Sociotechnical dilemmas in healthcare: A cognitive ethnography

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1. Introduction

Organizational life can be understood as emerging in the dynamic interactions between people, artefacts, technologies, institutional structures, and procedures. These dynamics enable, inhibit, and transform organizational practice, including the ways people engage with their tasks and with each other. Yet little is known of the techno-political ambiguities and repercussions new digital media technologies entail for organizational practice (Beverungen, Beyes, & Conrad, 2019; Leonardi & Barley, 2008; Orlikowski & Scott, 2008). The digitalization of the Danish primary healthcare sector is an example of how organizational change offers opportunities for more efficient interprofessional workflows, as health professionals can rely on digital consultations with patients, communicate across departments and sectors, and document diagnoses and treatment plans in electronic medical records. However, digitalization also disrupts the non-digital domain of face-to-face interactions because digital technologies require that professionals adapt to technobureaucratic procedures and policies. Accordingly, technologies are not neutral tools, but carriers of the governmental policies by which they are shaped. Digital technologies are implemented to scaffold the organizational workflow, but this workflow unfolds in social relations between professionals and patients. Therefore, the technologies change the conditions for the organization of social interaction, language, and cognition. In short, they reshape the *organizational cognition* of the healthcare sector (Secchi & Cowley, 2020).

With an empirical focus on a single case from a nursing home, this chapter explores the cognitive consequences of digital technologies in the Danish primary healthcare sector. In the last two decades, this sector has undergone massive digitalization as part of governmental management strategies that aim at cost efficiency, standardization, routinization, and modernization. As a result, health professionals are increasingly required to use digital communication technologies as an integral part of their everyday working life, either through record keeping in the electronic medical record (EMR) or via digital correspondences with patients and other health professionals—or both (Assing Hvidt, Søndergaard, Klausen, & Grønning, 2020; Grønning, Assing Hvidt, Brøgger, & Fage-Butler, 2020; Simonsen, 2021). While the political narrative about "digital era governance" (Schou & Hjelholt, 2019) is that the use of digital technologies supports efficient task-performance and interprofessional collaboration across settings, digitalization can be traced to a series of New Public Management initiatives (Simonet, 2013), including governmental policies and standardized procedures for using the technology. The purpose of these initiatives is to avoid human errors and adverse events due to misunderstandings and misinterpretations by ensuring that all actions and observations are recorded concisely and consistently. Accordingly, there are procedures for what to document, how to document it, the writing style, the use of jargon and medical euphemisms, and more (cf., Section 2). However, these procedures rarely take into account that individual health professional use digital technologies *in situ* and in light of personal experiences and organizational

circumstances. Accordingly, the procedures may conflict with organizational complexities and individual circumstances tied to roles, relations, and responsibilities (Mørck, Langhoff, Christophersen, Møller, & Bjørn, 2018; Simonsen, 2021). Even when following the procedures, records may still be produced and interpreted differently across sectors and professions. Though it may seem simple to adhere to procedures, it is often not that obvious how to do so in practice, since what is considered clear and according to procedure, is not necessarily perceived similarly across different professions. For instance, all GPs partaking in our study expressed that the care assistants at the nursing homes both overinform and underinform in digital systems, where the former is related to the fear of not having shared enough information, and the latter relates to uncertainties and lack of knowledge about what information to share. This tension between the ideal(ized) use of digital technologies and real-life experiences with it may create conflicts when it comes to the medical treatment of real, non-digital, living patients.

Using cognitive ethnography, this chapter explores how the implementation of digital technologies lead to critical decision-making. By doing so, we contribute to contemporary socio-material and organizational fields of research (e.g., Beverungen et al., 2019; Leonardi & Barley, 2008) with a distributed and organizational cognition lens (Hollan, Hutchins, & Kirsh, 2000; Hutchins, 1995a, 1995b; Secchi & Cowley, 2020). By illuminating the ambiguities that digital technologies entail for professional work, we thus explore how contextual conflicts lead to dilemmatic behavior.

1.1. Theoretical frame: the 3M model of organizational cognition and multiscalar conflicts

Secchi and Cowley (2020) promote a theoretical innovation within the field of organizational cognition by integrating elements from distributed cognition (Hollan et al., 2000), 4E cognition (Menary, 2010), and radical embodied cognitive science (Chemero, 2009). They propose a "3M model of organizational cognition" (Figure 1). The 3M model depicts how microprocesses pertaining to the individual sphere and macroprocesses pertaining to organizational sphere, culture, policies, routines, norms, etc., constrain social organizing in the mesosphere, which is thus both *emergent* (from the perspective of the micro) and *immergent* (from the perspective of the macro).

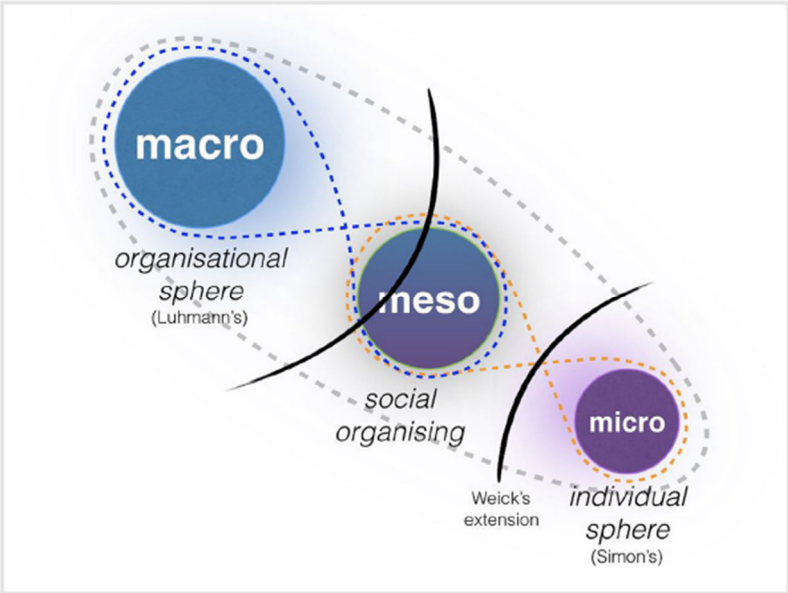

Figure 1. Secchi and Cowley's 3M model of organizational cognition (Secchi & Cowley, 2020).

As suggested by Secchi & Cowley (2020), the epistemological interest of organizational cognition is social organizing in the mesosphere. Our chapter adds an emphasis on the conflictual nature of the dynamics between the three spheres. Our focus is guided by two observations. First, much work in distributed cognition focuses on cases with a high degree of proceduralization (e.g., Hutchins's (1995b) study of airplane cockpits) and with little room for individual modi operandi. In contrast, numerous ethnographic studies have taught us that much work is carried out by agents who find themselves in stressful and tense situations, which can be traced to the complexity of organizational life. Second, contemporary organizational practices give rise to mesospheric events where human agents are supplemented by an array of technologies. Accordingly, we propose that an explicit recognition of *hybridity* in cognitive systems (Sutton, 2010) may add to the current view of the microsphere as basically a biological domain of individual "brains and bodies" (Secchi & Cowley, 2020, p. 1). Broadening our understanding of the microsphere also has repercussions for our understanding of the mesosphere, because the technologies are not just tools to be used for people, but crucially designed artefacts that shape the sensorimotor dynamics and emotional reaction of the persons involved, as these are enacted.

In the following, we diverge from Secchi and Cowley (2020) as we avoid the spatial metaphor implied by the term 'sphere'. We rather interpret the three M's as temporal scales that describe regularities at the organizational, interactional, and agentive level, respectively (for a technical discussion of our concept of such scales, see Steffensen & Pedersen (2014) and Loaiza, Trasmundi, and Steffensen (2020)). This perspective emphasizes the conflicts and tensions between different logics at different scales. Thus, even in situations where all agents belong to one and the same organization, the constraints imposed by the macro-organizational scale are still numerous and potentially conflicting. Likewise, given that the mesoscale is populated by "*self-regulating systems* that, at a given moment, may be an individual with (or without) support, or a dyad or group who address a larger project" (Secchi & Cowley, 2020, p. 7), the mesoscale is indeed an arena for regulatory processes between components that are not necessarily aligned. This multiplicity guides

our interest in understanding cognitive conflicts. The axiomatic assumption, thus, is that social organizing in the mesoscale is an arena of multiple conflicts. We have no ambition of providing an exhaustive overview of all the possible conflicts; more modestly, we explore three *kinds* of conflicts that depend on inherent tensions in the three spheres of the 3M model. Thus, in this chapter we investigate the following three phenomena:

- *macroscale overconstraints*: Different macroscale structures constrain the mesoscale in ways that create tensions in the self-regulating mesosystem. Such tensions may come to the fore as conflicts between two or more elements in the system or as decision-making dilemmas;
- *mesoscale adaptivity asymmetries*: Different elements in the mesosystem have different breaking points, or different levels of brittleness, which leads to asymmetries in how tensions are resolved. The functional components of hybrid mesosystems can either align or fail to align in many different ways. On some occasions, redundancy elsewhere in a resilient distributed system may bring levels of adaptive plasticity that can compensate for human error or manage an intractable task more or less effectively. On other occasions, more inflexible or brittle technological systems may prompt human agents to absorb the full responsibility for adapting to or resolving tension;
- *microscale ethical asymmetries*: Even if the entire cognitive system carries the agency (in that the outcomes of the system cannot be traced to a single component in it), the *responsibility* to act is not symmetrically distributed among the components.[1] Human agents have a capacity to feel an ethical responsibility for how the (macroconstrained) mesosystem in which they are embedded handles a given situation. So where decision-making or action at the mesoscale carries ethical weight, microscale ethical asymmetries may emerge. Specifically, the individual human parts of the system may absorb full responsibility for resolving ethical conflicts.

In Section 3, we present and discuss each of these conflicts, first in theoretical terms, then through exploration of a single case where all three types of conflicts are enacted in real-world interprofessional collaboration. But first, we present our methodological approach (Section 1.2), as well as the case-study that underlies the discussion of conflicts in hybrid cognitive systems.

1.2. Methodological approach: Cognitive Event Analysis

Given that "it is the binding role of the various *meso* domains that allow [sic] individuals to cognise within wider socio-economic systems" (Secchi & Cowley, 2020, p. 6), the implication of the 3M model is that cognitive processes at the mesoscale are *observable*, as they play out in the relations between the components of the mesoscale self-regulating cognitive systems (Hollan et al., 2000).

[1] Strangely, Secchi and Cowley (2020, p. 10) define the microsphere in terms of "neurophysiological processes associated with a biological individual." As we, for instance, recognize how hybridity between human and machine components offers new ways of organizational work, organizational cognition and social relations, we argue that since Secchi and Cowley acknowledge that meso cognition is extended (and distributed), the physical constitution of *all microsphere* components matters, not just the human ones.

On this view, cognitive ethnographers have approached naturalistic data captured with video cameras, field notes, and other methods (Alač & Hutchins, 2004; Ball & Ormerod, 2000; Hutchins, 1995a; Ormerod & Ball, 2017; Trasmundi, 2020). In a recent attempt to develop a detailed method for analyzing ethnographic video data of the embodied and enacted micro-dynamics of cognitive processes, Steffensen and colleagues have deployed *Cognitive Event Analysis* (Cowley & Nash, 2013; Pedersen & Steffensen, 2014; Sune Vork Steffensen, 2013, 2016; Sune Vork Steffensen, Vallée-Tourangeau, & Vallée-Tourangeau, 2016; Trasmundi, 2020; Trasmundi & Steffensen, 2016). Space only allows for an overview of the method.[2]

The guiding assumption in Cognitive Event Analysis (CEA) is that cognitive processes can be identified from their results. A 'result' (or 'outcome') could be the articulation of a solution to a problem, the formulation (or implementation) of a decision, or a behavioral adaptation to a change in the environment. A result is not necessarily planned or intended; thus, from a CEA point of view, Roth's (2018) analysis of a plane crash due to the pilots' switching off the working engine rather than the one on fire, would also count as an analysis of an (unfortunate) result. Accordingly, the criterion for a cognitive event is not (exclusively) what the participants perceive as a relevant event, but (also) what from an observer's perspective appears to be a noteworthy moment, for instance by establishing relevant theoretical criteria.

Having identified the emergence of such results, one can now trace the "necessary constituents of the living system determining the achievement of these results" (Järvilehto, 2009, p. 118). CEA draws two key methodological principles from Järvilehto's insight. First, accepting a premise of all varieties of embodied cognition, CEA sees cognition as inseparable from organismic animation: even when cognition is steeped in socio-technological apparatuses, it ultimately still depends on the presence of a living system that, so to speak, breathes life into the system. Thus, how the living beings animates the cognitive system is a key concern for CEA, for which reason it is concerned with the minuscule details of embodied behavior.

A second insight drawn from Järvilehto is the importance of temporality. Thus, a segmentation of the cognitive trajectory reveals how embodied behavior iteratively builds up to bring forth cognitive results on an enchronic timescale (Enfield & Sidnell, 2013), that is, the timescale of moment-to-moment temporality by which humans perform situated actions. Thus, by focusing on the particularities and singularities of behavior, according to which a given outcome is contingent on one-offs, serendipities, and accidents (Sune Vork Steffensen, 2016), a given outcome in the mesoscale can be scrutinized as the result of events in both the macroscale and the microscale.

2. A cognitive ethnography of interprofessional collaboration with digital consultations

Our cognitive ethnography was conducted over a ten-month period (by Simonsen in 2018-2019), where it was studied how digital consultation technologies are embedded in Danish health practices and enacted in interprofessional interactions across different settings including a nursing home, a general practice, and the homes of three elderly patients. Multiple medical-collaborative activities were video-recorded, including physical consultations with patients, general practitioners'

[2] The most detailed presentation and discussions of the method can be found in Sune Vork Steffensen et al. (2016), Trasmundi (2020), and Ormerod and Ball (2017).

preparation before conducting sick visits at the nursing home, and collaborative situations between GPs in the clinic and between care assistants and nurses at the nursing home.

In this chapter, we zoom in on a case study that stems from the nursing home and focuses on how nurses and care assistants produce and interpret their own and other health professionals' digital records (including those of the GPs affiliated with the nursing home). Because care assistants and nurses deal with different aspects of the patient care and have different educational backgrounds, they have overlapping as well as individual tasks and responsibilities. As their professional roles bring forth cross-professional variations across their professional vision (Goodwin, 1994), they enact different sensitivities when they use, produce, and interpret digital records. In the Cognitive Event Analysis in Section 2.2-2.4, we therefore scrutinize the mesoscale organization in a situation where a nurse (anonymized as *Nina*) and a care assistant (anonymized as *Caroline*) are confronted with a dilemma that pertains to insufficient information in the EMR. The situation[3] is as follows: during a semi-structured interview with Caroline, conducted in the common area in one of the wards at the nursing home on a Tuesday morning, Nina enters the room and initiates an informal conversation with Caroline concerning a patient who is currently receiving palliative care. Two days earlier, on the Sunday, the patient had a physical consultation with an on-call GP, where the patient's relatives and the patient made the decision that if the patient should pass away, resuscitation should not be attempted. Thus, a so-called DNACPR decision has been made: "**D**o **N**ot **A**ttempt **C**ardio**p**ulmonary **R**esuscitation," if the patient dies. Though a medico-ethical decision in fact has been made by a GP, the decision has not been recorded properly in the digital system, which give rise to a dilemmatic situation in the mesoscale organization of the interprofessional collaboration. We will analyze on how the dilemma is embodied in the interprofessional interaction between Nina and Caroline via CEA (Section 2.2-2.4), but first we present findings from our cognitive ethnography, which explores how the macroscale conditions give rise to ethico-legal complexities in sociotechnical systems (Section 2.1).

2.1. Macroscale conditions: An ethnographic outline

The Danish Patient Safety Authority (Sundheds- og Ældreministeriet [Ministry of Health and Elderly Affairs], 2019) requires (1) that a DNACPR decision must be recorded in the EMR, and (2) that the decision must be formulated as a medical phrase that states: "there is no medical indication for attempting resuscitation in case of heart failure." In the absence of such a record, cardio-pulmonary resuscitation (CPR) *must* be attempted by default. The function of the record, thus, is that all employees at the nursing home have access to the information that the patient must *not* be resuscitated. Indeed, the importance of the attestation is so crucial that the legal instructions specify that: "if there is any doubt whether the situation is included in one of the exceptions [i.e., the specified cases in which it is legal not to attempt CPR], *CPR must be initiated*" (Sundheds- og Ældreministeriet [Ministry of Health and Elderly Affairs], 2019; our translation and emphasis).

Given this legal backdrop, the situation is tricky for Nina and Caroline. Thus, a record of the decision is in fact stored in the nursing home's digital system, "One Plan", but it is not stored in the

[3] The situation is captured with a handheld camera which follows Nina and Caroline moving around in the room. The interaction was recorded by Simonsen who was present before, during, and after the interaction. Consent was given from all parties prior to the recording.

EMR. Further, it is not, technically speaking, authored by the GP, as it is merely an observation note made by an assistant who reports from the GP's visit. From our ethnographic fieldwork, it is clear that the staff on a routine basis copy information into the EMR from One Plan and vice versa. This practice may lead to blurred boundaries between systems, so the staff lose track of the macroscale and legal implications of where a given record is stored and who has authored it. Finally, the observation note states that "good loving care has been arranged with patient and relatives." Though the professionals *know* what this phrase means, namely that resuscitation should not be attempted, it is not formulated in accordance with the authorities' requirements. Additionally, our ethnographic interviews with other GPs make it clear that "good loving care" is a widespread medical euphemism for DNACPR. The phrase is a GP's way of expressing the patient's need for "a hand to hold and some painkillers" (as explained by a GP in an interview). However, the legal instructions reject the sufficiency of such short-hand notions: "Abbreviations/codes about the [DNACPR] decision can solely be used as a supplement to the proper record of the decision" (Sundheds- og Ældreministeriet [Ministry of Health and Elderly Affairs], 2019; our translation). So while the nursing home for all practical purposes has a record stored in their digital system stating the decision, the record is not a legally valid document because it is not produced by a GP and it does not provide the designated concise legal phrasing.

Nina and Caroline thus face a dilemma. On the one hand, they do not have a valid record of the DNACPR decision; on the other, there is little doubt about the articulated intention from the GP, the patient, and the relatives that CPR should *not* be attempted. In this situation, if the patient has a cardiac arrest, they either comply with their legal obligations and attempt CPR according to procedure *or* they rely on their interpretation of the stored record of "good loving care" and abstain from CPR. In the former case, they violate central medico-ethical principles (Beauchamp & Childress, 2001), including the patient's autonomy. In the latter, they violate the law. Thus, until they receive a GP's proper DNACPR documentation, Nina and Caroline find themselves in a precarious situation.

Having outlined the macroscale conditions as they are embedded in the governmental policies that constrain the sociotechnical dilemma emerging at the nursing home, we present an overview of the cognitive trajectory of the distributed cognitive system animated by Nina and Caroline (Figure 2, below). As shown, the cognitive trajectory exhibits a cyclical structure, as Nina and Caroline twice move through the same three stages: (i) they perform a narrative re-enactment of the patient; (ii) this re-enactment leads to a decision point; and (iii) the decision is avoided through a strategy of what we term *decision displacement.* This triptych structure plays out in Segment 1-2-2b and again in Segment 3-4-4b. The following analysis has three parts. Section 2.2 focuses on the decision dynamics in Segment 1-2, tracing them to macroscale overconstraints. Section 2.3 emphasizes the mesoscale dynamics in Segment 3-4. Finally, Section 2.4 discusses the ethical and emotional dynamics of decision displacements in Segments 2b and 4b, by relating the cognitive trajectory to the microscale in the 3M model.

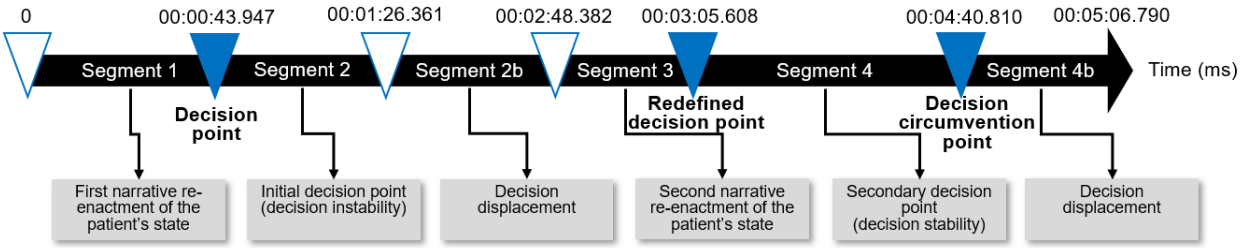

Figure 2. The cognitive trajectory of the DNACPR case.

2.2. Navigating macroscale overconstraints

While not explicated in Secchi and Cowley's (2020) 3M model, it goes without saying that the macroscale is irreducible to a single constraint that conditions the mesoscale. The organizational dynamics allow for multiple constraints that each exert their forces on the cognitive dynamics enacted in the mesoscale. As stated, in Section 2.1, an example of how multiple constraints co-constrain the mesoscale is the way legal and ethical constraints push Nina and Caroline into the dilemma discussed above. In a case where two or more constraints conflict, we describe the mesoscalar cognitive system as *overconstrained*. In computer science, "an *overconstrained system* (OCS) is a set of constraints with no solution, caused by some of the constraints contradicting others" (Jampel, 1996). Leaving the mathematical rigor behind, an *overconstraint* refers to the simultaneous presence of two or more conflicting macroconstraints. Evidently, when behavior enacted in mesoscale organization is overconstrained, it tends to be tense and edgy because it must balance various conflicting macroconstraints.[4]

We therefore continue to investigate how Nina and Caroline then struggle to balance the overconstraint imposed by the organizational macroscale. We specifically focus on how the two healthcare professionals realize that they find themselves in an overconstrained situation. We trace the overconstraint to two central macroscale dynamics: technobureaucratic constraints and ethical standards for performing palliative care.

As we enter the situation in Segment 1, Caroline is sitting at a desk, talking to the ethnographer. Nina has just seen the patient, and as she comes back to the staff room, she reports her observations.

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Segment 1: How long will it take?[5]
N:   °I have given her some morphine°
CA:  yeah
N:   but eh: the question is how long it will take before (.) that (.) that it
     is over because she has- she begins to be- well i don't know how long she
     has- she has just had an apnoea (period)- right when i came in I thought
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[4] A similar point is made in Sune Vork Steffensen (2012), where systemic values (Hodges & Baron, 1992) are said to constrain dialogical systems. Given that these constraints may conflict, the (mesospheric) dialogical system exhibits *metastability* (Kelso, 1995).

[5] The English transcriptions are translated from Danish and follow CA conventions (Jefferson, 2004).

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CA:  =yes
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Nina reports that the patient is approaching a point where death is impending. The impending death entails a decision point regarding the initiation of CPR procedures, if the patient has a cardiac arrest (cf. Figure 3).

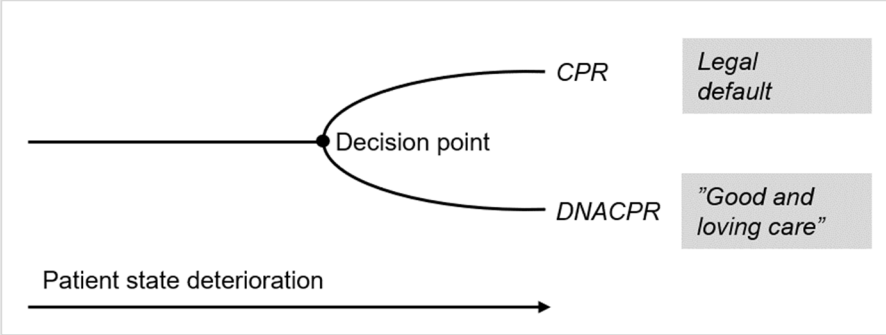

Figure 3. The decision point is shown as a bifurcation point where the order parameter is the patient's deterioration. The two decision terms, CPR and DNACPR, are shown as the two branches. The grey boxes indicate the two sides of Nina and Caroline's dilemma, superimposed on the bifurcation model.

Under normal circumstances, the decision point will be unambiguously defined: A DNACPR attestation annuls the legal default, and in the absence of such a DNACPR record in the EMR, CPR is the default decision. However, as shown in Section 2.1, the situation is not clear-cut. In Segment 2, we see how this opacity leads Nina and Caroline to redefine the decision point, as illustrated in Figure 4.

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Segment 2: With good loving care
N:   yes (1.2) BUt have you got a hold of the GP? hh.
CA:  no i will do that now (.) I was just about to eh: right now but I have
     paused- or everything and stopped giving (0.5) all that other (.)
N:   =°yes°
CA:  =eh well there is- there is actually from from the on-call GP with good
     loving care and with (0.9) everything
N:   =yes I- I didn't get to do anything at all eh there Sunday afternoon I
     thought-
CA:  =no
N:   =it was most important that we [made a record >(that we could set up)<
CA:                                 [yes BUt I tried yesterda↑y to get hold of
     them and I couldn't get through to them but
N:   =I↑ have written to them but but it well- I forgot to make it a high
     priority
CA:  =YEah
N:   =so it so it cou- they have well- they have five days [(xx)   [(xx)
CA:                                                       [Yeah  [YEah↑ but I
     have simply just been in yesterday and then I have written paused (xx) in
     there and then stopped all the giving on the (.) normal medicine so there
     is only some PN and then eh: now i will just call them right now at this
     moment (0.5) and just ask °if they can pause it°
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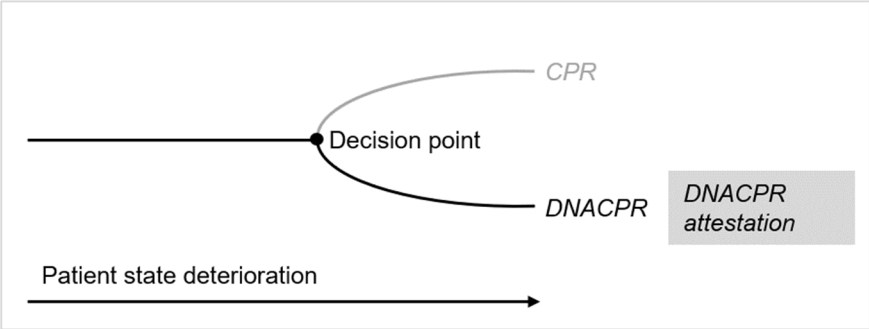


Figure 4. A redefined decision point. The "good and loving care" record is insufficient, and the task is thus redefined as the elicitation of proper DNACPR attestation.

From the beginning of the interaction, it is clear that their decision depends on the GP (Nina: "have you got hold of the GP?"), and it is clear that they have waited for the GP for two days (Nina: "I didn't get to do anything at all eh there Sunday afternoon"; Caroline: "I tried yesterday to get hold of them"). Crucially, they still need to get hold of a GP to formally issue the DNACPR attestation, and thus, the cognitive task is to rectify the error by eliciting a DNACPR attestation that disambiguates the decision terms.

Throughout the segment Nina and Caroline are fully focused on the computer, as their gazes shift from the screen towards each other. Thus, as Caroline responds to Nina's initial question, she immediately connects the GP's input to the state of the EMR. For instance, when Caroline says, "no I will do that now," she turns her head in the direction of the computer, on which the EMR runs (see Figure 5).

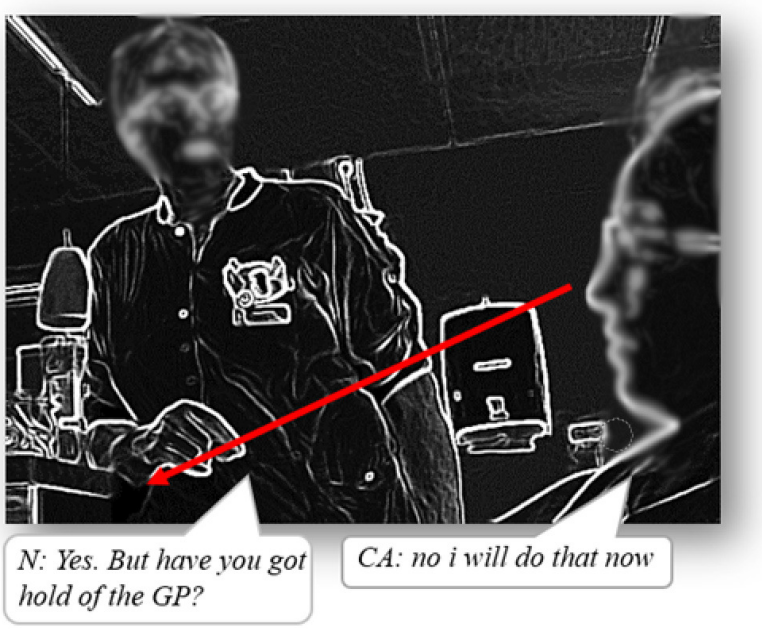
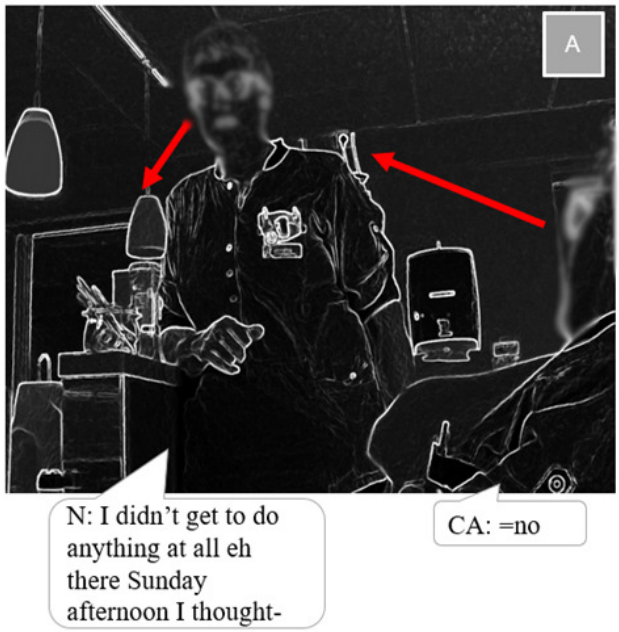
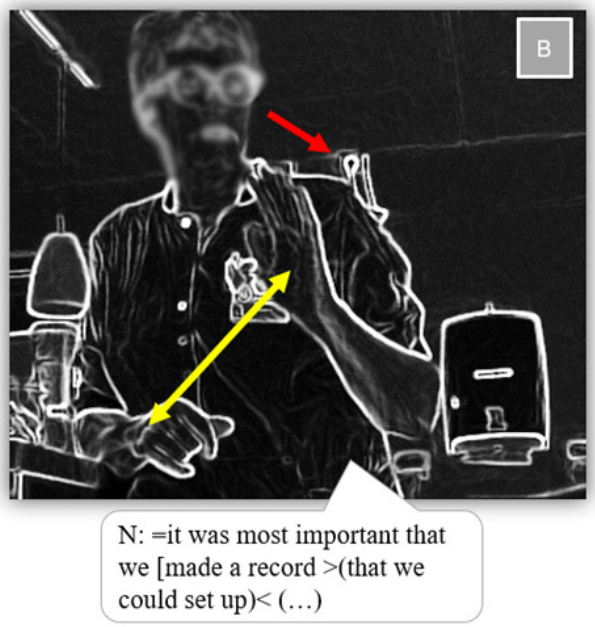


Figure 5: Constrained by the technology. Caroline sits down on and gazes toward the computer and the EMR on the screen while she replies to Nina, who leans toward a counter and fidgets while Caroline answers. The red arrow indicates the direction of Caroline's gaze toward the computer that is outside the frame.

In Figure 6 (below), we further see the operation of material constraints, as the computer attracts their attention In Picture A, Nina gazes at the computer, as she explains how she did not get to do anything that Sunday afternoon, referring to how she did not have time to complete any tasks in their digital system. Then she explains that "it was most important that we made a record", while making a quick sweeping gesture toward the computer and shifting her gaze toward Caroline (Picture B). In doing so, her explanation exemplifies how the digital system indeed constrains her work priorities (cf. the importance of making a record), and thus tangibly exemplifies the extent of how the digital system block the professionals in "getting to do anything", as in getting to complete other important tasks. Caroline then shares information about the actions she has performed in their system as she shifts her gaze from the computer to Nina. While her right hand moves quickly from spatiotemporally indexing "yesterday" (Picture C), she defuses tension by downplaying the circumstances via "simply" (Picture D) and "normal" (Picture E):





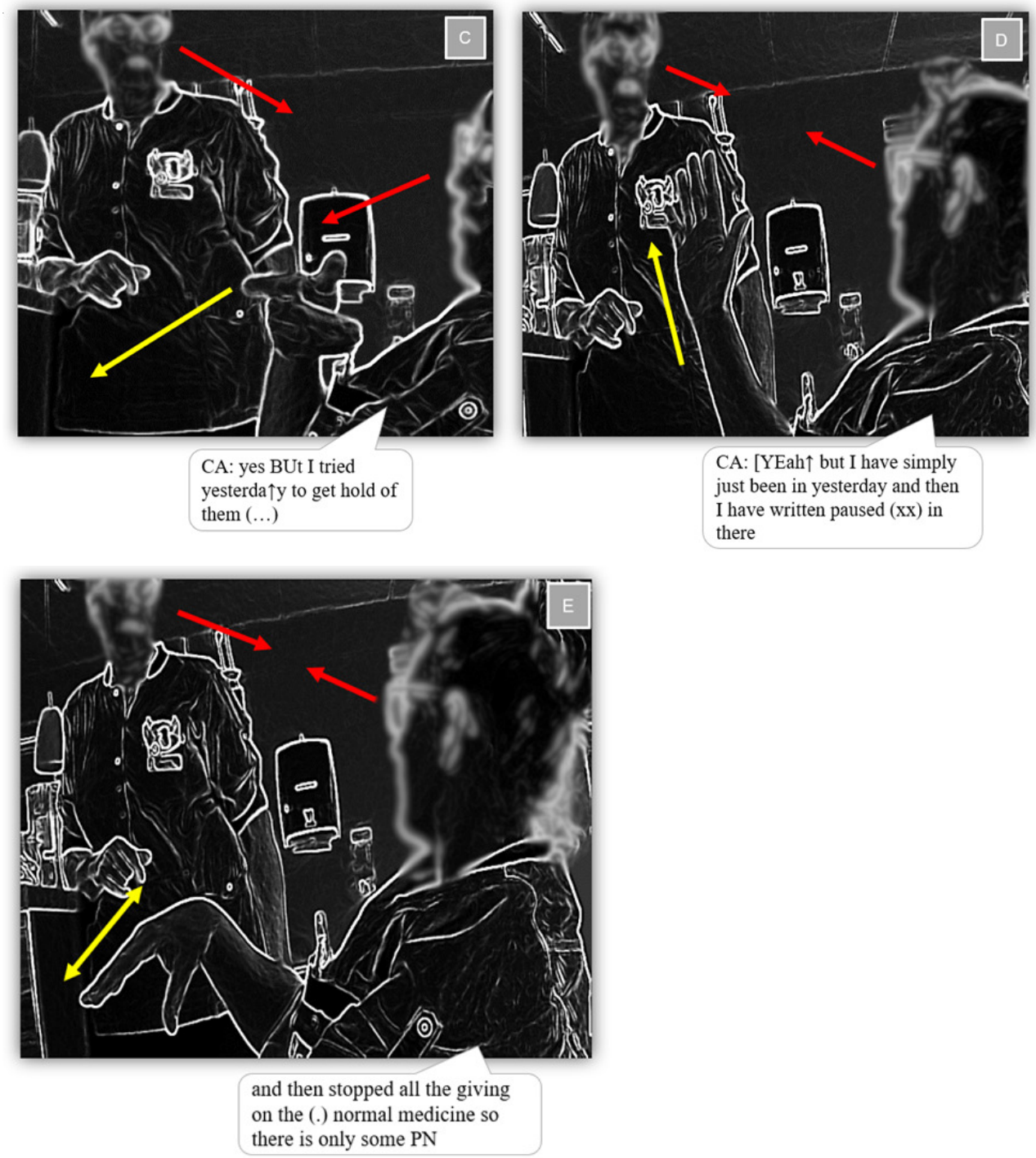


Figure 6: Constrained by the digital system. The computer is located outside of the diagram frame in the left corner. See the text for an explanation of the events. Red arrows indicate gaze direction and yellow arrows indicate the direction and movements of hands.

Figure 6 illustrates how previous actions done in the digital system constrain how they explain, understand, and negotiate what they have (not) done—and hence their decisions on what to do next. Accordingly, the digital system demands cognitive work pertaining to administrative aspects that are only relevant for the treatment of the patient because of associated procedures. As such, discussing previous actions and obstacles in the digital system, ultimately increases pressure on the

cognitive system due to the time-sensitive aspects of the situation (should the patient pass away while they talk).

A comparison between Segments 1 and 2 reveals the two dominant macroconstraints on their dilemmatic decision-making. In the former segment, focus falls on the patient and how to administer her medication if she passes away. Here, the dominant macroconstraint pertains to professional standards of palliative care, including their consideration of the patient-as-a-person with family and relatives[6], and their experiences. In the latter, the technobureaucratic macroconstraint takes control. The two macroconstraints conflict, as the decision about DNACPR (Segment 1) does not match the invalid record (Segment 2) for which reason their mesoscale decision-making is *overconstrained*. The overconstraint is palpable due to the critical state of the patient, and because Caroline has started to enact the GP's instructions (e.g., by pausing the medication), despite the fact that the DNACPR attestation is insufficient. The mere display of the written information in the digital system underlines that the engagement and presence of the technology is not neutral, but saturates the situation, as it seems that Caroline *perceives* the record 'good loving care' as valid. This is evident in the way she presents it to Nina, because she (1) presents it *as if* it is the on-call GP who has recorded it (though it is not), and (2) places dialogical emphasis on "actually" and "everything" in "there is <u>actually</u> from <u>from the on-call GP</u> with good loving care <u>and with (0.9) everything</u>", by which she signals that she deems the record as valid. The overlapping and interconnected digital systems, in conjunction with the ease with which the professionals obtain and copy-paste information and documentation, may blur the professionals' sensitivity to legally important questions of authorship and source: who actually produced the record, and where is it stored?

At this stage, they have already attempted to rectify the problem by performing tasks in the digital system, but on two occasions their attempts have failed because of technobureaucratic circumstances. First, Caroline tried to call the GP, but she got caught up in a telephone queue.[7] Second, Nina has written to the GP, but she "forgot to make it a high priority". This error is crucial, as messages in the digital system take two forms: a GP has five working days to respond to ordinary messages, whereas a "high priority message" must be returned on the same day. A checkbox in the digital layout distinguishes between the two. Thus, while the distributed cognitive system comprises the nursing home staff, the GPs, and their digital system, as well as the physical layout of the room (e.g., the location of the computer) and the social situation (e.g., hierarchies, power relations, reporting lines etc.), the functionality of the entire cognitive system is limited by technological design features vulnerable to agent oversights.

This brings us the crux of the problem: the overconstraint is *asymmetric*. The techno-bureaucratic macroconstraint tends to take precedence over the other(s), insensitizing the mesoscale agents to other relevant macroscale constraints than the dominant one. While the technology might in principle support efficient access to medical information and mediated interaction, in this case it

[6] In a segment that is not included here, Caroline meticulously accounts for how the patient's relatives have visited her, referring to them by relation ("her daughter has been here until half past four"), by name ("I'm counting on that that Doreen and them will come"), or by location ("those from Copenhagen were here yesterday").

[7] In line with Ball and Ormerod's (2000) insight that "artefacts are implicit psychological hypotheses," we will add that technological systems are also ethical hypotheses. In this case, the call queue is the (virtual) incarnation of the medico-ethical principle of justice: one gets to talk to the GP in turn, depending solely on the sequence of the incoming calls.

diverts the professionals' attention away from the work environment and the real living-and-dying patient in the nursing home. They instead fixate on the intermediate task requirements of the *digital system* and its administrative demands, sidestepping the real problem at hand, namely the ethical problem of attempting CPR against the patient's will.

2.3. Mesoscale adaptivity asymmetries

In the previous section, we established how the cognitive system has reached a tense decision point because of the technology-induced overconstraint. Figure 4 shows what it takes to resolve the conflict (a DNACPR attestation) but given the limitations in the digital communication systems, the cognitive system cannot elicit the attestation right away. This raises the question; how does a cognitive system react when facing a task that is insoluble?

Let us begin with a theoretical digression. In classical mentalist accounts of cognition, a given input is taken to prompt the organism to come up with (and execute) a behavioral plan for pursuing some goal, for instance to cancel out a difference between a current state and a goal state. A radical embodied point of view instead treats the distinct and distributed parts of the system, such as an organism and its environment, as dynamically coupled, with their states "continuously codetermining" (Anderson, 2014, p. 195). Any change in the environment prompts the organism to adapt to uphold a given homeostasis. Anderson (2014, p. 183) quotes Paul Cisek's insight that "Fluctuations in the measured value of the variable outside some 'desired range' initiate mechanisms whose purpose is to bring the variable back into the desired range" (Cisek, 1999). This adaptation might be physiological (if we're warm, we sweat) or behavioral (if we're warm, we move outdoor or indoor, depending on the climate). Anderson continues:

> the fundamental *cognitive* problem facing an organism—deciding what to do next—might best be understood not as choosing the right response in light of a given stimulus but as choosing the right stimulus in light of a given goal. Here knowledge of sensorimotor contingencies (Noë 2004)—how perceptions change with action—and the perception of affordances work hand in hand to allow an organism to follow environmental affordances to the right sensations. (Anderson, 2014, pp. 182-183)

Such a view also applies to hybrid or amalgamated cognitive systems, though they are not evolutionarily predisposed to uphold a given state of homeostasis. For instance, in Hutchins's (1995b) analysis of a McDonnell Douglas MD-80 cockpit during the landing of the plane, keeping the plane's integrity is a central goal. To pursue that goal, there is a central "desired range" for the plane's speed/wing configuration. Thus, keeping the plane airborne requires that the wing configuration changes as the plane decelerates. Hence, the speed/wing configuration is a Cisekian variable that must be kept within a desired range.

If we apply this perspective to the cognitive system approaching the decision point in Figure 4, we can conceptualize *decision stability* as a 'desired range': the system has a preference for a stable state with no impending decisions. Decision stability is achieved when there is no need for decisions, when such decisions are already made, or when one decision term incontrovertibly outweighs the alternatives. In contrast, decision instability emerges when the system must decide

between uncertain decision terms under time pressure. When the system experiences decision instability, it requires what Cisek called "mechanisms whose purpose is to bring the variable back into the desired range" to kick in. In Figure 4, such mechanisms will take the cognitive system away from the decision point to a more stable zone.

Optimally, the movement would take the shape as a decision where the system ends up in one of the two branches of the bifurcation: CPR or DNACPR. However, as we have seen, such a movement is unfeasible due to the missing DNACPR attestation. So, what mechanism can then bring the system out of its decision instability? We will argue that the cognitive system resolves the decision instability by reinterpreting the patient's state. By coming to see the patient as doing better, they reduce the order parameter (i.e., they make a leftward movement in figure 4) so that they reduce the imminent need for deciding between CPR and DNACPR.

Such a reinterpretation of the patient is sculpted by the asymmetries of the cognitive system in question, comprising both human components (the health professionals) and technological components (the EMR and the digital communication systems). The technological components are fundamentally brittle, serial systems that function only on complete and unambiguous input, without which the process can only crash: the digital components rule out imperfect but adaptive responses to situations where the designated input is absent. While the digital record plays an essential role in the formal decision-making protocol, it is a merciless memory system that leaves no leeway for flexible behavior or for adjusting attitudes in new or complex contexts. In contrast, biological memory systems tend to be adaptive, in that they have some built-in redundancy to ground resilient responses to partial or missing input, unless they are entirely subsumed into a larger brittle computational system. The tension created by this asymmetry of resources drives the human actors temporarily away from the computer and to seek a way of provisionally bypassing its brittle protocols.

In what follows we analyze how the two health professionals in Segment 3 adapt their biological memory-based narrative of the patient in order to resolve the decision instability. We resume our analysis as Caroline accounts for the events on the previous day. Caroline narrates that the patient's daughter, Doreen, had asked the staff to postpone the analgesic medication so that the patient would be awake when her relatives arrived. They had agreed to this proposal, as long as the patient is not suffering. In Segment 3, Caroline renders what she had said to Liz, another care assistant at the nursing home ('she'/'her' refers to the patient; Therese is a third care assistant).

Segment 3: She doesn't respond to anything

```
CA:  […] as I said to Liz then i would prefer that she gets something now than
     Doreen comes and then she's- well you know because yesterday she couldn't
     cope with it at all when we touched her too much- °that was [like that°
N:                                                              [WEll Therese has
     just been in and stroke her on the cheek
CA:  =YEah
N:   =and all such things and she doesn't respond at all
CA:  =no.
N:   [she
CA:  [BUt neither did she do very much
N:   =she doesn't respond to anything that I that I gave her something in:
```

Nina and Caroline draw two different pictures of the patient: Caroline highlights the patient's increased sensitivity to stimulation, and Nina accentuates a state of unresponsive near-unconsciousness, which is in line with Nina's initial judgment of the patient in Segment 1 ("she has just had an apnoea (period)- right when I came"). Their *collective* representation of the patient thus exhibits *multistability* (Kelso, 1995), that is, it has more than one stable state, and "the shifts from one state to another is [sic] caused by slight changes in the system state, because multistable systems are extremely sensitive to perturbations" (Sune Vork Steffensen, 2012, p. 525). The central observation is that the two states generate a continuum of how one can relate to one's surroundings: from unresponsive to hypersensitive.

Multistability entails a bifurcation dynamic, which means that the system can adopt different coordination patterns in relation to other systems, and as Kelso and Engstrøm (2006, p. 166) remark, "the ability to bifurcate provides living things with an essential means of flexibility." Thus, the lack of flexibility inherent in the technological system, is compensated by increased flexibility in the human components' collective recollection of the patient. In other words, we observe how the health practitioners reinterpret the patient's state (i.e., the order parameter in Figure 4) through these flexible recollective narratives of the patient. To corroborate this analysis, we should expect that the metastability in Segment 3 metamorphosizes into a stable state, namely a state where the cognitive system is not required to make a decision here-and-now, and thus allowing for decision stability. Indeed, that is what we observe in Segment 4 as the two practitioners reinterpret the patient's state.

Segment 4: Who is stinging me

```
CA:  […] I would say that yesterday morning when we just changed her shirt and
     rubbed some lotion and by then she laid and said NOw it is enough. NOw it
     is enough. NOw it is enough. NOw it is enough. ((CA imitates the patient))
N:   =y: but Sundays when I gave her some before I went home
CA:  =YEah
N:   h. hh. and then I had forgotten to (xxx) to take tha:t
CA:  =YEah
N:   =transparent eh: film dressing so I could have made such an injection- then
     I had to prick her in the thigh so h. I lifted a chunk and then I pricked
     her and then she says WH↑O is that stinging me WH↑O is that stinging me ((N
     imitates patients)) ((laughs)) hh. I had just written in One Plan that h.
     she- she was unresponsive h:
CA:  =↑Yes yes everything in moderation
N:   =[if you wan-
CA:   [YEs yes but I must s:say yesterday morning there she says that she would
     like to have coffee with creme (.) can I get coffee with creme↑((CA
     imitates the patient)) in the end we had to take a (°plunger°) and then she
     got- but she took her time swallowing it
N:   =YEah
CA:  and then she says- then Doreen says (.) Yes can i °hav°((CA imitates the
     daughter)) and then yes yes I say- you just have to make sure that she can
     swallow it because so she doesn't choke on it right (.) .h then when they
     came from Copenhagen↑ well then she was up- up and sit up and then she
     drank half a cup of coffee with creme h. and you (xx) OKay↑ [then-
N:           [it could be that right that morning it was the °blossoming°
```

```
CA:  =well then she was also just- just gone afterwards right
N:   =yeah
```

We observe how the two professionals' re-enactment of the patient's actions brings forth new meaning (Figure 7, below), as their coordinated dialogical and bodily behavior displays a patient actor capable of modifying her own organism-environment relations, that is, the patient is seen as "*a system doing something by itself according to certain goals or norms within a specific environment*" (Barandiaran, Di Paolo, & Rohde, 2009, p. 369), which indeed is the enactivist definition of a system with agency. In the narrative in Segment 4, the patient's agency comes to the fore in (1) her ability to protest against the care staff's rubbing her with lotion, (2) her ability to register, and object to, being syringed, (3) her ability to request a cup of coffee, and (4) her ability to ingest the coffee (sitting up and holding the cup herself):

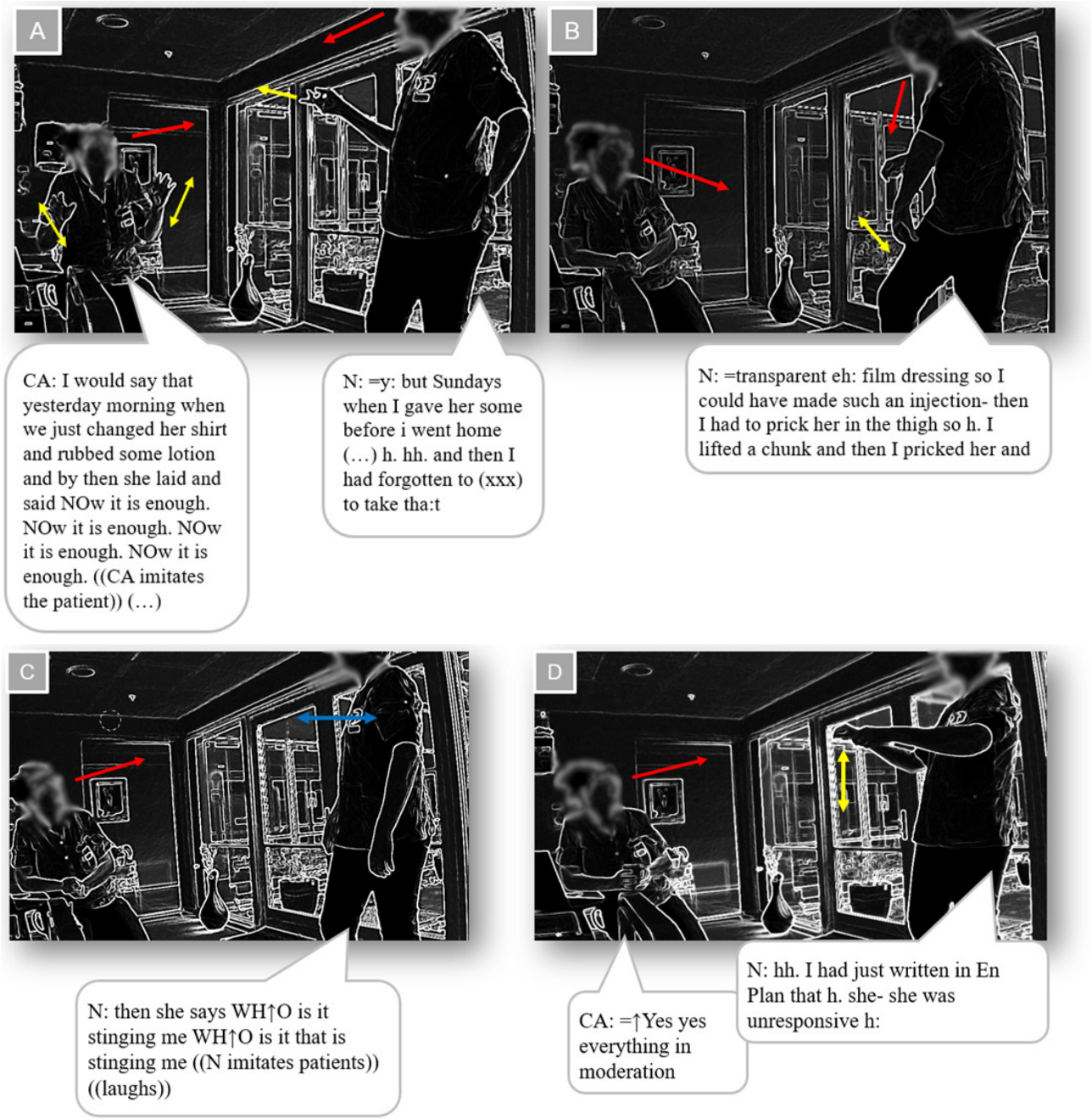


Figure 7: Re-enacting the patient: The figure illustrates how Caroline vividly moves her arms and fingers up and down (Picture A) as she imitates the patient uttering "now it is enough." Nina imitates and shows Caroline how and where on her body she syringed the patient in the thigh (Picture B), then Nina imitates the patient, as she moves her torso and head from side to side while clear and loudly changing her intonation (Picture C). Finally, Nina makes fun of herself as she with vivid gestures directed to an imaginary air computer imitates how she has hit the keyboard as she has previously documented how unresponsive the patient has been (Picture D). Red arrows indicate direction of gaze, yellow arrows indicate direction and movement of gestures, and blue arrows indicate bodily movements.

The central observation here is that Nina and Caroline abandon their initial narrative positions (the hypersensitive and the near-unconscious patient, respectively) and converge on a joint understanding of the patient as a person with full agency. In so doing, they downplay the *urgent*

need for a DNACPR attestation, and hence invoke a relaxation of the decision instability created by the systemic errors. Invoking a relaxation of the decision instability is a way to avoid discussing the real problem at hand: attempting CPR against the patient's will or violating the law. Figure 7 furthermore illustrates that the two have moved physically across the room, away from the computer, and hence away from the constraints of the digital technologies. They orient their bodies more directly toward each other, and their gesturing changes from indexical functions (Segment 2, Figure 5) to richer iconic-narrative functions (Segment 4, Figure 7). As they move away from the macrostructural constraints materialized by the computer, they bring forth a physical change in their settings that shapes a different layout of affordances, which arguably supports the pursuit of decision stability. Dialogically and bodily they disengage from the invalid DNACPR attestation, and attune to their memories of the living patient and their previous actions performed in the digital system. Thus, by selectively reinterpreting past events, which changes their assessment of their current situation, the embodied cognitive dynamics allow them to reach decision stability.

Importantly, by claiming that the cognitive system *resolves* the decision instability by reconfiguring their memory of the patient's state, we do not claim that the two health professionals are delusional or that they suppress their understanding about the patient's terminal state. After all, both Nina and Caroline end Segment 4 with two utterances that connect their evocation of the agential patient to their understanding of dealing with a terminal patient. Caroline links it to a subsequent stage of deep sleep, and Nina interprets the agential pattern as a "blossoming". Our ethnographic data do not show whether they often experience such a "blossoming," or if it is an idiosyncratic description of the patient. Either way, the effect is that they reach a modus operandi that allows them to *contain* the uncertainty caused by the missing DNACPR attestation in the digital system.

2.4. Microscale ethical asymmetries

We have demonstrated how the technological system, while being designed for the registration of medical records and efficient interprofessional communication, has social and cognitive repercussions beyond its intended domains. Though the collateral effects of technobureaucratic systems are well-established in the literature that echoes, for example, Max Weber and his view on formal rationality (e.g., Böhme, 2012),[8] our study adds to this literature by empirically investigating how practitioners deal with technology-induced problems that are ethically difficult. In this last part of the analysis, we therefore elaborate on the ethical aspects of the case. Our starting point is the key premise in Distributed Cognition that a cognitive system is "a functional system […] involved in the performance of some invariant task" (Hutchins, 1995b, p. 281). Thus, for a system to work, it requires that all parts of the system are aligned with the overall task. But what does it take for the system *not* to work? And how is the responsibility for dysfunctionalities in cognitive task performance distributed in the system? After all, as Pedersen comments, "while artefacts help us

[8] Böhme (2012) offers a critical view on the inherent ethical constrains technology might induce when technology norms rule following over the prioritisation of human values. For example, and related to our case, when technical preconditions (such as procedures for record keeping) blur the professionals' abilities to make straightforward medico-moral actions, such as deciding on DNACPR in alignment with a patient's wish. In such cases, technobureaucratic rules norm a behavior non-conducive for patient treatment.

solve problems in some cases, they constrain problem solving in others. A distributed cognitive system can be constituted in a way that makes cognition dysfunctional" (Pedersen, 2012).

Obviously, as we have seen in the previous sections, a cognitive system is extremely sensitive to slight deviations in its brittle components: a missing tick that marks "high priority" in the digital communication system is all that is required for the entire system to run into problems (cf. Nina's utterance in Segment 2: "I forgot to make it a high priority"). These technological components are not ethical agents with a sense of responsibility. Thus, while cognition can be distributed, the *feeling* of an ethical prerogative to act when facing a difficult situation cannot. This is what we refer to as a microscale ethical asymmetry: only the embodied human agents can react to situational demands with an urge to act.

Nina and Caroline, as we have seen, are *blocked* from acting on the problem of the missing DNACPR, but nonetheless they can act, and they *do* act—by displacing the decision in Segment 2b and 4b:

```
Segment 2b: Some more painkillers
N:   =yeah eh:: also can't you ask for some more eh:: painkillers
CA:  =sure
N:   =eh: some more morphine
CA:  =sure
N:   =because the:re is for (.) maybe three-four four injections still I think
     or something like that
CA:  =yes↑
N:   =but we can just leave it over at the pharmacy so far
CA:  =yes↑ (1.0)
N:   eh:: it's just
CA:  =sure
N:   =It's just if it if it all of the sudden there is a need to give-
CA:  =YEah
N:   eh: to give a lot right
CA:  (xx) yes
N:   =Then it is stupid if we don't have[(xx)

Segment 4b: You don't even have to pick it up
N:   so (.) yes yes but you can just call if there is anything
CA:  yeah but I will call and then I will say that about the morphine↓ (0.9)
N:   yes
CA:  yes
N:   =it is just to- so it can be at the pharmacy you don't even have to pick it
     up
CA:  no but I will also just say that they should pick it up
N:   [(xx)
```

From a systemic perspective, procuring a sufficient supply of analgesic is evidently an important task. However, the timing of the two segments is remarkable: Segment 2b follows right after that Nina and Caroline have established that their central problem is the missing DNACPR attestation. On that backdrop, the detailed explanation of how and why to procure the analgesic is not a meaningful reaction to the problem, but rather a sort of displacement: All the attention and energy

that the two cannot invest in solving the (for them) unsolvable problem of the missing DNACPR attestation, is displaced onto the trivial task of procuring painkillers. Similarly, segment 4b follows the sequence where they have modified their patient representation to resolve the decision instability. At this stage, the DNACPR problem has been circumvented, which prompt them to engage with a typical medical problem: analgesic medication.

Kirsh once observed that not all shortcomings in designed systems surface as cognitive problems because of "the creativity which well motivated participants show in compensating for bad design" (Kirsh, 2006, p. 259). We will add that even when no degree of creativity can solve problems caused by suprapersonal systems dynamics, human ingenuity also allows for defense mechanisms (*Abwehrmechanismen*) in Freud's sense. They allow human agents to *emotionally* contain irresolvable problems by replacing them with more approachable ones. A strict functional analysis would render such problem circumventions as dysfunctional, but since living human beings are bound to engage with the world continually and unceasingly, coming to a halt is no option. Accordingly, the emotional containing strategy of the sort observed here might be a meaningful option when human agents face what Sune Vork Steffensen and Vallée-Tourangeau (2018) call a "suspended next" that is, an impasse where no action is conducive, yet abstaining from acting is impossible. The human agents act because acting is an ethical imperative, and because they are the only parts of the cognitive system that can feel this imperative. This asymmetry in the materiality of the embodied agents and the technical systems is thus a central aspect of how organizational cognition works. It is for this reason that we suggest that we must broaden our understanding of the microscale to include non-human components as well.

3. Concluding remarks

This chapter has contributed to the field of organizational cognition with an empirical investigation of how conflicting macroscale constraints shape cognitive processes in hybrid cognitive systems, and how the resolution of overconstraints depends on the embodied interactions in which the asymmetries are enacted. We have used cognitive ethnography and CEA to explore organizational life and cognition in an everyday sociotechnical workplace, which aided our goal of making conflictual macro-, meso-, microscalar constraints tangible. We have broadened the understanding of how organizational life is shaped by digital technologies beyond instrumental analyses. On an empirical level, our study both challenges and offers new support to organizational-political decision-making when implementing and evaluating digital technologies. In turn, that may lead to educational improvements for medical practice in order to cultivate awareness of how digital technologies are intertwined with social and cognitive dynamics across different professions. Though the manifestation of these socio-cognitive dynamics in dialogical decision-making may be left unspoken by professionals in their day-to-day practice, they still condition organizational life. It is thus important to have an eye for the emergence and enaction of tensions and inherent ambiguities induced by macroconstraints and adaptive asymmetries, as they potentially induce conflicts and unsolvable dilemmas, as seen in the case.

Based on the troublesome and conflictual dimensions pertaining to the organization of hybrid cognitive systems, we therefore call for a critical turn in the cognitive sciences, when studying organizational cognition, behavior, and cognitive ecosystems. While cognitive scientists may downplay conflict and trouble by focusing on smooth coping and the flexible nature of cognitive

systems, we argue that we need to develop a deeper understanding of technology-induced tensions and dilemmas. As socio-material approaches also are sympathetic towards recognizing the organizational complexity (Beverungen et al., 2019; Leonardi & Barley, 2008; Orlikowski & Scott, 2008), we add to these studies with our ethnographic and critical cognitive emphasis. Overall, we encourage the scientific communities preoccupied with organizational cognition, socio-material practices, and healthcare communication (as well as policy-makers and educators in medical practice) to carefully regard the manifestations of conflicting constraints in everyday organizational life, as the conflictual nature may be different from what we expect.

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