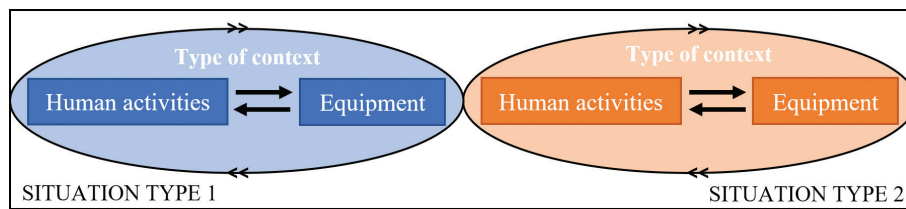
Figure 2. The influence of the type of context: Specific combinations of human activities and equipment in maintaining reliability. Source: Own elaboration.

Roberts, 1993), at the heart of reliability, are supported by concrete equipment, they can also be obstructed by this equipment; for example, in our case, when there is no common workplace between doctors and other health workers.

Attention to equipment appropriation processes should not, therefore, lead us to neglect the impact of this equipment on the situation. At the same time, however, attention to equipment should not lead us to fall into the opposite trap, by seeking to explain organizational reliability through structures: the situation, as an intermediate unit of analysis between situated activity and organization, between given and created, captures this dual movement.

The situation as an intermediate unit of analysis between singularity and regularity: The influence of the type of context on HRO principles

Considering the situation as an intermediary notion between situated activity and organization allows us to go further in analyzing the structuring effects of equipment, by restoring the context's 'powers of determination' on action (Schatzki, 2005, p. 468). The situation thus makes it possible to study the active role of context, rather than viewing it as a mere passive background to action (Nicolini, 2011). Indeed, the logic of situations leads to an emphasis on the unique and singular character of all human activity, contingent on events. However, at the same time, when we pay attention to the combination of heterogeneous elements that constitute the situation, we find that it presents forms of regularity. Thus, the situation is an intermediary notion between situated activity and organization, as the situation carries with it the idea of uniqueness constitutive of situated activity and, at the same time, the idea of stability and replication underlying organization. Reliability maintenance activities are not constantly reinvented, new or singular. On the one hand, they vary according to the situations encountered, on the other, they follow a recognizable logic and are only partially improvised (Faraj & Xiao, 2006; Orlikowski, 2002). Forms of regularity can be observed that result from the specific interlocking of human activities and equipment, which form types of context (Schatzki, 2005). These types of context play an active role in the way professionals behave, act and make decisions within the situation, and thus in the activities

involved in maintaining reliability (Figure 2). This brings us back to the double movement described above: interactions between human activities and the various pieces of equipment shape context types, which in turn influence the way in which these interactions take place.

In our case, the HRO principles, which remain generic in the work of Weick and Sutcliffe (2001), take on different forms and importance depending on the contexts in which they are operationalized. Thus, maintaining reliability in extended situations depends first and foremost on the principles of 'reluctance to simplify' and 'sensitivity to operations', whereas these principles are put in the background in bounded situations. HRO principles take on different forms with regard to the tangible and intangible equipment in which they are embodied and which help to support them. In standard situations, vigilance is supported by management devices (e.g., in our case, by tools such as the operating room checklist), while in extended situations it relies on the interactions of the collective, themselves supported by other types of equipment (for example, in our case, the orientation room or paper operating schedule). The type of expertise required to manage the situation also differs from one situation to another: in standard situations, expertise refers to knowledge of rules and tools; in bounded situations, it is based on professional knowledge and know-how, linked to the object of the situation (e.g., in our case, medical disruptions); in extended situations, it is in the hands of the actors who can see the big picture.

Studying the type of context in which human activity takes place is therefore essential for analyzing and explaining social and organizational phenomena (Schatzki, 2005). However, this project faces a major difficulty: the situation forms a 'contextual whole' (Dewey, 1993) in the sense of a profound intertwining of equipment and human activities that mutually constitute each other (Journé & Raulet-Croset, 2008). As Girin (1990a) acknowledges, the logic of situations, by nature heterogeneous and muddled, is discouraging for management sciences, 'if we don't allow ourselves any a priori breakdown to simplify the phenomenon' (p. 145). The literature on management situations is extremely useful for breaking down this context, through the prism of the four dimensions of the management situation, and thereby identifying new managerial levers (Journé & Raulet-Croset, 2012). Over and above the variability of

situations, we can then identify common salient features concerning their social dimensions (e.g., dominant forms of communication, pivot-actors in the situation), physical (e.g., nature and use of the main tools mobilized), institutional (e.g., nature of the formal and informal norms that participants have in mind when managing this type of situation), and temporal (e.g., duration of the situation, time horizon considered).

The situation as an intermediate unit of analysis between instantaneity and continuity: Uncovering trajectories for maintaining reliability

The situation is by nature instantaneous: situated in the here and now, it is first and foremost local (Girin, 1990a; Nicolini, 2011). Organization, on the other hand, is characterized by permanence (Girin, 1990a). As an intermediary notion between situated activity and organization, the situation is both fleeting and has a temporal depth that inscribes the past and the future in the instant.

As Journé and Raulet-Croset (2008) observe:

> understanding management in situational terms also means preparing oneself psychologically for the situation to change, more or less abruptly. […] It also means constantly updating this state of awareness, and remaining vigilant. […] Identifying these changes is a prerequisite for maintaining control of the situation. (p. 50)

The temporal dimension of the situation thus invites us to observe situations from a dynamic perspective. At any moment, a standard situation can turn into a disrupted one. Over the course of the inquiry, which is never completely finished, the situation gradually becomes structured: hence, a situation initially perceived as extended may in fact turn out to be a bounded situation, and vice versa. The past and future are thus constantly revisited through this work of inquiry, which inscribes them in the present experience. Here, we find the observations made by Lorino and Mourey (2012) in a pragmatist approach to time.

However, as Girin (1990a) points out, situations are highly interdependent, and this can open the way to situations interlocking and splitting apart. Trajectories for maintaining reliability therefore emerge in our study, ones that professionals have in mind in the inquiry work they carry out. Since the big picture is temporarily put into the background, bounded situations regularly lead to extended situations. In the hospital, for example, an unexpected patient reaction during a surgical procedure calls for the immediate reliability of the operation to be maintained, but can also generate disrupted organizational situations: operating room and team made unavailable for a scheduled operation, equipment being used that had been booked for another procedure, etc. By mirror effect, extended situations can generate bounded situations. For example, in a hospital, the decision to put a stabilized patient on standby to

manage an organizationally disrupted situation may suddenly turn into a medically disrupted situation, if the patient's condition suddenly deteriorates.

The trajectories observed from one situation to another can be clarified, in particular, by the concept of organizational slack (Schulman, 1993). In bounded situations, once the slack has been used up, the urgency of the situation leads to the use of resources otherwise allocated to other situations. In doing this, these situations regularly produce extended situations. Here we find the two types of slack put forward by Leuridan and Demil (2022): that provided by the organization, which absorbs shocks without deforming the organization, and the situational slack, created by the teams, which transforms the organization thereby producing new disrupted situations. Extended situations are themselves generators of slack, this time being conceptual (Schulman, 1993): they open up the field of possibilities, enabling the construction of several action scenarios. Slack is negotiated here, unlike in bounded situations, where the consumption of slack is not discussed, given the urgency of the situation.

Research contributions to situational approaches

Our research also contributes to situational approaches in at least two ways. It enriches our understanding of the concept of the pivot-actor in the situation, by demonstrating the active role of equipment in structuring and legitimizing this pivot-actor. It reveals that the problem is constitutive of the type of context and thus influences the social, physical, temporal, and institutional dimensions of the situation.

The structuring equipment of the pivot-actor

Not all participants play the same role in a situation: each disrupted situation is built around the subjective point of view of a professional who plays the role of an expert in maintaining reliability. It is this professional who activates the resources likely to help him/her make sense of the situation. According to Journé and Raulet-Croset (2008), the pivot-actor is the person in charge of controlling the situation, exercising responsibility toward it, responsibility instituted by the organization or claimed by one of the professionals. This idea is echoed in the bounded situation, where the legitimacy of the doctor's position as a pivot-actor in the situation is not debated, his/her responsibility being clearly engaged by the nature of the problem to be solved. Our research enriches this work by showing that equipment contributes to his or her status as a pivot-actor. The study of organizational reliability has led us to pay attention to the nature of the expertise mobilized in the situation, through the principle of 'deference to expertise' highlighted by HROs. Nevertheless, this expertise is not an objective attribute,
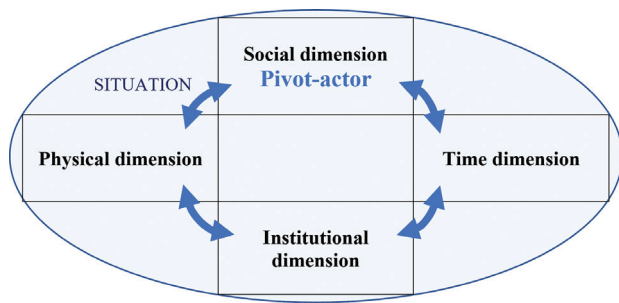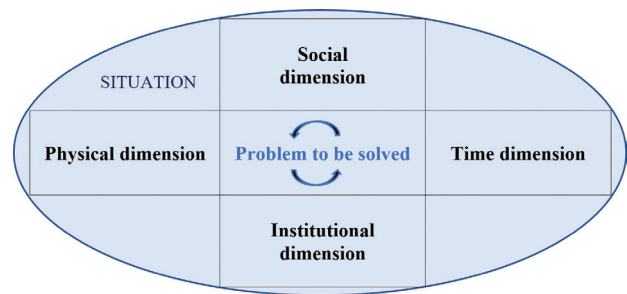
Figure 3. Role of equipment in structuring the pivot-actor.
Source: Own elaboration.

Figure 4. The problem to be solved: The catalyst for the situation.
Source: Own elaboration.

external to the situation; it is not the property of individuals or collectives, nor is it stable over time, but constituted by practices (Nicolini, 2011; Orlikowski, 2002). It is entwined with the equipment of action, in the material objects, artifacts, and spaces in which professionals evolve (Orlikowski, 2006). Expertise is based on the situation and thus depends on the type of situation in which the participants act. In our case, nurse coordinators are the pivot-actors for extended situations, because they have the broadest possible vision of the organization's activity and the situations that take place within it, over time: it is this knowledge that underpins their status as pivot- actors for the situation. They have a local vision of each situation and, at the same time, of the big picture (Weick et al., 1999). This knowledge is supported by the tools and spaces they invest in their work, which themselves constitute real pivotal resources in the situation. Their workspace enables them to interact with the various professionals in the operating suite, who come there to get material or consult a tool. Within this space, they also act as an interface between incoming and outgoing teams. Similarly, their work tools (telephone and operating schedule) give them a global view of the clinic's activity, even beyond the operating suite. So, while responsibility for the situation plays an indisputable role in the emergence of a pivot-actor, the study of equipment also reveals the role of pivot-tools and pivot time-space as sources of legitimacy for these pivot-actors (Figure 3).

The nature of the problem to be solved: A catalyst for the situation

Finally, the dialogue between the HRO approach and the concept of management situation reveals a significant dimension of this context: the nature of the problem to be managed. The study of organizational reliability through the prism of resilience has led us to take a close look at the disruptions faced by teams. This focus on the 'problem' in the situation is not new (Dewey, 1993). The problem is the starting point of the situation, the one that triggers the inquiry. Thus, in their four-dimensional framework of the

situation, Journé and Raulet-Croset (2012) do not include the problem as a structuring dimension of the situation. Even so, our research shows that the problem does not only consist in the event that triggers the situation, the one around which the situation is built but is also constitutive of the type of context in which the participants find themselves. It thus contributes to the structure the activities involved in maintaining reliability. The 'type' of situation is defined principally on the basis of the problem to be solved (in our case: absence of disruption, disruption 'on the level of'[10] medical care, disruption 'on the level of' organization), the qualification of the type of problem being itself the product of the inquiry. The nature of the problem not only directly influences the social dimension of the situation (Who are the experts?) but also the temporal dimension of the situation (Is temporality constrained or not?), as well as the institutional dimension (in particular, the hierarchy of norms that teams refer to in order to act). In the end, the arrangement created between human activities and equipment to maintain the reliability of situations takes a different form depending on the type of problem that the inquiry reveals. Ultimately, the problem is a catalyst that influences the social, physical, temporal, and institutional dimensions of the situation (Figure 4).

Conclusion: Principal managerial implications

This research focuses on how organizations facing significant risks manage to maintain the reliability of their systems, by exploring the equipment (Sandberg & Dall'Alba, 2009) that supports organizational resilience. In so doing, it helps to shed light on a field of tension that runs through organizational studies today (Feldman & Orlikowski, 2011), between situated activities and organization. Indeed, situated approaches, which suggest an infinite number of possible situations, can find themselves in contradiction with the classical logic of

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10. As Girin (1990a) points out, the expression 'on the level of' brings us back to the context (of meaning and action) in which the participants recognize themselves to be.

organization, which presupposes a form of regularity (Journé & Raulet-Croset, 2008). Organization, which is characterized by its permanence (Girin, 1990a), does not therefore appear to be useful for supporting actors in the face of this infinite variability. This article explores the contribution of situational approaches (Girin, 1983; Nicolini, 2011; Schatzki, 2005) to these reflections. By treating the situation as an intermediate level of analysis between situated activity and organization, situational approaches can enrich HRO work in three dimensions. Firstly, we show how a situational reading provides access to the study of the tangible and intangible equipment that supports the vigilant interactions underpinning reliability (Weick & Roberts, 1993). We then show that HRO principles, which remain generic in Weick and Sutcliffe's (2001) proposal, take different forms depending on the sites and types of context (Schatzki, 2005) in which they are implemented by professionals. Three typical situations are identified from our empirical material: the standard situation, the bounded situation, and the extended situation. Finally, we show that by considering the temporal depth of situations, we can identify trajectories for maintaining reliability.

Ultimately, this research enables us to identify several managerial implications for developing the reliability of high-risk organizations. Resilience is not only based on cognitive and communicative mechanisms but is also built by and in concrete equipment that differs from one situation to another. In standard situations, it is a question of equipping professionals to be vigilant and encouraging redundancy of controls. In these situations, organizational reliability is based on the effectiveness of management tools and rules in preventing risks, which presupposes, from a dynamic perspective, working on the link between anticipation and resilience in order to learn from disrupted situations and to enrich response systems. In concrete terms, this means designing time-spaces that support the system's capacity to learn, so as to enrich these rules and tools (e.g., feedback and discussion forums outside the course of action). In bounded situations, organizational reliability depends on the capacity of the actors involved to quickly put the expert in a position to make a decision on the situation. This involves designing equipment (tools and spatial organization) to support rapid coordination with the expert. Finally, in extended situations, professionals need to be equipped to build up as complete a picture as possible of the situation and its entanglements (facilitating the construction of the big picture). In these situations, the challenge is also to support teams in making the often complex arbitrations that these situations require. This last point echoes the work on discussion spaces, whose theoretical proposal, close to that defended in this research, is to take an interest in managerial devices likely to support the work of regulation carried out by professionals in their courses of action (Detchessahar, 2019).

The distinction between these three types of situation also poses a major challenge for organizations: in support of the HRO principle of 'deference to expertise', we need to devise processes that allow hierarchical constraints to be relaxed. However, this also means working to legitimize sources of expertise that do not refer solely to professional knowledge and considering the way in which the situation (and its equipment) underpins expertise. This is particularly true in hospitals, where the distinction made in this research between organizational and medical disruptions highlights the limits of medical expertise in the face of organizational disruptions, the management of which requires a global vision that doctors do not always have. It seems to us that hospital systems may be weakened in their ability to maintain organizational reliability in the face of organizational disruption. This involves either restoring decision-making latitude to other actors with a global vision (e.g., nurse managers and nurse coordinators) in organizationally disrupted situations or equipping doctor decision-makers with tools and time-spaces enabling them to construct a vision of the big picture. The challenge is therefore not just to organize these decentralized decision-making processes within centralized bureaucratic cultures but also to develop each professional's capacity to integrate these situational approaches into their daily practices.

Acknowledgements

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Appendix

Appendix I. Extract from the coding table

| OBSERVATION No. 1	OBJET OF SITUATION	GROUPING; TYPE OF SITUATION	Time dimension		Social dimension			Physical dimension			Institutional dimension	HRO's PRINCIPLES
			MANAGEMENT SITUATION	TIMEFRAME	COMMUNICATION	RELATIONSHIPS BETWEEN ACTORS	SPACE CONFIGURATION	PHONE	PAPER TOOL	IT TOOL	RULES, STANDARDS, EXPERIENCE	
The nurse coordinator asks a nurse (N.) about her son: she has just phoned because her son is sick. N. tells her he has no fever. So much the better, says the coordinator, because Dr. L. has 'a prosthesis' (emergency) and has asked for a second operating assistant to do it. The two nurses talk about the weekend's emergences.	STAFF	ORGA	S2 U S9	FUTURE	INFO TRANS° (FUTURE)		CENTRAL					P1 P3
A nurse enters the orientation room. She consults the paper program. The nurse in charge of materials asks her where she is. "With Doctor B., but he's doing the video", she replies. She tells him she's going to set up a new procedure. The caddy nurse didn't know about this procedure.	PATIENT	HABITUAL	S0 U S3	PRESENT	INFO TRANS° (PRESENT)		CENTRAL		CONFORM GET INFORMED CONSULT		DEVIATION	P3
The nurse coordinator calls the reception desk to find out if Dr. L's next patient has arrived. She had received a call from the ambulance drivers saying that the patient would be late. She receives confirmation from reception that the patient has not yet arrived. She therefore calls the stretcher-bearer to bring down the next patient. She gives his name and room number. It's the emergency (prostheses).	TEMPORAL	ORGA	S2	PRESENT	INQUIRY INFO TRANS° (PRESENT) INSTRUCTION	DISTANCE		IMMEDIATE				P1
The nurse coordinator updated the program. She has highlighted the entire line of patients who have been taken on the program. Initially, only the doctor in charge, the date and time, the file number and the patient's name are highlighted (when the patient enters the room).		HABITUAL	S0	PRESENT			CENTRAL		CONFORM SITUATION UPDATE INPUT			P3

Appendix I. (Continued)

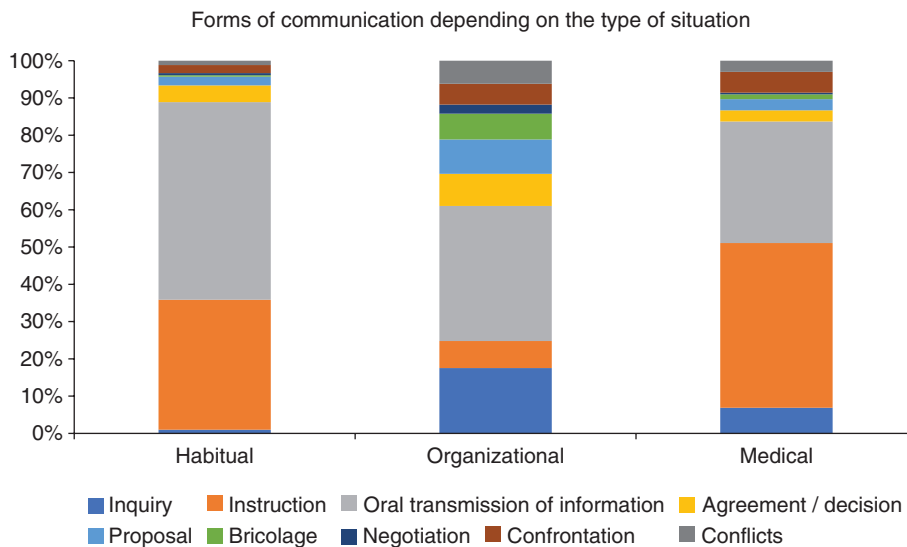| OBSERVATION No. I	OBJET OF SITUATION	GROUPING: TYPE OF SITUATION	MANAGEMENT SITUATION	Time dimension	Social dimension		Physical dimension				Institutional dimension	
				TIMEFRAME	COMMUNICATION	RELATIONSHIPS BETWEEN ACTORS	SPACE CONFIGURATION	PHONE	PAPER TOOL	IT TOOL	RULES, STANDARDS, EXPERIENCE	HRO's PRINCIPLES
The manager enters the orientation room at the same time. He explains the equipment: there's an extra 'Canadian' (= the surgeon's operating outfit) to put on the cart. The suite has in fact changed a 'pack' for an operation, but the 'Canadian' in the pack is not suitable for a surgeon. He asks for one that he prefers next to the one in the pack. This addition costs three euros each time.	MATERIALS	ORGA	S5	PRESENT	INFOTRANS° (PRESENT) CONFRONT	Relationship med -	CENTRAL				DEVIATION ACTUAL	P5
In the orientation room. The nurse coordinator tells A.: "There's a scar recovery for Mr. Ali'. A. asks: 'In septic?' 'I don't know', replies the coordinator. It was the outpatient department that had just called her (not the doctor). The outpatients nurse didn't call to warn her, but because she saw that the patient was scheduled at the end of the program: as it's an outpatients program, she wants to know if it's possible to change the order of patients and put this patient first. The coordinator discovered this 'scar recovery'. She hadn't been warned and didn't have it on her schedule. She discovered it by chance, thanks to a call from the outpatient department.	PATIENT PROCEDURE TEMPORAL	ORGA	S8	FUTURE	MEDIATION (FUTURE) PROPOSAL INQUIRY	CENTRAL DISTANCE	IMMEDIATE				DEVIATION	P3

Appendix I. (Continued)

OBSERVATION No. 1	OBJET OF SITUATION	GROUPING: TYPE OF SITUATION	Time dimension		Social dimension		Physical dimension				Institutional dimension	
			MANAGEMENT SITUATION	TIMEFRAME	COMMUNICATION	RELATIONSHIPS BETWEEN ACTORS	SPACE CONFIGURATION	PHONE	PAPER TOOL	IT TOOL	RULES, STANDARDS, EXPERIENCE	HROs PRINCIPLES
The nurse coordinator calls the outpatient department for clarification of the procedure, while the nurse manager calls the scheduling department. He can't get hold of the service, so he calls the manager in charge of scheduling directly. At the same time, he hears the nurse coordinator asking the outpatient department questions about the procedure. 'Well done', the nurse manager says to her. The coordinator learns that it's a back scar recovery under local anesthetic. The coordinator and nurse manager find this surprising. At the same time, the nurse manager tells the scheduling manager that it's an addition from Friday (he can see it on the tool with a special code: tracers). He asks the scheduling manager to find out whether or not the procedure is under general anesthetic. The scheduling manager tells him that it may be her department (scheduling) that hasn't notified the operating suite, as they have a bed assigned to the patient so it's not an emergency that's just arrived, the information is passed on by the scheduling department if the patient has a bed.	PROCEDURE	ORGA	S8	FUTURE	INFO TRANS° (FUTURE) CONFRONT PROPOSAL INQUIRY		DISTANCE SIMULT	FAILURE IMMEDIATE		CONFORM EXPLORE CHECK	DEVIATION QUESTION	P3 P2
A nurse [N.] waiting to speak to the nurse manager in the orientation room tells the other nurses (coordinator and nurse in charge of materials) that she has already seen such a procedure (back scar recovery) performed under local anesthetic.	PROCEDURE	ORGA	S8 U S9	PAST	INFO TRANS° (PAST)		CENTRAL				QUESTION REMINDER	P2 P3 P5

Source: Own elaboration.

Appendix 2. Examples of statistical tables and graphs produced from observations to study the different forms of reliability maintenance activities within each type of situation.

Percentage of verbal interactions/number of situations
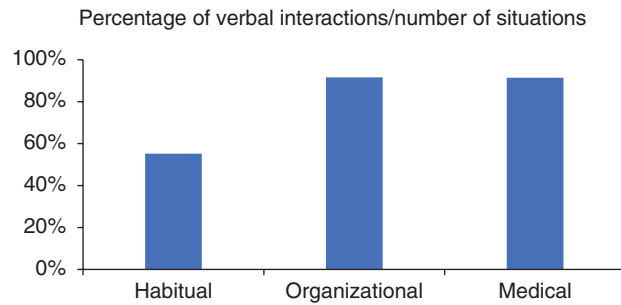
	Habitual (%)	Organizational (%)	Medical (%)
Percentage of each type of communicative activity/number of verbal interactions Inquiry	I	**34**	II
Instruction	**37**	I4	**69**
Oral transmission of information	57	7I	5I
Agreement/decision	5	**I7**	5
Proposal	2	**I8**	5
Bricolage	0	**I4**	2
Negotiation	I	**5**	I
Confrontation	2	**II**	9
Conflicts	I	**I2**	5
Nb. of verbal interactions	I00	I00	I00

Forms of communication depending on the type of situation

	Habitual (%)	Organizational (%)	Medical (%)
Number of situations where tools are used/total number of situations	32	46	6

		Habitual (%)	Organizational (%)	Medical
Use of paper and computer tools, when consulted	GET INFORMED	**20**	11	Not significant (very limited use of tools)
	EXPLORE	2	**15**	
	REORGANIZE	3	**17**	
	UPDATE SITUATION	**16**	7	
	TRACEABILITY	**43**	18	
	ALERT	1	12	

Source: Own elaboration.

Number of situations where tools are used/total number of situations

Use of tools/type of situation

- INFORMATION role
- EXPLORATION role
- ORGANIZATION role
- REORGANIZATION role
- UPDATE SITUATION role
- TRANSMISSION role
- TRACEABILITY role
- ALERT role

Time scale of situations

- Present
- Present (urgent)
- Past
- Future

Source: Own elaboration.