Article

Organization Studies
2022, Vol. 43(3) 437–463

DOI: 10.1177/0170840620941314
www.egosnet.org/os

Towards a Processual Understanding of Task Complexity: Constructing task complexity in practice

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Abstract

This study uses a process perspective to examine the construction of task complexity as a social practice that is continuously created and recreated. For this approach, we conducted an ethnographic case study of an intensive care unit in a large university hospital. By shifting the analytical focus from measuring task complexity to task complexity as a social practice, our research provides insight into the microprocesses involved in constructing task complexity. This paper stresses the importance of a processual view of task complexity by analysing how paths form, keep open, are enacted in parallel and eventually dissolve. We conclude with a process model of how task complexity is constructed. Our findings contribute to research on task complexity by (1) elaborating on the process of enacting task complexity in practice, (2) explaining the mechanisms driving the dynamics of task complexity and (3) stressing the dynamics of task complexity.

Keywords

dynamics, enacted task, practice, process, task complexity, unexpected events

Introduction

Organization theorists have always been interested in how collective work is accomplished within organizations 'to explain the ways in which collective action on a task takes place' (Okhuysen & Bechky, 2009, p. 464). Earlier research in this area was interested in how tasks can be accomplished efficiently and designed for optimum performance (Chandler, 1962; Fayol, 1949; Taylor, 1916). In line with this, research on task complexity focused on task complexity independent of any task doer to find best practices, the shortest path or alternative designs (Campbell, 1988; Wood, 1986). In contrast, recent research in organization studies has focused on how tasks are enacted as

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they happen (Feldman, 2000; Hernes, 2014; Jarzabkowski, Lê, & Feldman, 2012; Orlikowski, 2000), assuming that people in organizations must accomplish their work regardless of the organizational design (Okhuysen & Bechky, 2009), particularly under conditions of uncertainty, novelty, or change (Bechky & Okhuysen, 2011; Jarzabkowski et al., 2012). A first approach following this line of research was made by Hærem, Pentland, and Miller (2015), focusing on tasks as they are enacted by organizational actors. Building on practice and process theory, they stress that tasks can change, and task complexity can change in the enactment of a task (Hærem et al., 2015).

However, research on task complexity has, until now, mostly focused on measuring task complexity (Campbell, 1988; Hærem et al., 2015; Wood, 1986). By only measuring task complexity we can say less about the process of enacting task complexity as it happens. Thus, we suggest shifting the analytical focus from measuring task complexity to task complexity as a social practice. Thereby, we show that creating task complexity is a dynamic social practice that is under continuous (re-)construction and provide insights into the microprocesses involved in constructing task complexity.

Therefore, the purpose of our study is to develop a processual view of task complexity by empirically examining these questions: *How do actors construct task complexity in task enactment, and how do these constructions change over time?*

To study social practices it is important to conduct a qualitative ethnographic case study. Thus, the researcher is supposed to 'being there', which means 'being immersed in the situations, events, interactions' and observing 'actors in their own settings, in the midst of doing whatever it is that they do every day' (Miettinen, Samra-Fredericks, & Yanow, 2009, p. 1315). Thus, we conducted our research within an intensive care unit (ICU) in a large university hospital. The second author spent 19 months in the field collecting data, focusing on the actions that actors took to accomplish an organizational task. As sequences of actions that lead to the completion of an organizational task are defined as paths (Hærem et al., 2015), we were drawing on the concept of paths (Goh & Pentland, 2019) to examine how paths formed, were kept open, were enacted in parallel and dissolved. As more paths mean more task complexity and fewer paths mean less task complexity, we can explain how task complexity is constructed as a social practice.

Our study develops three insights. First, tasks themselves do not *have* a complexity, but they *become* (Tsoukas & Chia, 2002) complex in their enactment. A processual view helps scholars to unpack how complexity is constructed by focusing on actors' day-to-day enactment of organizational tasks. Second, we explain the mechanisms that drive the dynamics of task complexity. Third, we stress that task complexity changes dynamically throughout the process of enactment; thus, task complexity is quite different in different phases of the enactment.

Our paper is organized into four main sections. In the first part, we briefly review the research on task complexity. The second part presents our research setting and methods. In the third part, we introduce the findings of our study. Finally, we discuss our findings in terms of theory.

Task Complexity

The original concept of task complexity defined tasks by three essential components: *products, (required) acts* and *information cues* (Wood, 1986, pp. 64–5). As seen from this definition, tasks are separated from the task doer (Campbell, 1988; Hackman, 1969; Wood, 1986). The interest in task complexity is based on an interest in *task design* to describe how tasks differ from one another (Wood, 1986; Zhou, 2013). Usually, the aim of designing tasks is to maximize outcomes and reduce employees' cognitive burden by dividing tasks into subtasks (Campbell, 1988; Cyert & March, 1963; March & Simon, 1958; Walton, 1980; Wood, 1986; Zhou, 2013). Hence, tasks are

designed to possess the 'optimal' level of complexity because a high level of task complexity presents a challenge for individuals to enact the task, as certain knowledge, skills and effort are required (Wood, 1986, p. 79). Following this, the optimal level of task complexity is *reduced* as much as possible to prevent possible overload and lower task performance.

Whereas task complexity was traditionally defined as independent of any actor (Campbell, 1988; Hackman, 1969; Wood, 1986), Hærem et al. (2015) argue that 'anything that affects how a task is accomplished can potentially influence task complexity' (p. 456). They continue their argument by stating that collaborative tasks are the most common form of tasks and, therefore, can involve multiple actors (Hærem et al., 2015). Hence, they extend the definition of task complexity from the traditional perspective by introducing the component *multiple actors* (Hærem et al., 2015). Thus, in their revised model to measure task complexity, they model tasks as networks of events in which each event represents an action performed by an actor. Sequences of events that lead to the completion of the task are defined as paths. Once the task has been modelled as a network of multiple paths connecting events, task complexity can be computed.

Towards a processual perspective on task complexity

Hærem et al. (2015) made a first attempt towards a processual perspective. In their approach, the process of enacting a task is defined by actions enacted over time. Moreover, the authors (2015, p. 456) theorize tasks as 'not frozen in time. They are performed, and as they are performed, their complexity can change'. This is in line with insights from process theory, highlighting the pervasiveness of change in organizations as an ongoing process (Tsoukas & Chia, 2002). Rather than seeing change as the exception, change is an 'ongoing process, a stream of interactions, and a flow of situated initiatives' (Tsoukas & Chia, 2002, p. 569). Haerem et al. (2015) elaborate their argument by pointing out that a task itself can change because of events within the task context. Accordingly, task complexity can change quickly and dramatically as tasks change.

However, by only computing a measure of task complexity, time is, at best, understood as a 'series of snapshots' (Tsoukas, 2017, p. 4), as each measured number represents one moment in time. Computing task complexity as ending in a number at different moments in time only provides 'comparative statics' (Pettigrew, Woodman, & Cameron, 2001), allowing the comparison of different measures of task complexity at different moments in time. However, from a process perspective, 'studying things as process is obviously not about comparing states of being in time [. . .], but about how something persists and changes' (Hernes, 2014, p. 3). Therefore, strong process theory (Hernes, 2014; Langley & Tsoukas, 2016; Tsoukas & Chia, 2002) stresses the unfolding process as the unit of analysis to analyse things in the making, e.g. how organizational phenomena are constituted, reproduced, adapted and defined (Emirbayer & Mische, 1998, p. 287; Hernes, 2014; Langley, 2007).

As such, the interest of process studies is not to realize that things change; rather, it is an interest in how and why things emerge, develop, grow, or terminate over time. Langley and Tsoukas (2010) explain this approach with the following example: knowing that practice B is more effective than practice A is only a comparison and does not provide any insights into how to move from A to B over time. In terms of task complexity, this means that the computed number of A is higher than that of B, and thus, the task complexity of A is higher compared to that of B. Possible reasons might be that more actors were involved or more actions were enacted. However, we still do not know how the task complexities of A and B emerged, developed, or grew over time and how the level of task complexity was constructed in the process. Moreover, we do not learn how to move from A to B. Thus, these numbers do not provide us with an explanation for how the change occurs.

Narrative networks and the concept of paths

To examine the social practice of constructing task complexity, we draw on the notion of narrative networks and the concept of paths. Narrative networks 'involve sequences of action that move from a beginning (a task begins) through a middle to an end (the task is accomplished or abandoned)' (Feldman, 2016, p. 631). As a path is a 'time-ordered sequence of actions [. . .] in the process of accomplishing an organizational task' (Goh & Pentland, 2019, p. 2), narrative networks help to trace those paths (sequences of actions) in the process of enacting a task. Narrative networks are different from social networks because the nodes represent actions, not actors (Goh & Pentland, 2019). Putting actions in the foreground is consistent with a process perspective (Pentland & Feldman, 2007). The edges in the narrative network represent movement from one action to the next, connecting them into paths (Goh & Pentland, 2019). Thus, each event (action taken by an actor) shows what happens next (Pentland & Feldman, 2007), which represents the flow of actions according to process theory.

Narrative networks provide a theoretical explanation for how enacting different actions influences paths and, thus, the accomplishment of a task. For example, adding actions (nodes) and/or handoffs (edges) will tend to increase the number of paths, and removing actions (nodes) and/or handoffs (edges) will tend to decrease the number of paths (Goh & Pentland, 2019). As more paths (more actions and/or handoffs) mean increased task complexity and fewer paths (fewer actions and/or handoffs) mean decreased task complexity, adding or removing actions/handoffs produces more or less task complexity.

In sum, from a process perspective, accomplishing an organizational task is the process of enacting multiple paths – time-ordered sequences of actions. Following this, the process of constructing task complexity is a dynamic social practice that is under continuous (re-)construction. Narrative networks and the concept of paths help to elaborate on these microprocesses in constructing task complexity.

Methods

Research setting

We selected a research setting based on purposeful sampling (Patton, 1990), which is strongly marked by a task that changes many times in the process of enacting it (Christianson, 2019; Faraj & Xiao, 2006; Klein, Ziegert, Knight, & Xiao, 2006; Rudolph, Morrison, & Carroll, 2009). Healthcare organizations seemed a promising setting, as the task *patient treatment* changes considerably depending on the individual patient, and treatment cannot be specified ex-ante and must be customized each time (Faraj & Xiao, 2006). In particular, we chose a multidisciplinary ICU ward in a German university hospital which treats surgical and other patients in critical, life-threatening situations, e.g. after resuscitation. When patients arrive in the ICU, physicians establish an initial diagnosis (explanation). Because this diagnosis is often rushed and critical information is not yet available, the diagnosis retains a stochastic quality (Faraj & Xiao, 2006; Weick, 1990). The ensuing treatment process is thus often described as an 'educated guess based on limited clues' (Gawande, 2002 cited in Faraj & Xiao, 2006, p. 1160). Patients within trauma units are prone to 'problematic trajectories' (Faraj & Xiao, 2006, p. 1164), which are marked by sequences of actions and interactions driven by novel events, unexpected realizations, or disconnecting information that challenges steady treatment (Hannah, Uhl-Bien, Avolio, & Cavarretta, 2009). This means that updating, 'the process of revising provisional sensemaking to incorporate new cues' (Christianson, 2019, p. 45), is constantly taking place. In these situations, initial diagnoses are re-evaluated

Table 1. Summary of collected data.

Interviews	Observations	Documents
19 formal interviews Interview partner: Board member, senior physician, ward physician, consultant physician, head nurse, residents, nurses Several informal interviews throughout the data collection phase (documented in the field notes)	4.5 months 52 protocols shadowing physicians 64 protocols following patient cases Observed persons: senior physician, ward physician, resident or patients	Emails, posters, manuals, announcement sheets, clinic's publications

(working diagnosis for the moment), and actors alter the course of action in which the team is engaged (Rudolph et al., 2009; see Table 2 in the findings for the development of working diagnoses).

Data collection

For this study, we adopted a qualitative, practice-based, ethnographic approach to understand the processes and daily activities of practitioners in detail (Feldman & Orlikowski, 2011; Langley, 1999; Miettinen et al., 2009; Schatzki, 2006). We followed Faraj and Xiao (2006), who also conducted a study in a healthcare organization and used a combination of observation, shadowing, in-depth interviews, archival material and follow-up interviews.

The second author conducted an ethnographic study for 19 months. She began with a *familiarization phase*, analysing documents (e.g. medical guidelines) and conducting five semi-structured expert interviews to understand how teams work in an ICU. Next, she started to *observe actors* in the field as her *main data*. She adapted to the physicians' shift schedule and was allowed to shadow (Czarniawska, 2007; McDonald, 2005) certain ICU members all day (or night). This approach equipped the researcher with legitimation to follow an organizational member 'on their heels' from the beginning to the end of a work shift and to participate in all settings in which the actor was involved, thus leading the researcher to settings where an ordinary observer may not be permitted. The in-field researcher followed three physicians in the ward for several consecutive weeks. This included all formal occurrences (ward rounds, internal training sessions, division meetings) as well as informal occurrences (smoking breaks, talks in the hallways, coffee breaks). Furthermore, shadowing meant that the person being followed was induced to provide the researcher with a running commentary to elaborate on actions or uncover reasons for certain conduct, combining action and opinion (McDonald, 2005).

Thereby, shadowing allows the disclosure of what is actually going on instead of what should be going on (Czarniawska, 2007), which neatly suits the intent to uncover the ongoing construction of task complexity in the enactment of tasks. After the researcher gained an understanding of how the physicians performed their tasks, she traced (Czarniawska, 2007) certain patients from their admittance to discharge (or death). This step helped her to gain a deeper understanding of the completion of the task *patient treatment* across cases. In all, the second author spent 4.5 months in the ICU ward for the purpose of ethnography. She wrote field notes throughout each day and compiled them into daily protocols (116 protocols). Afterwards, she conducted 14 validating interviews for elaboration. To complete the dataset, the second author collected documents such as emails, posters, manuals, and announcement sheets. For an overview of our data collection, see Table 1.

Data analysis

The data analysis progressed in several stages. In *stage 1*, we began by writing case narratives for each patient, as the task of the hospital staff was to treat the patient. This helped us to focus on *stage 2* in events, which are defined as 'an action performed by some actor at some moment in time' (Hærem et al., 2015, p. 452). For this purpose, we used narrative networks (Pentland & Feldman, 2007) as our method, as outlined above. These networks helped to visualize actions taken by actors which formed into sequences of actions. Hence, each node in the network identified an event, or an action performed by an actor. The connections between the events (edges/handoffs) form sequences of actions. According to Hærem et al. (2015), these sequences of actions that lead to the completion of an organizational task are defined as paths. By focusing on these sequences of actions, we realized that to accomplish the task, more than one path was enacted; moreover, they formed and dissolved throughout the process (this is similar to Goh & Pentland, 2019). We defined actions as belonging to one path when they created context for one another (Kremser, Pentland, & Brunswicker, 2019). This means that when an action did not create the context for the next action, a new path formed. For example, the action 'realizing a high blood loss' did create context for the action 'instructing to order blood reserves' (path 3, see Figure A1 in the appendix, available as online supplemental material). In contrast, the action 'noticing that blood loss has declined' did not provide context for the action 'noticing circulatory monitoring alarm' (path 4, see Figure A1 in the appendix), thus a new path formed. In contrast to forming a path, a path dissolved when no further actions were enacted within the same context. In *stage 3*, we focused on the moments when a new path formed, were kept open, or dissolved. Thereby, we came up with four empirical codes, which were (1) forming paths and (4) dissolving paths. Then, focusing on path development, we identified (2) keeping paths open and (3) enacting interdependent parallel paths. We identified interdependent paths in cases where the sequence of actions created the context for another sequence of actions (Kremser et al., 2019). In the *final stage*, we started a focused coding process to analyse how and why paths formed, were kept open, were enacted in parallel, and dissolved over time. To form a new path, actors noticed cues, which could either be primary or secondary cues. To keep a path open, actors were questioning their working diagnosis or were searching for another working diagnosis. Moreover, in order to form a new path or keep one open, it was important that questions were raised across all hierarchies. Parallel paths were enacted in situations with certain interdependencies between paths. Thus, actors were enacting interdependent interruptions, consultations, courses of actions, or actions. To dissolve a path, actors either solved the issue or the path phased out. See Figure 1 for our analysis process.

Findings

The findings detail how a team of nurses and physicians enacted *the task of caring for a patient* named Fritz, who had undergone cardiac surgery in which he acquired a new heart valve. He was, in general, a very sick person; he also had lung disease and had received a new kidney. The physicians expected a 'normal' post-surgery healing and wake-up process; however, Fritz's treatment was by no means a streamlined process (see Figure A1 in the appendix for the entire narrative network), as new health issues appeared, many times contributing to the formation of new paths (new context). Some of these paths were kept open, were enacted in parallel, and/or dissolved after a while. Because it is not possible to offer detailed examples of all the patients we observed, we use Fritz as an illustrative vignette. However, Figures A2 and A3 in the appendix provide further examples.

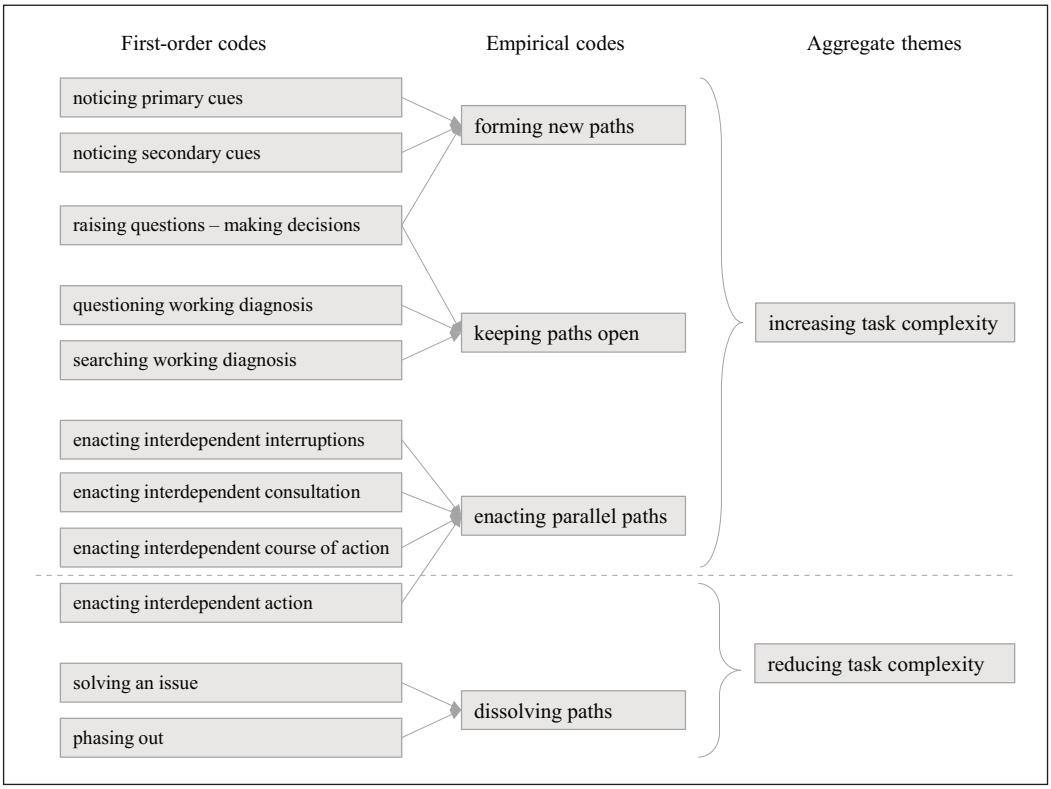

Figure 1. Coding scheme.

Forming paths

When the patients first arrived in the ICU for treatment, they were handed over to the physicians with vague, initial diagnoses about their state of health. Thus, physicians started the task of *patient treatment* by dealing with the initial diagnosis (path 1). Their goal throughout the process of caring for the patient was to improve the state of the patient's health to transfer him or her to another unit. However, in many cases, more health issues emerged that formed new paths, which the physicians had to follow in order to treat the patient. A physician explained the reasons for this process as follows:

> What's so exciting about medicine is that with all the standards that we have, there's no such thing as a standard patient who is delivered along (. . .). It is different from fixing a Volkswagen.

Another physician illustrated this phenomenon by comparing patient treatment with using a navigation system that recalculates the respective route several times:

> We are not driving a specific route as a bus driver. We start driving and have a certain goal where we want go. However, while driving, several times you hear the announcement 'the route will be recalculated', and then you drive along a different route, but you expect from the beginning that there will be several ways to go.

Only by closely *monitoring* the patient can physicians *notice cues* that form new paths. These cues can have two different origins: physicians or nurses notice *primary cues* as a new health issue because either the patient or IT-based alarm systems make them aware of it. In this case, the new health issue has nothing to do with previous actions within one of the existing paths (new context). *Secondary cues* are noticed as a side effect of already-treated health issues (paths) because either a procedure with unknown consequences in the beginning results in a new health issue (new context) or general monitoring tools (e.g. blood values) within one of the already-enacted paths indicate a new health issue (new context). Thus, the number of paths was never predictable or stable, and it changed dynamically throughout the process of accomplishing the task, as new paths could form at any time. See Figure A1 for an overview of all the paths that formed in the process of enacting the task *caring for Fritz* and Figure 2 for illustrative examples.

Noticing primary cues. While monitoring the post-surgery process (path 1), Klaus, the physician on duty, read Fritz's file and saw an antibiotic that was prescribed for an infection. Klaus could not find an explanation for this, so he collected more information from other departments (path 2; see Figure 2). After taking care of this issue, the nurse on duty during the night shift noticed that the

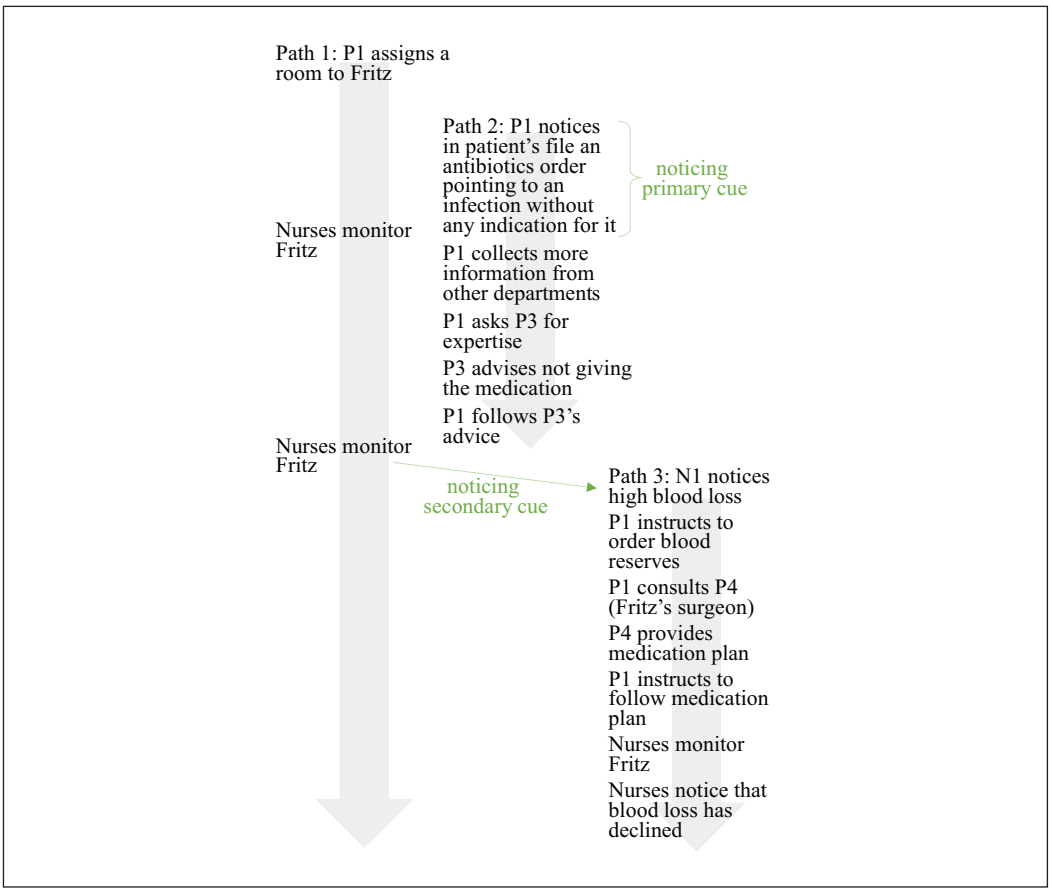

Figure 2. The process of forming paths.
Note. P: Physician; AP: Assistant Physician; N: Nurse.

circulatory monitoring alarm system came on; Marie, an assistant physician, treated this with medication (path 4). A few days later, a nurse asked for help when Fritz had problems breathing and had a panic attack. Mechthild, the physician on duty and two assistant physicians supported the nurse and gave Fritz medication; Mechthild then conducted a bronchoscopy (path 10). That same day, a nurse noticed that Fritz had a skin rash and insisted on a dermatologist consult. Mechthild decided against the consult but changed Fritz's diet (path 11). The next day, a nurse noticed that Fritz was saying confusing things to his wife and was acting aggressively. She immediately asked Fred, an assistant physician for help. Fred involved a physician who provided a medication plan (path 12).

Noticing secondary cues. While treating Fritz after surgery (path 1), a nurse who monitored Fritz noticed a high blood loss. Klaus, the involved physician instructed to order blood reserves (path 3; see Figure 2). During the night Marie, an assistant physician, checked Fritz's values as a normal post-surgery monitoring step (path 1) when she noticed that the blood values were pointing to kidney failure. She consulted the nephrology department, which advised conducting a dialysis and an ultrasound (path 5). While treating the possible kidney failure (path 5), Marie checked Fritz's blood values again and noticed a lack of white blood cells, which indicates a higher infection risk. Thus, the physicians transferred Fritz to a single room (path 6). Later that day, the physicians tried to wake Fritz up (path 1). While waiting to see if the trial was successful, a nurse noticed that Fritz was having seizures; these were treated with medication (path 7). Because the physicians could not explain why Fritz was not fully waking up (path 1) and had circulatory problems (path 4), they decided to conduct a CT scan. This CT scan did not provide new information regarding the existing health issues; however, the radiologist noticed a pneumothorax as a new health issue (path 8). As before, the physicians were monitoring Fritz's blood values intensively (path 4), whereby they noticed that Fritz had growing infection values; this was treated by administering antibiotics (path 9).

Fritz's treatment shows how new paths formed because hospital staff *monitored* the patients closely, which helped them to *notice cues* pointing to a new context. When nurses or physicians took actions in the direction of these cues, which did not belong to any previous path, new paths formed. Physicians are quite aware that patients can exhibit new symptoms all the time, as one physician explained:

> A lot can happen, all the time. It is possible that a patient feels all right in the morning, and in the afternoon, he all of a sudden has several health issues.

The example of Fritz shows how several paths emerged throughout the task *patient treatment.* As per the definition, each new path meant that the complexity of the task changed (increased) in the process of treatment. The more paths that the physicians had to treat, the more complex the task was. As new paths emerged during the process, no one could have determined the number of paths, and therefore the complexity of the task, beforehand. Only working through the task revealed the number of paths and the involved complexity.

Keeping paths open

Moreover, paths did not just form in the process of treating a patient; paths were also kept open, whereas others dissolved. For each health issue (path), physicians set up an initial diagnosis to work with. However, throughout the process of treating the health issue, this initial diagnosis updated several times, usually because the patient did not get better, as one of the physicians told us in an interview:

> You first propose a working diagnosis that you follow, and if the patient does not get better, you might change the diagnosis because you might need to enact another plan or procedure. And then you continue and might change the diagnosis again.

Another physician explained the following about patients in the ICU:

> We cannot say from the outside what a patient's problem might be. There are only a few diagnoses where you can say 'this is the diagnosis one hundred percent'. Usually, you make assumptions with more or less certainty.

Thus, because patients were not getting better, physicians were either *questioning their own working diagnosis* repeatedly or *searching for a new working diagnosis* to confirm it or prove it false. In treating the circulatory problems and possible kidney failure, two severe health issues that were treated during Fritz's time in the ICU, the physicians were questioning and searching the working diagnosis many times. Figures 3 and 4 illustrate these processes. Table 2 shows the development of the working diagnosis in the process of searching for a working diagnosis.

Questioning working diagnosis. Soon after Fritz was transferred to the ICU, Marie, an assistant physician, noticed that his blood values were pointing to possible kidney failure (path 5). As Fritz had a new kidney and the team in the ICU did not specialize in this field, Marie consulted the nephrology department. This team advised conducting a dialysis and an ultrasound. The ultrasound was analysed by Monika, a nephrologist who cooperated with the ICU team and worked with them on the entire case. She confirmed the first working diagnosis, that it was a temporary post-surgery problem and that it was best to wait and monitor how the kidney developed. The next day, Monika asked for another ultrasound to verify whether the diagnosis still worked; it was confirmed by the results. The following night, the physician on the night shift noticed growing lactate values, which can signal a lack of oxygen in the tissue – a sign of kidney failure. Thus, he questioned the current working diagnosis of a temporary failure and consulted the nephrology department. The respective physician from that department ordered an ultrasound, which again reconfirmed the current working diagnosis. However, during the morning rounds, Gerd, the chief physician, attended and questioned the working diagnosis: 'Do we really need to give tacrolimus? Immunosuppression does not make the patient any healthier. Please ask the nephrologists again how they forecast the development of the kidney. I'd like to critically question whether that is still necessary.' Thereupon, Tim, the responsible physician, and Monika discussed the situation again and conducted a new ultrasound. Monika also involved the physicians who transplanted the kidney. They all confirmed that it was still a temporary problem. A few days later, Monika asked for another ultrasound due to a bad blood gas analysis. The radiologist conducting the ultrasound reported that there was poor blood flow to the kidney; however, he thought it was due to Fritz's medication. On the following morning rounds, Gerd, the chief physician was present and questioned this diagnosis again. Even though the physicians did not agree whether the kidney failure was only temporary or permanent, they agreed to transfer the patient to the nephrology department.

Searching for working diagnosis. Almost from the beginning, Fritz had circulatory problems. The physicians treated these symptoms with medication and agreed on the working diagnosis of a temporary post-surgery complication. As cardiac arrhythmia also occurred after the wake-up trial, the physicians questioned this diagnosis and conducted an ultrasound to test if it was heart disease. This was not confirmed; however, they assumed that the circulatory problems were permanent. On

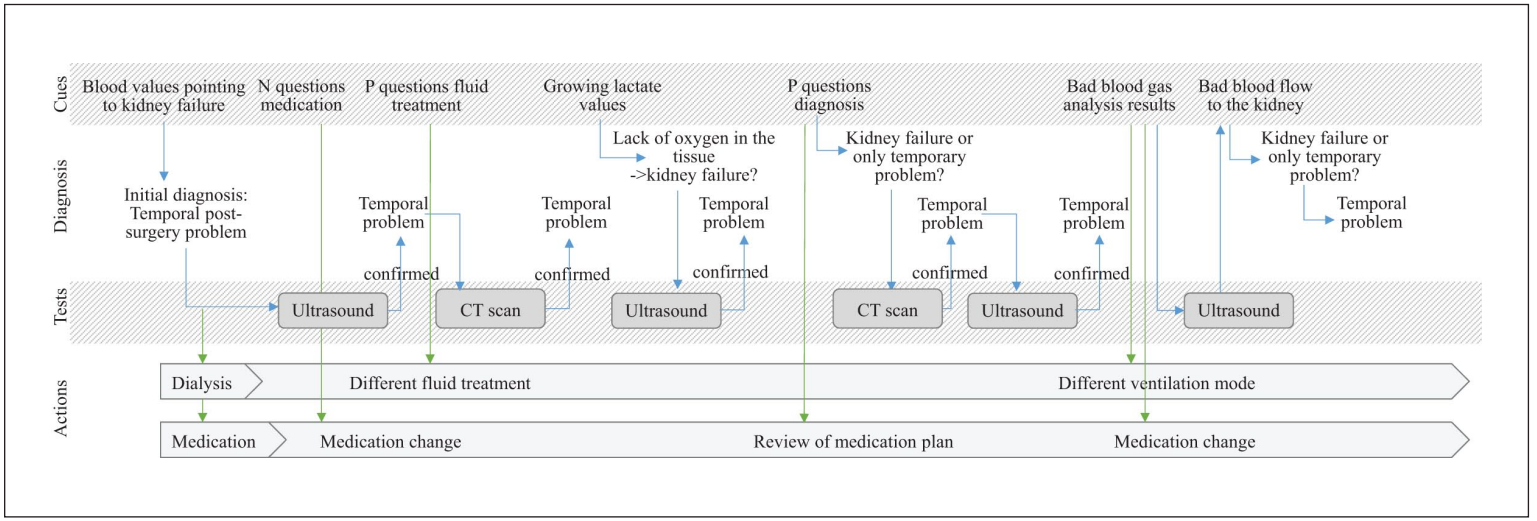

Figure 3. The process of questioning working diagnosis (similar to Ostermann, 2014).
Note. P: physician; AP: assistant physician; N: nurse.

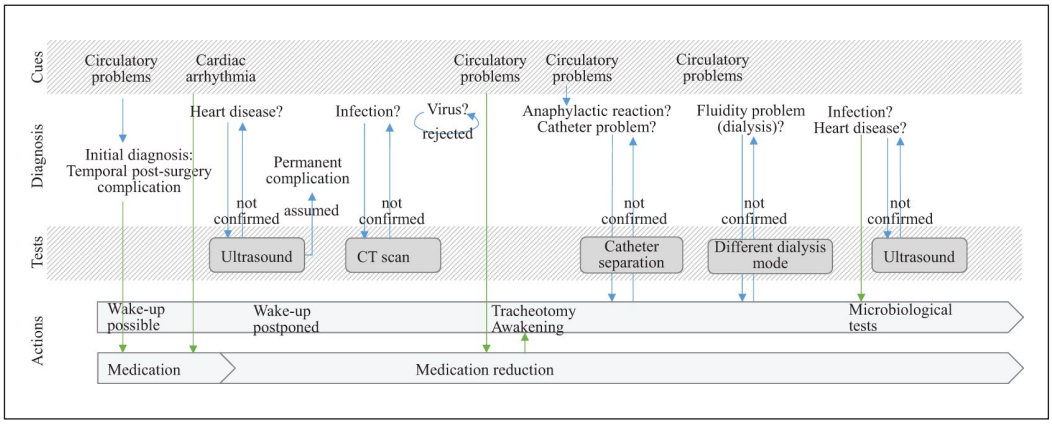

Figure 4. The process of searching for working diagnosis (similar to Ostermann, 2014).
Note. P: physician; AP: assistant physician; N: nurse.

Table 2. Development of working diagnosis for path 4 of patient Fritz.

Actions	Diagnosis
AP1 gives medication	Patient has circulatory failure, 'normal' post-surgery complication
AP2, P5 conduct ultrasound of the heart P2 reduces medication	P2: Patient might have a pericardial effusion (heart disease)
P2 orders a CT scan	P2: Patient might have an infection
P2, P7 discuss the situation and process P7 give medication due to circulatory monitoring alarm P2 checks Fritz's blood values P9 orders X-ray	P7: Patient might have a virus
P7 notices that Fritz circulations is unstable P7, P9 discuss different diagnosis P7, P2 discuss the treatment process again Nurses monitor patient	P7: Patient has anaphylactic reaction P9: Problems with the dialysis catheter and medication catheter
P7, P2 monitor and document process P7, P2 discuss different diagnosis P4, P2 discuss the situation Physicians notice that amount of medication varies AP4 notices circulatory failure and gives medication AP3 notice circulatory failure and gives medication	
AP3 checks Fritz's blood values AP4 notices circulatory failure and gives medication	AP3: Patient loses too much fluid through the dialysis
P2 orders new microbiological tests P2 conducts ultrasound of the heart to rule out heart disease – results are ok	P2: Patient might have an atypical infection P2: Patient might have a heart disease

the next morning rounds, Tim, the responsible physician and Björn, the assistant physician from the last shift, discussed the situation:

Tim: 'Did you conduct a CT scan?'
Björn: 'No.'
Tim: 'Do we have a focus on infections?'
Björn: 'No.'
Tim: 'That would be useful! We thought Fritz had a cardiac problem, but we could not confirm that. It must be a different focus.'

Thus, the physicians conducted a CT scan to verify this working diagnosis, but it could not be confirmed. Thereupon Mechthild, another physician, suggested that it might be a virus. Although Tim did not agree and thought it was too early to search for a virus, he agreed to test it. However, the team forgot to do the test, and the idea was dismissed later. The physicians reduced the seizure medication since this medication is also responsible for drowsiness. To adequately wake Fritz up, they inserted a throat tube to ease his breathing, but because Fritz was still drowsy, the physicians again discussed the situation on the next morning rounds. Mechthild assumed that it was an anaphylactic reaction, whereas Gerd, the chief physician, believed that it was a catheter problem (the medication catheter was next to the dialysis catheter, so all medications might be filtered by the dialysis). Thus, the physicians stopped the dialysis to verify this diagnosis, but it could not be confirmed. As the physicians still had no diagnosis to work with, they treated the circulatory problems with medications but still did not know why they were occurring. When Fritz had a new episode of drastic circulatory failure, Susi, an assistant physician who had not worked on Fritz before, analysed his file. The new working diagnosis was that Fritz had a fluidity problem created by the dialysis. Thus, she changed the dialysis mode. However, Fritz had new episodes of circulatory problems, so this working diagnosis was also not confirmed. The physicians were, at this stage, desperate to find a working diagnosis. Tim came back to his initial idea that Fritz might have an infection. The ultrasound to verify an infection on the heart did not confirm this working diagnosis, and the microbiological tests had not been analysed yet when Fritz was transferred to the nephrology department.

Fritz's treatment shows how paths were actively kept open. When the working diagnosis was not confirmed, physicians were more pressured to search for a new working diagnosis to cure the patient. However, even when the working diagnosis was confirmed, the physicians questioned it time and again. They tried to stay open and not become narrow-minded in their work:

> Especially with patients staying in the ICU for a long time, the danger is to say 'well, we know him or her'. Therefore, we need other physicians coming along questioning what else we could do. These physicians work against routine-blinded behaviour.

Physicians also explained that they always wanted to be up to date, as the patient's state of health changes all the time:

> We are aware that nothing is set in stone; everything is in flux. The status of a patient is always subject to a change process. Thus, I always have to be up to date.

Questioning the working diagnosis means to make repeated efforts to do something. In Fritz's case, physicians were relatively sure for a long while that the kidney problems were only

temporary. As long as no new information was available, they could have also just waited, doing nothing. However, from time to time, they conducted a new ultrasound to question their working diagnosis. In other words, the actors enacted actions to keep the path open. Searching for a new working diagnosis was different insofar as the physicians could not find a working diagnosis to start from. What they assumed was not confirmed by the tests they conducted. In contrast to the first example, the actors were forced to enact more actions to treat the patient respectively since, otherwise, the worst case would be that the patient could die. To keep a path open, more actions by a number of actors are necessary. Per the definition, more actions by more actors means that the complexity changes (increases) in the process of treating the patient. The more actions that are enacted by actors, the more complex the task is.

Raising questions/Making decisions. To form new paths and to keep paths open, everyone throughout the hierarchy was allowed to raise questions, and physicians listened to them, as one high-ranked physician explained:

> I have done CT scans because physiotherapists have told me something. [. . .] The same holds true for nurses. I would also react to the cleaning lady if she gave me important information.

Moreover, they were not just allowed to speak up; everyone was expected to monitor the patients and question whatever was suspicious. Physicians were quite aware that nurses, especially, had the most direct contact with patients:

> No other professional group in a hospital has as much contact with patients as our nurses. That means no one is observing them as intensively and frequently besides the technical monitoring devices. [. . .] No one has the possibility to collect so much information about patients. In consequence, this means that [. . .] they are our detectors, who collect and report all information.

Another physician confirmed this:

> They are also medical professionals. [. . .] They have never been to a medical school, but sometimes this is not a disadvantage. They have learnt much better to observe and to actually get to know the patient and, thus, have expertise in a field in which we are novices.

Even though everyone is asked to speak up, final decisions are made by the physicians. Nevertheless, nurses see this process as a team decision, as they can provide their opinion:

> [A] transfer is a team decision. Experienced physicians also listen to us when we say 'better not'. They may not do what we say right away, [. . .] but they take to heart what we say and question their decision.

This interactive process between physicians and nurses is exemplified in the following situation in which Tanja, a nurse, makes Mechthild, a physician, aware of a skin rash:

Tanja: 'Don't we need to consult the dermatologists about Fritz's skin rash?'
Mechthild: 'I think this is only a reaction to the contrast medium we gave him before he was in the CT scan.'A few minutes later, the nurse approaches Mechthild again.
Tanja: 'I think we need a consult here. Fritz has intense itching.'
Mechthild: 'He is getting Fenistil now, but it will itch a bit anyway. I just asked him, and he said it is better.'

Tanja: 'Hmm, he scratches himself a lot and rolls around in his bed.'
Mechthild: 'Hmm, [. . .] it is clear that it is uncomfortable. But I'd like to wait and put nothing on the skin.'After reflecting a while, she decided to give Fritz a different liquid food, hoping that would help.

Following the patients' wishes, although they are oftentimes not able to articulate themselves due to unconsciousness or poor health conditions, was important to the nurses and belonged to their identity as nurses, as the following quote indicates:

> We always think 'if that were our mum or dad, we would like to have someone doing everything they can'. [. . .] I think that is what drives us.

In sum, all personnel were called in to monitor patients, speak up and question treatments. Nurses are of particular importance, as they are very close to the patient. In the process of decision-making, they can also provide their opinion; however, the final decision is up to a physician within the hierarchy. Speaking up and questioning specific treatments or providing information for possible new treatments is of utmost importance in forming paths or keeping them open, thus maintaining or increasing the task complexity.

Enacting interdependent parallel paths

As outlined above, at times, several paths occurred in parallel. Some of these paths formed as a side effect of an already-existing path and had consequences for the existing path. Moreover, while actions were taken on multiple paths, interdependencies came up, which had to be considered to enact the task of *patient treatment*. One physician explained interdependencies between different health issues as follows:

> This is even more complex, as different organs influence each other. This leads to situations that are even more unexpected than the initial situation that you already categorized as unexpected.

These interdependencies are of a different nature. *Interdependent interruptions* are when actions in one path stop actions in another path. *Interdependent consultations* are when physicians acting in one path have to consult actors within another path in terms of side effects or intolerances. *Interdependent actions* are those that unite several paths into one specific action, e.g. one test or one medication for several paths. *Interdependent course of actions* are actions that are enacted in at least two paths in relation to each other.

Interdependent interruptions. An example of this occurred in the beginning, when the ICU team treated Fritz after surgery with the expectation that he would wake up soon (path 1). However, a nurse noticed high blood loss (path 3). Klaus, the physician on duty consulted Fritz's surgeon to discuss the further procedure. Fritz's surgeon provided a medication plan, but moreover, advised not to wake Fritz up until they were sure that Fritz had no secondary bleeding. Another example is that Fritz had seizures (path 7) when the physicians tried to wake him up (path 1). Tim, the responsible physician first administered medication and then checked Fritz's file for further information. However, the physicians did not try to wake him up again until the medication had taken effect. Only then did they try another wakening approach.

In these examples, actions in one path were interrupted and stopped by actions in another path for a certain time. The treatment in path 1, waking Fritz up, was interrupted by the high blood loss (path

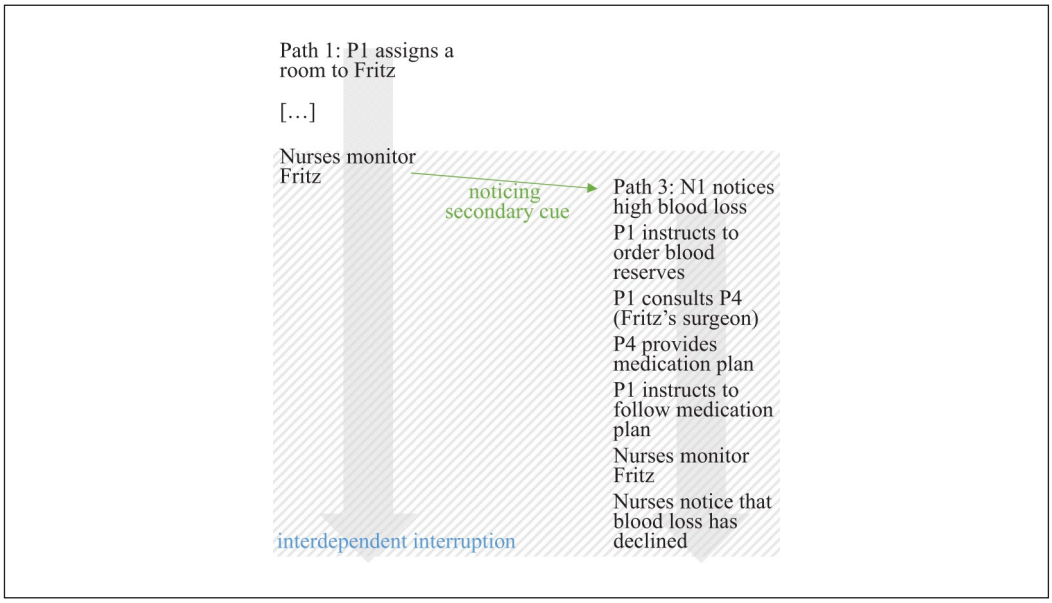

Figure 5. The process of enacting parallel paths – enacting interdependent interruption.
Note. P: physician; AP: assistant physician; N: nurse.

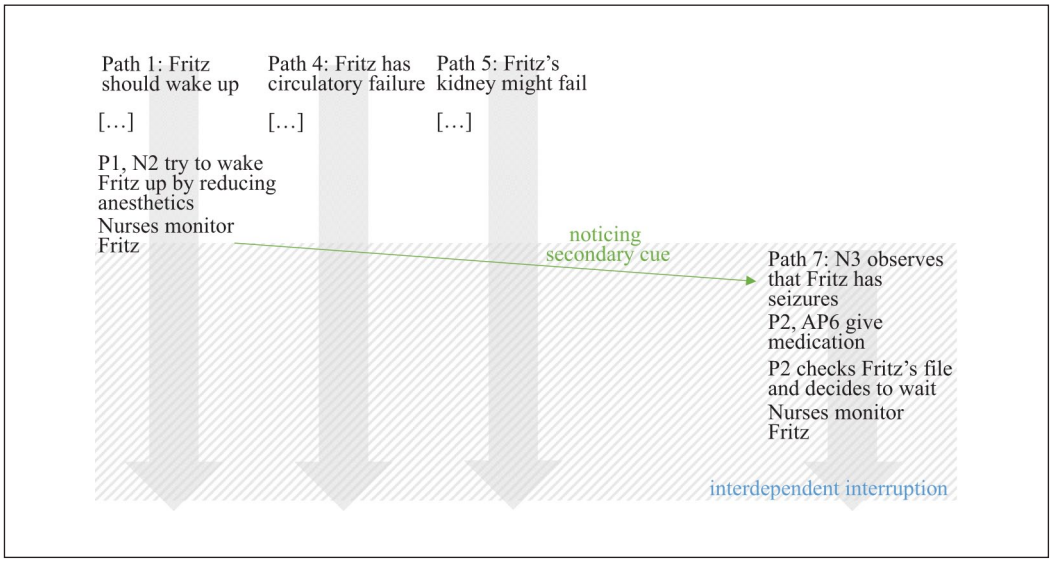

Figure 6. The process of enacting parallel paths – enacting interdependent interruption.
Note. P: physician; AP: assistant physician; N: nurse.

3). The physician who operated on Fritz decided that the on-duty physician should not take any actions to wake Fritz up (path 1) until the bleeding (path 3) was stopped. Thus, path 1 was interrupted by path 3, and the actors stopped any actions related to path 1 until path 3 was cleared (see

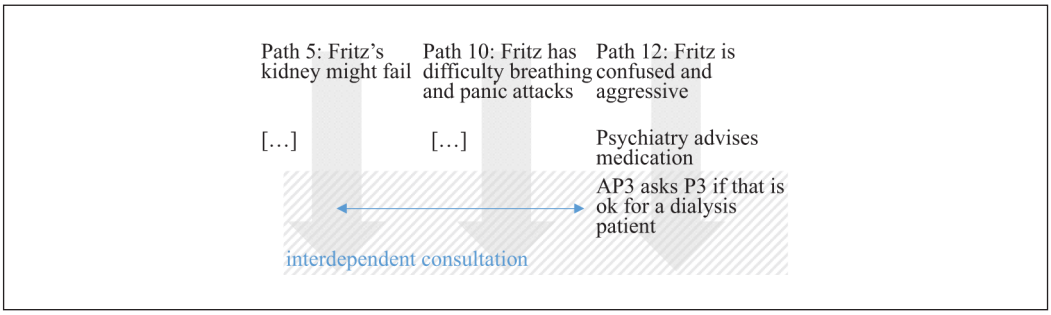

Figure 7. The process of enacting parallel paths – enacting interdependent consultation.
Note. P: physician; AP: assistant physician; N: nurse.

Figure 5). Later, path 1 was again interrupted. This time, Fritz had seizures (path 7) when the physicians tried to wake him up (path 1). Thus, path 1 was interrupted by path 7, and actions within path 1 stopped until the physicians thought that the medication would prevent the seizures (see Figure 6).

Interdependent consultations. At the end of Fritz's time in the ICU, he became increasingly confused and aggressive (path 12). Tim, a physician decided to consult psychiatry for advice. They provided a medication plan. However, assistant physician Susi was not sure if she could give a certain medication because Fritz's kidney was not working properly (path 5). Thus, Susi called nephrologist Monika to determine which medication could be given to Fritz.

In this case, psychiatry advised a certain medication to treat Fritz's confusion and aggressive behaviour (path 12). However, the attending physician was not sure if this medication would have consequences for path 5. Thus, Marie consulted an actor of path 5, in this case, the attending expert, nephrologist Monika (see Figure 7).

Interdependent actions. When the physicians attempted once more to wake Fritz up (path 1), they continued to monitor him for seizures (path 7). On the next morning rounds, physician Tim ordered a CT scan to figure out why Fritz was not properly waking up (path 1) and why he had circulatory problems (path 4). Moreover, nephrologist Monika wanted a new ultrasound to evaluate the current state of the kidney (path 5). Tim told her that Fritz was going to the CT scan anyway and that they could scan the kidney as well. The next day, Gerd, the chief physician ordered an X-ray to evaluate reasons for the circulatory problems (path 4), kidney problems (path 5) and the pleural drainage (path 8). The last incident was the moment a nurse noticed that Fritz was confused and aggressive (path 12). Physician Klaus immediately developed a working diagnosis that this might be a side effect of the anaesthesia; it could also explain the breathing problems and panic attacks (path 10). Thus, he provided a medication plan for both paths. The physicians were still handling these paths separately because Fritz had panic attacks from time to time, which needed immediate treatment, and the laboratory found a fungal infection, which could also explain the breathing problems (path 10). After a while, Fritz became more depressive; this was treated with antidepressants meant to help against the panic attacks (path 10) and aggressive behaviour (path 12).

These two examples illustrate that one action was enacted for several paths. In the first example, paths 1, 4 and 5 needed that CT scan (see Figure 8); in the second example, paths 4, 5 and 8 needed the X-ray (see Figure 9). Thus, the physicians were able to conduct only one examination instead of three. The last example shows how medication was given for paths 10 and 12 (see Figure 10).

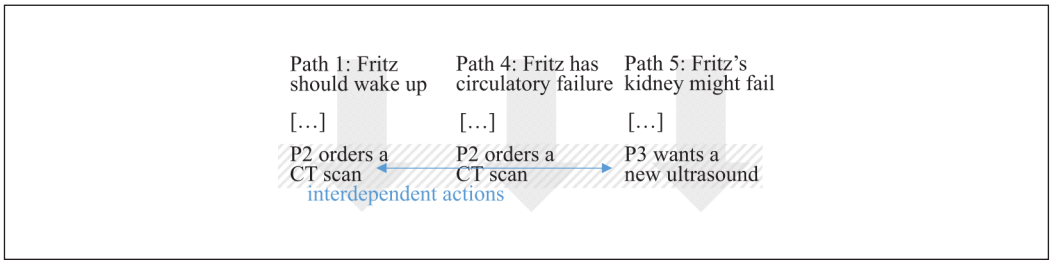

Figure 8. The process of enacting parallel paths – enacting interdependent actions.
Note. P: physician; AP: assistant physician; N: nurse.

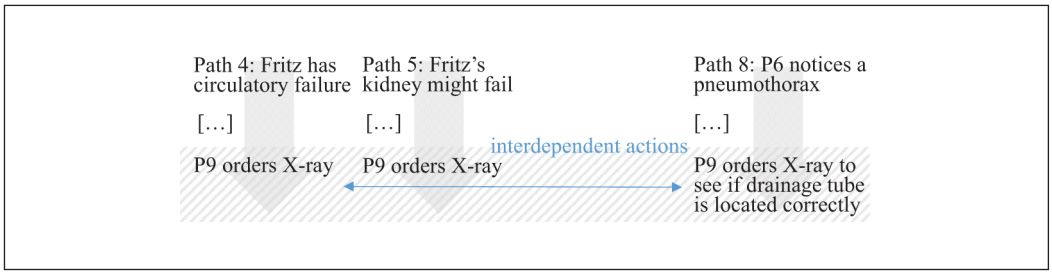

Figure 9. The process of enacting parallel paths – enacting interdependent actions.
Note. P: physician; AP: assistant physician; N: nurse.

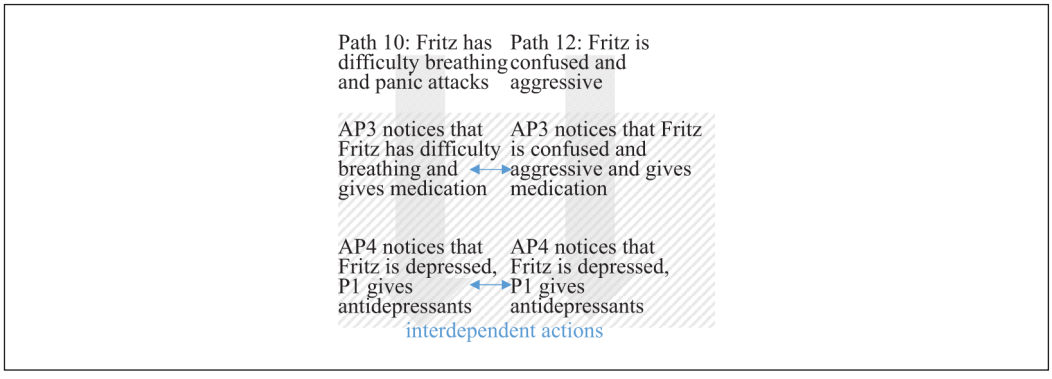

Figure 10. The process of enacting parallel paths – enacting interdependent actions.
Note. P: physician; AP: assistant physician; N: nurse.

This action, giving medication, belongs to both paths; however, it was only this one action that was enacted in relation to both paths. The actions before and afterwards belonged to only one of these paths, which is different to enacting an interdependent course of actions.

Interdependent course of actions. When the physicians started a second wakening trial (path 1) after Fritz had seizures (path 7), Fritz was waking up during the night. On the morning rounds, the physicians discussed how to continue and if Fritz was sufficiently awake to breathe on his own. Physician Mechthild suggested reducing the Keppra, the medication that Fritz had to reduce the

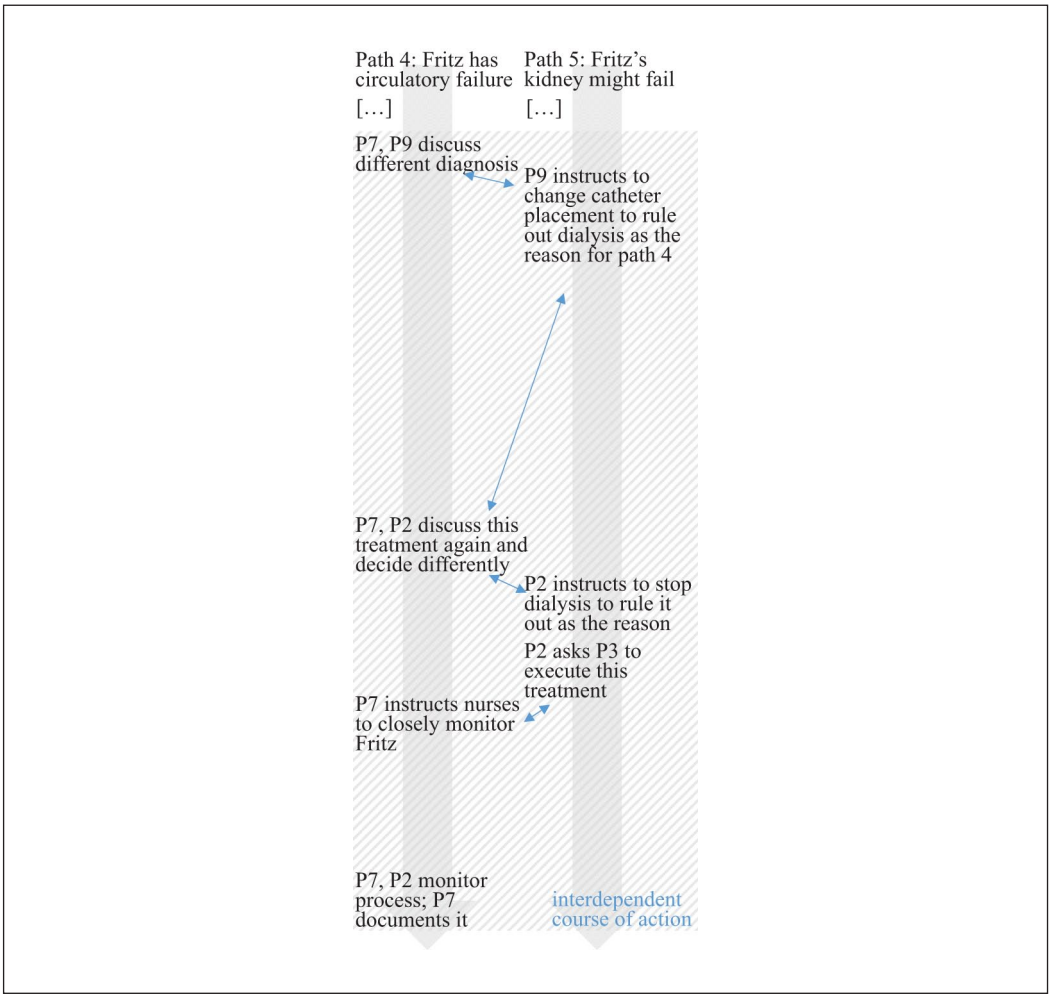

Figure 11. The process of enacting parallel paths – enacting interdependent course of action.
Note. P: physician; AP: assistant physician; N: nurse.

likelihood of seizures (path 7), because it also made him drowsy. Physician Tim agreed. In another instance, chief physician Gerd assumed that the medication to treat the circulatory problems (path 4) was being filtered out by the dialysis to treat the possible kidney failure (path 5). His working diagnosis was that the catheter to give medication and the one for the dialysis were located too close to each other. Thus, he decided to relocate one of these catheters. The executing physicians Tim and Mechthild decided to execute this in a slightly different manner and did not relocate the catheter but did stop the dialysis to evaluate this working diagnosis. Nurses monitored this process, reporting that the dialysis was not the reason for the circulatory problems.

The examples show how actions in two different paths influenced each other on an ongoing basis. Whereas in the first example, the physicians only reduced the medication in path 7 to continue actions along path 1, in the second example, the interdependencies continued over a course of actions. Gerd, the chief physician assumed that there was an interdependency between

paths 4 and 5 (see Figure 11). While reflecting on path 4, he assumed that the medication for path 4 was being filtered by the treatment for path 5. Following this, he gave the order to relocate the catheter in path 5; however, the attending physicians discussed the situation related to path 4 again. They made a different decision to stop the dialysis for a certain time. The expert belonging to path 5, the nephrologist Monika, had to execute this action. Nurses had to monitor the results, which were important for path 4. Thereby, actions were moving back and forth between the two paths.

To sum up, these examples show how different paths are interdependent. However, the manner of interdependence is quite different. Dependent actions merge different paths into one path for one specific action, thereby reducing the number of actions, as only one action is enacted instead of three. Per the definition, this reduces the task complexity for the moment. The underlying logic for the other three interdependencies is quite different. In none of these paths could actions continue without a connection to one of the other paths. From a path management perspective (Goh & Pentland, 2019) a new path is formed which, per the definition, increases task complexity. When one path was interrupted by another one, a new path was formed because the first path could not continue unless the interrupting path was cleared. Thus, the two paths are, for a certain time, inseparable. The same holds true if actors from one path need to consult actors from another path. The two paths are only connected for a short moment, but they form a new path based on the inseparable connection. The broadest interconnectedness is created if two paths are interwoven for a longer course of action, going back and forth.

Dissolving paths

So far, we have only illustrated how paths formed and were kept open. However, time and again, paths also dissolved. Above, we defined the forming of a new path as when nurses or physicians started to take actions in the direction of a new cue within a new context. In terms of dissolving a path, one way was enacting an action which was meant to *solve the issue*, thus closing the path. However, more often, it was not as easy to say when a path dissolved, as the ending was more blurred. This means that the physicians acted with the intention to end an issue, but as this sometimes was more of a cautious approach than a certain approach, paths rather *phased out*. Analytically, paths dissolved when no more actions were performed within them.

Solving an issue. When Fritz was first transferred to the ICU, physician Klaus noticed an antibiotics order which he did not understand (path 2). Thus, he collected more information, asking the nephrologist for an expert opinion, which he followed. The issue was solved by stopping the antibiotics. Shortly afterwards, the nurses and physician Klaus noticed a high blood loss (path 3). Klaus gave Fritz medication, and the nurses monitored the blood loss. As this declined during the night, the issue was solved. Later Marie, an assistant physician, noticed a lack of white blood cells, which is an indicator for a higher infection risk. Thus, she transferred Fritz to a single room to reduce the risk of infection (path 6). However, after a few days Tim, the physician on duty, noticed growing infection values, which he treated with antibiotics (path 9).

Phasing out. When the physicians started the first trial to wake Fritz up, a nurse observed that Fritz was having seizures (path 7). Thus Tim, the physician on duty, gave him medication. Moreover, the team waited for the medication to work. When Tim and Klaus started another wakening trial, the nurses monitored Fritz for further seizures, but he did not have any. However, he was also not fully awake. Two days later Mechthild, the physician, suggested reducing the seizure medication, as the medication also made Fritz drowsy. Tim agreed to follow that suggestion. Shortly before, the

radiologist had noticed a pneumothorax due to a wrongly positioned pleural drainage tube (path 8). Tim and two assistant physicians put in a new drainage tube. Over the next few days, Fritz still had problems breathing, and his kidney values were poor. So Gerd, the chief physician, ordered an X-ray. He also ordered to check the drainage in the X-ray. After another few days, Mechthild decided to change Fritz's diet because nurse Tanja made her aware of Fritz's skin rash (path 11). In the next round, Jupp, an assistant physician asked how to continue with the skin rash. Mechthild decided to wait. A few days later Tim, Klaus and two other physicians discussed the skin rash again and assumed that it was an allergic reaction due to different medication. Tim instructed that Fritz be closely monitored.

These examples illustrate how paths dissolved because health issues were solved or phased out. When a treatment helped to overcome the health issue and it was assumed for the moment that the health issue would not come back, it was considered solved. Discontinuing or administering a medication, transferring Fritz to a single room, and giving antibiotics generated direct results. In contrast to solving a health issue by generating a direct result, in other examples, it was unclear for a while if the treatment helped to overcome the health issue; thus, the path did not dissolve right away and rather phased out (no further actions). Giving Fritz the seizure medication helped to prevent further seizures. However, it took a while for the physicians to decide to stop giving him the medication. When the physicians put in a new pleural drainage tube, they could not be sure if it was located correctly, as it was not visible from outside the body. Not until Gerd, the chief physician, decided to order an X-ray anyway did they check to see it was located in the right place. Similarly, to treat the skin rash, Mechthild decided to change Fritz's diet and then waited to see how Fritz would react. A few days later, other physicians discussed the situation again and decided to just monitor Fritz closely. All these examples indicate that some treatments do not generate any direct results.

In sum, actions either dissolved because the health issue was solved or stopped for a while because the physicians waited to see if the treatment worked. Either way, paths eventually dissolved or at least fewer actions were performed, both of which changed (decreased) the complexity of the task. The fewer paths that were enacted by physicians or the fewer actions that were performed, the less complex the task was.

Discussion

Enacting task complexity in practice

Our research makes the case for moving from a discussion of measuring task complexity to a discussion of constructing task complexity in practice. Research in the field of process theory has stressed the importance of understanding the process of organizing as it opens up new avenues for our field (Jarzabkowski et al., 2012). Thus, to understand how phenomena evolve and develop, process research focuses on the temporal progression of actions (Langley, Smallman, Tsoukas, & Van De Ven, 2013). The major advantage of a process perspective is that it allows us to obtain a more complete understanding of the microprocesses of change and how change is accomplished (Tsoukas & Chia, 2002). Enacting tasks is clearly a fundamental part of organizing, and yet the way we conceptualize task complexity continues to be discussed as outside the process itself. Whereas research on task complexity so far has treated task complexity as a 'thing' out there, waiting to be designed, used and measured, a processual view advocates a processual, social constructivist understanding of task complexity as streams of action that come into being through their performance. By focusing on the process of enacting task complexity, the interest is more in how task complexity is constructed and changed as people enact tasks. Thereby, our research has

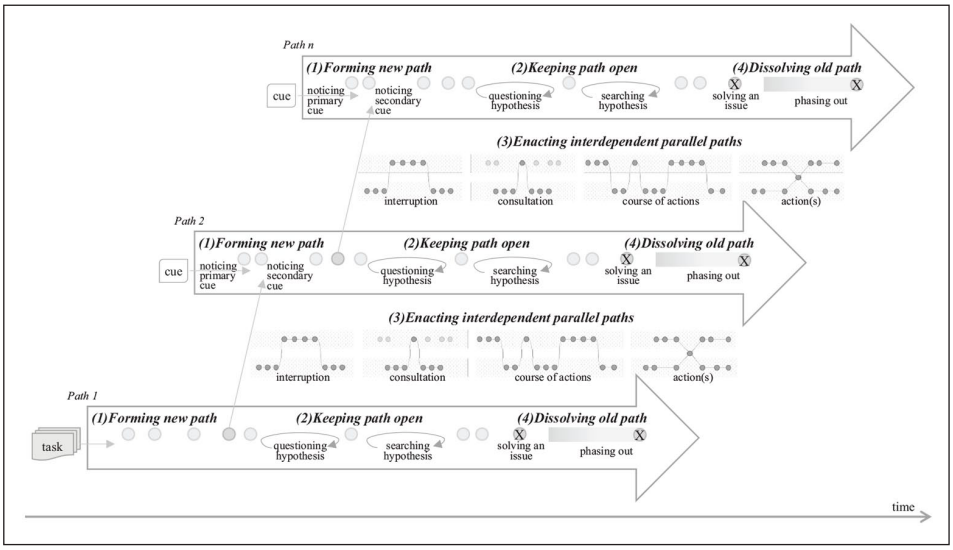

Figure 12. Process model of constructing task complexity.

helped us see the work that is required to make the enactment of a task more or less complex. Where we used to say, 'That task is complex,' we can now say, 'Enacting this task creates more or less complexity depending on the way in which the task is enacted.' Accordingly, tasks do not *have* a complexity, but tasks *become* (Tsoukas & Chia, 2002) more or less complex in their enactment. Our process model of constructing task complexity in Figure 12 is a graphical representation of this process.

In the beginning, there is always a general task that actors have to accomplish. As in the model, actors usually start to follow one path. While following this path, actors now and then notice new cues. These cues can be of different natures: either a cue is noticed as a primary cue, which means there is no connection to one of the existing paths, or a cue is noticed as a secondary cue, which is seen as a side effect of one of the already-enacted paths. Both possibilities can form a new path (mechanism 1 in the figure). Whenever a new path formed, it can be kept open for a while (mechanism 2 in the figure). Obviously, each action to accomplish the task contributes to keep a path open. However, paths can also be kept open because actors question their hypothesis or search for a hypothesis to work with. Both mechanisms produce more actions; thus, the path keeps open. As several paths can be enacted in parallel, actions of multiple paths can be interdependent (mechanism 3 in the figure). One option is that one path is interrupted by an action in another path; another option is that actors in one path consult actors within another path; a third option is that over a certain period of time actions are interdependent, and thus a shared course of action emerges; and a last possibility is that one or more paths share one action. In the end, paths can also dissolve (mechanism 4 in the figure) as either an issue is solved or a path phases out, which means there are no actions for a certain while without someone making the final decision that the issue of the path is solved. However, as no one acts upon the path, it dissolves. It is important to note, as our findings have illustrated, that these mechanisms are enacted many times throughout the process of accomplishing a task. More than one path can form, many paths can be kept open and be enacted in parallel, and several paths can dissolve.

Mechanisms driving the dynamics of task complexity

As our findings have shown, enacting tasks, and thus task complexity, is a continuous process with the 'necessity to act, while at the same time the best way to act is unclear' (Kramer, 2007, p. 57). On the one hand, the task itself is differently enacted each time (e.g. each patient is different from the next one), and on the other hand, unexpected events can occur at any time (Bechky & Okhuysen, 2011; Weick & Sutcliffe, 2007). Accordingly, no predefined set of actions or paths exists prior to simply enacting the task. Our findings indicated four different mechanisms in how tasks were enacted: (1) forming new paths; (2) keeping paths open; (3) enacting interdependent paths in parallel; and (4) dissolving old paths.

New paths are formed. In line with research on unexpected events, actors were driven to act upon new cues to start or continue working (Bechky & Okhuysen, 2011; Christianson, 2019; Klein et al., 2006). As outlined in our findings, actors reacted to cues but not with a simple and rushed approach, as this could lead to inferior consequences as research on decision-making has convincingly shown (Kahneman, 2012). Instead, actors started to enact 'meaningful action', which is action beyond the level of mere guessing (Kramer, 2007, p. 77). Kramer outlines that meaningful action is a response between the extremes of being absolutely sure in a closed system of rules and completely guessing with no rules whatsoever. Meaningful action in that sense means working with hypotheses. Hence, meaningfulness is not to be confused with knowing exactly what to do but acting on the basis of 'fallible, partial, and preliminary knowledge' (Kramer, 2007, p. 77). Nevertheless, starting to act with a hypothesis in mind generates new information and makes cues available through acting (Rudolph et al., 2009). In our findings, being open to new cues and acting upon them formed new paths, in other words, new sequences of actions to accomplish the task of patient treatment. The formation of new paths increased the task complexity.

Keeping paths open. Through acting, attention becomes focused on specific aspects of the task. An inherent danger in these situations is that the hypothesis with which actors are working becomes 'closed off' from other cues, which means that actions become increasingly influenced by existing insights without being open to new ones (Kramer, 2007; Weick, 1979). In order to prevent actors from only working with those existing insights, the insights must be updated repeatedly. As Christianson (2019, p. 46) mentioned, the essence of sensemaking is captured in the question 'What's the story?' (see also Weick, Sutcliffe, & Obstfeld, 2005), whereas 'updating also raises the question of whether the sense that has been made still makes sense'. Moreover, research on updating stresses that it differs from initial sensemaking, as it is more constrained due to earlier sensemaking (Christianson, 2019; Weick, 1988). For example, Rudolph and colleagues (2009) showed that updating only took place when actors were open to new cues and the plausibility of explaining the new cues was in favour of the current sensemaking process. This research stresses that updating the current sense can be a self-reinforcing feedback loop in favour of the existing sense. Thus, Kramer (2007) stresses that discrediting one's existing insights helps to overcome the risks of a positive feedback loop. Discrediting existing sense is not only the attempt to update existing insights but an active doubt of current beliefs. Our findings underpin this research by showing that a current questioning of a working hypothesis is a constant mechanism to doubt current sense. In addition, the process of searching working hypotheses uses doubt to question initial assumptions.

Our findings indicate that the process of discrediting existing sense was supported by allowing every actor throughout the hierarchy to raise questions. This is in light of research pointing to a discussion-friendly culture (Schulz-Hardt, Jochims, & Frey, 2002) or an open spirit of contradiction (Kramer, 2007). Our findings showed that superiors asked unpleasant questions by challenging

existing treatments or that nurses took over the role of patients' advocates, also challenging earlier or future procedures. However, as in situations of time pressure, actors cannot engage in endless time-consuming discussions; it is important that decisions are made in the hierarchy and not necessarily through mutual agreement. Our findings pointed out that even though everyone was allowed to speak up, in the end, decisions were made in the hierarchy.

In contrast to previous research stressing the importance of reducing task complexity as much as possible (Campbell, 1988; Wood, 1986), our research points to the significance of increasing task complexity as a productive encounter. The two mechanisms for forming new paths and keeping paths open are consequential for this increase. This finding is in line with research pointing out the importance of complex thinking (Tsoukas, 2017; Weick, 2007). Accordingly, in unique situations, paying attention to ambivalence and newness, that is, preserving 'disorder and confusion' (Weick, 2007, p. 17), is indispensable. Mechanisms to keep or increase complexity are necessary to capture unique situations and obtain sufficient information to make decisions (Schneider, Wickert, & Marti, 2017). Hence, nontrivial agents engage with an open world, which might be the trigger for more complex forms of inquiry (Tsoukas, 2017). Adding to this line of research, our findings demonstrate how complexity can be increased in the process to create disorder and confusion. The permanent questioning of hypotheses produces more actions, which also creates increased task complexity. Thus, the process of keeping a path open, not by just waiting and doing nothing but, instead, actively questioning the existing actions time and again (Rudolph et al., 2009) increases task complexity. Moreover, our findings show that updating is not something that needs to be balanced with tasks as highlighted by Christianson (2019). Instead, updating is – to a greater or lesser extent – part of any task, and thus, updating is enacted through enacting the task.

Paths are dissolved. In addition, our findings indicate that paths dissolve when the issue is solved or a path phases out, meaning no actions are taken for a while. Fewer actions and paths create a decrease in task complexity. This indicates that after being open to complexifying, decomplexifying is also indispensable. Staying open just for the purpose of being open (Tsoukas, 2017) does not help to complete a task. Whereas solving a task is a proactive action, phasing out is a rather passive process. For a while, no actions are enacted along a path, and actors simply wait for a result or do nothing.

Thus, our research provides insights on how task complexity changes in the enactment of an organizational task. Whereas previous approaches could only say that task complexity changed (Hærem et al., 2015; Wood, 1986), our findings point to the different mechanisms that form the enacted task complexity: how paths form, dissolve and phase out. Thus, task complexity is not seen as a 'thing' out there, which waits to be measured; quite in contrast, the construction of task complexity is a social practice. In the process of socially enacting a task, actors construct task complexity. Thereby, the focus is not on reducing task complexity; to the contrary, task complexity can be increased to accomplish an organizational task many times in the process.

Dynamics of enacted task complexity

The identified mechanisms have several implications for the dynamics of task complexity. Without giving the impression that we want to compute task complexity by producing numbers for comparison, we can nevertheless indicate that task complexity changes dynamically throughout the enactment of tasks. For example, each new path that formed potentially increased the task complexity as new ties along that path emerged. In contrast, each time a path dissolved, task complexity potentially decreased. As outlined above, new paths formed or dissolved throughout the process of enacting the task, which is why task complexity changed many times during its enactment. Therefore, our study reveals that task complexity is not an absolute number that one computes once at the end of an enactment. Instead, task complexity seen as a social practice is experienced by

actors as high or low based on more or fewer paths that are enacted. When task complexity is computed for the whole task, a high number indicates higher task complexity for the whole task, whereas a low number indicates lower task complexity for the whole task. However, as our findings have illustrated, only a few paths were enacted in some phases of the whole task, whereas at other times more paths were enacted. As such, when only a few paths were enacted task complexity was experienced as low, whereas when more paths were enacted task complexity was experienced as high. Acknowledging that task complexity changes dynamically throughout the process of enactment (Hærem et al., 2015) means incorporating the idea that task complexity is experienced quite differently in different phases of the performance. One cannot see these dynamics by only computing one number for the whole task, as one number does not account for the different numbers in between.

Conclusion

The goal of our study was to understand how task complexity is constructed in practice and how these constructions change over time. This paper is based on an ethnographic case study of an ICU in a large university hospital to observe how physicians perform the task of treating their patients. Our study shows that, first, tasks do not have a complexity, but they become (Tsoukas & Chia, 2002) complex in their enactment. Second, we explain the mechanisms that drive the dynamics of task complexity. Third, we stress that task complexity changes dynamically throughout the process of enactment; thus, task complexity is quite different in different phases of the enactment.

Acknowledgements

The authors thank the ICU ward for their invaluable support of this study. Without their support the paper would not have been possible. The authors are also grateful to Daniel Geiger, Georg Schreyögg, Matthias Wenzel, Gordon Müller-Seitz and Kenneth Goh for helpful feedback, which significantly helped in shaping the contribution of this paper. Earlier versions benefited from the thoughtful comments of participants at the EGOS Colloquium 2014 and the Academy of Management Conference 2015.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Supplemental material

Supplemental material for this article (Appendix: Figures Al–A3) is available online at: https://journals.sagepub.com/doi/suppl/10.1177/0170840620941314.

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