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The Complication of Presence in Telemedical Collaboration: Intersituativity and Its Organizational Consequences

(published as: Nils Ellebrecht, Andrea zur Nieden (2020): The Complication of Presence in Telemedical Collaboration: Intersituativity and Its Organizational Consequences, in: European Journal for Security Research 5 (Special Issue: Digitalisation and its security manifestations), p. 83–103, DOI: https://doi.org/10.1007/s41125-019-00060-x)

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Keywords

teleinteraction, organization, responsibility, sociology, telemedicine, emergency medical system, formality

Abstract

New information and communication technologies (ICT) change social relations. The article introduces a concept by Stefan Hirschauer grasping this change as a complication of presence. For Emergency Medical Services full presence of all participants is usually considered essential, however, telemedicine, telehealth physicians, and telecooperation are also gaining ground here. The study describes the foundation and challenges of telemedical situations and analyses how they are managed by physicians, paramedics, and patients being only gradually present for each other. On the organizational level formal guidelines become more important, and responsibilities shift toward the rescue workers on-site.

Introduction

"Have a doctor at the scene, right away!" This advertising slogan can be found with an accompanying image (figure 1) on the website telenotarzt.de, an emergency medical services (EMS) telemedicine provider. The image shows a female physician wearing a headset, sitting at a desk with three screens

Figure 1: "Have a doctor at the scene, right away!"

in front of her. The doctor in this picture is obviously not “at the scene” with the patient, and she does not appear to be in any kind of hurry to get there “right away” either. Our first impression is that the situation shown in the image is different from the one that is described and claimed in the text. This disconnect between image and text is intentional, of course. The combination of what we see and what we read results in a certain interpretation: The physician may be sitting at her desk, far away from the patient, but she is speaking on the phone with the patient, or a person helping the patient. This allows her to be *with* the patient much more quickly than any other physician could be. But is she really at the scene, as the slogan claims? And if yes, how is she there and what are her chances of having an impact? What does her partial presence mean for the EMS team at the scene? What problems, changes, and adjustments result from this?

In the following, we will address these questions from the point of view of the sociology of media and organization. Our investigation will begin with a brief introduction to the field of emergency medicine and telemedicine (I). Using the published results from a telemedical project that was evaluated by its developers during its development phase, we will first analyze the obvious difficulties associated with the use of telemedicine (II). In the next section (III), we will propose an approach based on media sociology that we will then develop further as a way to focus on the fundamental challenges of telecollaboration from a sociological perspective. This approach is based on the idea that presence can be increased gradually – meaning a complication of the presence of the collaborating parties in teleinteractions can be observed, and that the parties involved in

telemedical emergency services must develop strategies and modes of action for dealing with this. We will discuss the foundations of the telemedical situation in four steps and look at how these relate to presence. In the last section (IV), we will shift our perspective toward the organizational changes resulting from the use of emergency physicians practicing telemedicine. These primarily concern formal guidelines, hierarchies, and the delegation of responsibility. We will compare classic emergency situations (an emergency physician and paramedics are both at the scene) with the telemedical variety and demonstrate how the service providing EMS telemedicine follows formal guidelines more closely and that there is a clear shift in action and responsibility toward the non-physicians on-site.

I. Emergency Medicine and Telemedicine

Medical communication and actions operate along the distinction between healthy vs. sick and are based on diagnostic and therapeutic programs (Gibson and Boiko 2012; Luhmann 1990). The emergency medical context is especially defined by the fact that a diagnosis of illness or injury is not conclusive. Instead, it must remain intentionally vague and has the status of a working diagnosis. Treatment does not focus on making the patient healthy again at this point, but on stabilizing him or her. Emergency care is thus more about keeping patients within the medical system, and less about discharging patients who are deemed healthy. It can be said that emergency medical services focus on stabilizing patients for transport, meaning they have fulfilled their medical goal when a patient can be transported to a hospital for further treatment.

Telemedicine is medicine that operates across geographical distances. These days, traditional work relations have become more geographically spread out as a result of the incorporation and implementation of information and communication technologies (ICT) (Bruni et al. 2007; Gherardi 2010: 503). From a sociological perspective, we must distinguish between those teleinteractions in which medical experts communicate with each other and those in which experts interact with patients through telemedia, or audio-visual media. The first form is primarily dominant in emergency medical services and other first response care contexts. As early as the beginning of the 1980s, many EMS teams in the US were already able to contact an emergency physician in the emergency room (ER) via radio, who assisted and supported them (Mannon 1992: 9). In recent years, the repertoire of telemedical services has expanded to include additional technologies that now allow paramedics and emergency medical technicians (EMTs) to transfer the patient's medical data (vital signs, EKGs) to experts at the hospital or to involve these experts through audio-visual media and present certain symptoms displayed by the patient to them. A typical medical case illustrating this approach is an EMS response to an emergency call from a patient experiencing a stroke (Gonzales Armengol et al. 2009). The consulted experts analyze the information and propose a diagnosis and treatment, so that

the paramedics at the scene can implement the correct measures and save time until an emergency physician arrives. The experts involved can also inform the hospital where the patient will be brought about his or her condition, so that necessary preparations can be made.

The second form of telemedical interaction is much rarer in the emergency medical context, despite the fact that emergency phone numbers (112 in Europe, 911 in the US) are also used by people in need of medical assistance and can therefore be regarded as a form of telemedical consultation when medical advice is given. Many people who are experiencing a medical emergency are not able to dial the emergency number or contact a physician practicing telemedicine themselves, especially if they are severely injured or unconscious. In these cases, it is a family member, friend, or a first responder who does not know the patient who receives emergency medial instructions to initiate important first response care (basic life support (BSL) and cardiopulmonary resuscitation (CPR)) (Bång et al. 2003). The only emergency medical services project that uses telemedical technologies to directly connect people in a medical emergency with physicians that we know of, named ETHAN, explicitly excludes severe cases and is only accessible to people for whom it is questionable if they even need EMS in the first place. Although these people are tended to by an emergency medical services team, whether they will be taken to the emergency department (ED) in an ambulance is decided by the consulted tele physician in consultation with the patient. The goal of this project, located in Houston, Texas, is “to reduce the number of potentially unnecessary ambulance transports and ED visits” (Langabeer et al. 2016). The conversation between the emergency physician and patient takes place via video conferencing on a tablet used by the EMS team.

The high expectations for telemedicine are based on its promises of better patient care and reduced costs. However, whether this potential can actually be reached has been doubted by experts since the beginning (Whitten 2002) and has not been conclusively established for many areas of application to this day (see Clarke et al. 2018; Henderson 2018). The use of telemedicine in emergency medical services in rural areas is regarded as one of the most promising fields of application today. This is because it is believed that, by increasing the involvement of the scarce resource of emergency physicians through technology, it will guarantee their widespread availability, which is a goal in Germany that would otherwise not be possible in all locations and cannot be guaranteed for the future. Furthermore, the first economic studies in this context have also proven that telemedicine indeed leads to a reduction in costs (Natafgi et al. 2018).

The double promise of improved patient care and cost effectiveness is one of the main reasons why German health insurance providers are financing telemedical projects. The telemedical option thus not only makes it possible to bridge gaps in patient care; it also questions existing structures by offering a more cost effective replacement. However, its potential to amend the existing lack of

emergency physicians and replace the existing emergency medicine structures means it is also viewed critically by emergency physicians.

II. Empirical Case Study: The Development and Employment of Emergency Medical Services Telemedicine

In the following analysis, we will discuss teleinteractions from a general sociological perspective. We will base our discussion on our empirical fieldwork with an EMS telemedicine provider in Aachen, Germany.[1] This EMS telemedicine service has been operating since 2014 and was born out of a series of research studies that date back as far as 2007. The project was evaluated several times during its development and implementation phase. Before we discuss our own survey, we will briefly address the results of these previous evaluations.

In the first phase of development of the telemedical project, the emergency doctors practicing telemedicine supported fellow emergency physicians who were at the scene with the patient, and not the paramedics (Skorning et al. 2009; Bergrath et al. 2011). In the second phase, a system for EMS telemedicine was designed that focused primarily on the paramedics at the scene being able to contact an emergency physician practicing telemedicine.

The core of the system is an audio connection between the paramedics on-site and an emergency physician in the EMS control center (located in the city's fire department). Paramedics can send the emergency physician in the control center information and other data. The patient's vital signs can be transmitted via telemetry, along with any photographs taken by smartphone of the scene, the patient, prescribed medications, medical reports, and so forth. The emergency physician practicing telemedicine can also monitor treatment inside the ambulance through a camera attached to the ceiling. Paramedics can contact an emergency physician practicing telemedicine in cases when they want to administer highly potent pain medication, which they are not allowed to do without a physician's order. A second typical case for consulting an emergency physician practicing telemedicine is when the paramedics suspect that the patient has suffered a stroke. A third case

[1] We conducted several short ethnographies, group discussions, and interviews at this EMS telemedicine provider from 2015 to 2017. This sociological research was funded by the BMBF (German Federal Ministry of Education and Research) and was a part of the interdisciplinary joint project AUDIME. The goal of this project was to provide paramedics, who were administering acute care to people in a medical emergency onsite or in an ambulance, with smart glasses in order to improve their ability to support emergency physicians practicing telemedicine. We observed the interaction enhanced by smart glasses between the emergency physicians and the paramedics during three emergency exercises, recording these on video and conducting interviews afterward. Specific aspects of the smart glasses that are not addressed in this article have been discussed in other publications, also in relation to, among other things, "cyborgization." See zur Nieden (2017) and zur Nieden and Ellebrecht (2017).

would be when an emergency physician is needed but has not yet arrived, and the emergency physician practicing telemedicine fills in until the doctor has reached the scene.

During the first phase of development, the developers already identified “challenges and problems” (Laryionava et al. 2011: 31) that were not only of a technical nature. The initially employed “physicians reported the considerable impact of the telematic support system on communication within onsite rescue teams and with patients. Communication with invisible colleagues reduced both types of interactions, thus creating onsite communication and information gaps” (ibid.: 29). This change in communication was also addressed in a survey of paramedics, which was conducted later. More than half of those surveyed complained that this was “unnecessarily complicating the working method” (54.2 %), while 55 % of the participants thought there was a risk of communication breaking down within the team, and 71.1 % thought the risk of communicative disturbances was especially high for the patient (Schneiders et al. 2012). For this reason, they argued in favor of a change in the “communication culture” early on (Laryionava et al. 2011: 31).

A second major problem was the delegation of responsibility among those involved.The issue of responsibility arose already during the first phase of development because the emergency physician practicing telemedicine in the control center and the emergency physician at the scene were placed on the same level of hierarchy (ibid.). Emergency physicians “reported some limitation in their subjective freedom of action, a disturbing feeling of being observed and controlled through the ‘tele-presence’ of a colleague” (ibid: 30). Furthermore, according to the paramedics surveyed, because they are subordinates in the hierarchy, they believed there could be a “reduction in willingness to take over responsibility” (54.2%). Also, 28.8 % went as far as to say that incorporating an emergency physician practicing telemedicine would mean a “loss of their freedom of choice” (Schneiders et al. 2012).

The project leaders responded to these difficulties with implementation management. This was intended to guarantee the harmonious and efficient integration of media technology into daily work structures (Schneiders et al. 2014a; Schneiders et al. 2014b). However, the project concluded with a matter-of-fact statement that was somewhat surprising in light of the obvious concerns during the development phase: “In addition, no communication problems between the EMS team and the tele-EMS physician or other interpersonal negative effects were reported during the telephone based debriefings” (Bergrath et al. 2013: 5).

Did all of those problems mentioned simply dissolve into thin air? While during fieldwork from 2015 to 2017, we decided to take a closer look. In the following, our goal is not so much to present the problems and discuss how to improve practice, or even to find solutions – this was already achieved

in the development phase of the project and has been openly documented. Rather, we are more interested in exploring this telemedical constellation as a typical example of collaboration across media. We therefore focus on the question of how work relations change through the implementation of telemedia, or audio-visual media. What effects can be determined when the integration of ICT changes forms of work formerly based on physical co-presence into new structures of presence?

In order to answer this question, we will begin by outlining the general features of teleinteractions based on empirical findings (III). We refer to Stefan Hirschauer (2015), who proposed that spatial distance between partners of an interaction complicates their *presence*. Using four different aspects as examples, we will demonstrate why and how presence becomes problematic in telemedical situations and the possible consequences thereof. In the second step, we will address organizational changes (IV). The need for a new "communication culture" mentioned by those involved in the evaluation phase – in other words, the need to avoid the risk of communicative disturbances – indicates that the incorporation of a new medium leads to new forms of interaction, the norms of which may be unstable at first. Increased formalization and the redistribution of responsibilities could be regarded as solutions to these problems.

III. Telemedical Situations

In classical sociological approaches, social situations are understood as face-to-face situations in which physical co-presence and visual contact play a central role (Psathas and Waksler 1973). Alfred Schütz argues that ego and alter ego are able to grasp intended meanings through their mutual observation of each other. This occurs when they are bodily present in a "maximum of vivid symptoms" that also includes unconscious non-verbal forms of expression (Schütz 1972: 234; see also: 1976: 178). For Schütz as for Erving Goffman, mutual eye contact makes it possible for people to connect to each other and form a relationship, thereby producing intersubjectivity (ibid: 36) – in other words, focused interaction (Goffman 1961: 7-14; 1983: 3). Goffman defines social situations as "environments in which two or more individuals are physically in one another's response presence. (Presumably the telephone and the mails provide reduced versions of the primordial real thing.)" (ibid: 2). Thus, while he assumes a primordial bodily co-presence, he also allows for a gradual gradation of presence via media.

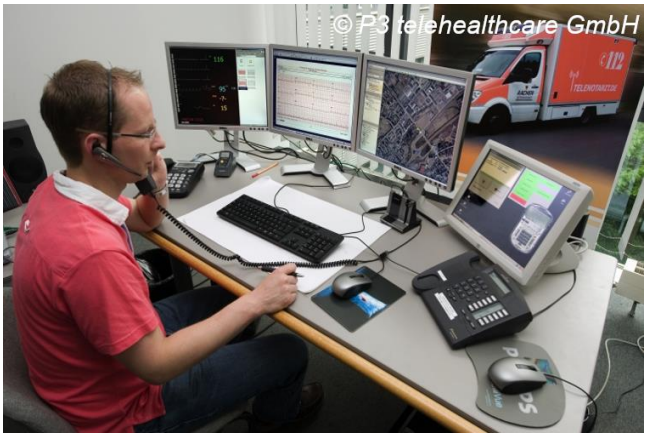
Co-presence is also a central factor for Niklas Luhmann, who defines systems of interaction as simple – in other words, as less complex – social systems (Luhmann 1972). However, Luhmann believes presence is not necessarily bound to the body, but is rather created by the interaction's participants, who establish variable systemic boundaries (who belongs and who doesn't) by *treating each other as*

if the other were present (Luhmann 1995: 405-420; 2013: 132-134). People who are physically present can thus be treated as if they were absent (for example, strangers on a train, who are ignored in a conversation), or vice versa (participants of a telephone conference, or ghosts).

The sociology of media works less along the lines of a strict dichotomy between a physical and virtual co-presence in interactions and rather identifies gradual differences. Ruth Ayaß (2005), for example, remarks that, in each interaction with or without physical co-presence, the actions and statements of the person we communicate with must be interpreted; they are never immediately obvious. In the case of spatial co-presence, there is a larger number, and greater variety, of resources available for this interpretation than in the case of presence through media. Christian Meyer (2015) also argues in favor of differentiating between interactions based on varying degrees of sociality. This means that the classic, dyadic face-to-face model, which is only one specific historical form of interaction in which two alert, normal adults have a concentrated conversation and mutually observe and pay attention to each other, is no longer universally valid in a global comparison with non-western societies and in more recent interactions via media. In fact, there are also weaker forms in which the interaction does not take place with absolute, multisensory co-presence, but which can be reduced to a single semiotic channel (such as audio).

A similar gradual gradation of presence is provided by Stefan Hirschauer (2015). Referring to Knorr Cetina (2009, 2014) and Bruno Latour (1996), Hirschauer introduced the concept of "intersituativity" to describe situations in the age of teleinteraction. In the following, we will rely fundamentally on his description in our approach to the EMS telemedical setting as a "telemedical situation."

Hirschauer states that classical concepts of interaction – like Goffman's microsociology, systems theory, and ethnomethodology – are currently being challenged by new telecommunication technologies. If interactions no longer occur at a particular place (Cetina's example is based on globalized financial markets), if physical co-presence is no longer required, then interaction must be described in different terms (Hirschauer 2015: 120). Hirschauer's terminology allows us to gain a more nuanced view of *presence* – one that does justice to the telemedical setting. Hirschauer begins his discussion by presenting the classical dualism between microsociology and macrosociology before reviewing several attempts to overcome it (Goffman and Luhmann, in particular). His hypothesis is that "the situational tradition has transcended the micro/macro dualism in a new way by translating the problem of intersubjectivity into a problem of interaction research and now focusing on *intersituativity*"(ibid: 111). Recent theoretical approaches focus more on how situations are connected via media and materials, instead of trying to establish a theoretical connection between distinct micro and macro levels. For Hirschauer the situational nexus lies beyond the micro/macro dualism (ibid. 112). Hirschauer's descriptions of teleinteractions as a symbolic exchange via media is



therefore informative in the following discussion, in which we look at four aspects of the telemedical situation and how they relate to presence.

1. The experience and knowledge of the emergency physician practicing telemedicine as well as of the paramedic is, to a high degree, *conveyed via media* (ibid. 121). While the resources available for the interpretation of what the other is saying are produced through media (Ayaß 2005: 42), not all senses or "semiotic channels" are addressed, depending on the situation (Meyer 2015: 339). For example, the facial expressions of the person we are communicating with in a purely audio conversation cannot be integrated in our interpretations. The emergency physician's ability to make a quick assessment of the situation based on first impressions ("visual diagnosis") is replaced by an extremely formalized description, delivered in bullet point form, by the paramedics at the scene and

Figure 2: Emergency physician practicing telemedicine

by the digitally transferred vital data and scanned medical documents. These are assembled on the emergency physician's computer and can be viewed on several screens (figure 2). From the beginning, they provide an overall data-based picture of the patient that is primarily defined by medical parameters. As is routine in hospitals, the patient's body also acquires a digital representation, or double (Lindemann 2002; Schubert 2006: 197-207; see also Haggerty and Ericson 2000). The emergency physician practicing telemedicine records and manages the collected information and observes the vital processes of the patient's body. Because this data double, or virtual body, does not have to be "next to" or "with" the body anymore, but rather makes the body representable without being bound to a particular place, telemedicine goes a step further than its stationary predecessors by increasing the range of interaction between emergency physician and patient (and between emergency physician and paramedic). The emergency physician does not perceive the patient *face to face*, but rather *face to screen* (Knorr Cetina 2014). This means that the participants' ability to have an impact on the situation is usually distributed differently in this case. Beyond their parametric representations, patients can only have an impact on decisions regarding diagnosis and treatment by attempting to talk to the paramedics who are on-site or to the physician

who is not. The emergency physician practicing telemedicine, on the other hand, makes or confirms diagnoses, requests more information about the patient throughout the process via the paramedics at the scene, and initiates medical treatment via the same paramedics (ideally, the emergency physician can monitor the effects of treatment via the telemetric representation of the patient's vital parameters).

2. Telemedical interaction *pluralizes situations.* Similar to when someone is talking on the phone, the emergency physician is in three situations at the same time. Physically, the physician is in the EMS headquarters, where colleagues could enter the room and cause a distraction, and where he or she is occupied with office work between calls. Acoustically, the physician is at the margins of the events at the scene and can follow the interaction between patient and paramedic via the paramedic's headset. In terms of interaction, the physician also belongs to the "placeless space of the telephone call." Both the physician and the paramedic focus on this shared placeless space by selectively absenting themselves from other situations in order to be present in this one (Hirschauer 2015: 121). In each of these situations, *intersituativity* can be subjectively experienced. By this, we mean situations that overlap and run parallel to each other – for example, when the physician stops speaking to listen because he or she notices that the paramedic is listening to the patient.

We would initially assume that the additional introduction of video media reduces this plurality of situations, because they enable the increase in joint focus and unified perspectives. However, this is not the case. Even when the emergency physician practicing telemedicine is watching through the camera installed in the ambulance or through a camera worn by the paramedic,[2] he or she is still only partially involved in the treatment of the patient. The angle of the camera can also be the same as the direction of the paramedic's view, but the paramedic and emergency physician will not see the same thing. In addition to the video stream, the emergency physician also sees other information on the screen as well as the surrounding space in the office. Similarly, the paramedic also perceives the patient's surroundings beyond the image seen via the camera. It could therefore be stated that what is missing here is a *visual diagnosis*, a first overall impression of the patient's situation that may include his or her environment (site of the incident, living situation, and so forth). This is an essential process for an emergency physician who is physically present. One paramedic sums this up as follows:

"Our basic trainer always said that if you get to the patient and think 'oh shit!' then it is 'oh shit' for the patient, because the first five seconds is when you see the clearest whether the patient is doing

[2] In the research project that we accompanied, this was tested via the camera on the smart glasses. In earlier attempts, the paramedics were equipped with a helmet camera.

fine or not, whether he or she is stable or not. Yes, that's a first impression, and emergency physicians practicing telemedicine can't have that."

Furthermore, the shared visual space of the video stream is not – as in a phone conversation – a "placeless space" of interaction. This is because, in video telephony, the people participating in the conversation can look at each other. In our example, however, the shared space is directed toward something or someone else – namely, the *object* of interaction, or usually the patient. However, the emergency physician can focus with his or her own eyes on a different part of the video stream than the paramedic. The physician might focus on the split eyebrow, while the paramedic focuses on the reaction of the pupils. The video stream does not offer information about the focus of the person watching or the person transmitting. What is visible of the object is by no means self-explanatory, but requires further acts of communication that can be achieved in the face-to-face situation through *pointing*, glances, or the spatial position of bodies and acts. In a televisual interaction, what is visible must be enhanced with verbal explanations ("do you see this?" "turn the camera to X").

3. The telemedical setting particularly illustrates the *complication of presence*. Instead of understanding presence as a person's inclusion in a situational community – which, from a binary point of view, you either have or you don't – we use Hirschauer's proposal of regarding presence as a "connective mechanism of the increasable involvement of people in social processes" under the aspects of *accessibility* (*is* someone there?), *increasable interactive presence* (is this person *involved*?), and *relational presence* (*who* is there?) (Hirschauer 2015: 122). In this discussion, we will focus only on the first two aspects because in our case there is no doubt regarding who is involved (the third aspect): The person calling the emergency physician in the control center is a paramedic treating a patient.

Teleinteraction increases *accessibility* at the expense of *interactive presence*; meaning a higher frequency goes hand-in-hand with a lower density of contact. This will be explained in the following. First, the EMS telemedical system increases the possible *accessibility* of the emergency physician significantly compared to a physician who must drive to the scene. At the same time, however, the expectations of everyone involved regarding the reception of their communication become troubled. When in doubt, *paramedics* must safeguard themselves by asking the emergency physician if he or she has understood everything (acoustically) and if he or she received all the images that were sent. Sometimes there are several emergency calls at once at the EMS headquarters, and it is uncertain when the physician will call back. When we look at the relationship between *physician and patient*, this uncertainty becomes even greater. As mentioned under point 1, the patient does not know whether what he or she is saying can be heard by the physician, and the physician only realizes indirectly if and how the patient is reacting to his or her suggested treatments.

Second, presence can be generally increased through the level of the *involvement of attention*. In face-to-face situations, we have the opportunity to look someone in the eyes. This can be described as the ideal situation of mutual perception: "By the look of the other, I can see that he or she can see that I see them […] that we see that we see each other" (Hirschauer 2015: 119). A decreased level of attention can be demonstrated by visibly turning away from the communication situation (looking away), to which the other person can react accordingly. In every telecommunication, however, there is always the question of how much the other person is not only *at the other end*, but also mentally *involved*. Even in cases when sequences of communication are confirmed by the other through verbal signals ("uh-huh," "yes"), the level of attention between these signals cannot be known.[3]

Emergency physicians practicing telemedicine bring up another issue that speaks in favor of a differentiation between *emotional involvement* and *mental attention.* Because they are *less emotionally involved* through their physical removal from the situation and geographical distance, they can focus their attention on what is *medically essential*. They can concentrate solely on the "facts" and are not partially absorbed by the immediate surroundings of the interaction during the emergency situation, or by the actual person inside the patient's body. In this respect, despite the lack of an initial visual diagnosis, this interaction through media rather poses an advantage for the emergency physician practicing telemedicine. One emergency physician summarizes her point of view thus:

"I think the advantage of the emergency physician practicing telemedicine is that you're outside of the situation and you get an overview without being in the middle of what's going on, and you can really only pay attention to the facts and don't get pulled into the situation."

The physician thus substantiates her telemedical presence with an objective, sober, and purely medical view of the patient receiving emergency care. Paradoxically, we could say that, because doctors are primarily interested in the body of the patient (especially the emergency physician, who must decide whether the patient can be transported), the emergency physician in the control center does not need the patient to be physically present. The patient's digital representation is free from any interferences that an emergency physician who is physically present at the scene has to deal with. The patient is present(ed) to the telemedical view of the emergency physician based on his or her medical significance. Neither the body's immediate surroundings, nor the actual person within the sick or injured body must be actively ignored to be able to see just the body. Therefore, the

[3] Meyer (2015) convincingly describes that the ideal situation of looking at each other during communication cannot be regarded as a global standard. He observed various non-Western cultures that use verbal signals of affirmation instead of eye contact in interactions to signal the end of a sequence, which also creates periods of time during which the speaker does not know whether he or she is being listened to.

relationship between the emergency physician and the patient is actually a radically objectified doctor-patient relationship in which the patient's self has been removed from his or her body (Hirschauer 1991; Saake 2003). The lack of impressions of the patient's surroundings and the common ground of the physician-paramedic interaction is a mental relief for the physician and enables him or her to establish a different, more objective perspective on the patient as an object of knowledge.

4. What is important for describing the *limits* of telemedical situations is the aspect mentioned *last* by Hirschauer: the *involvement* of the body in the disembodied interaction (ibid: 123). While in tele-communication, the bodies of others seem to fade away, much more is demanded of one's own body. The paramedics' perceptual and physical abilities are highly challenged due to their job of mediating between the situation at the scene and the telework office. This stress cannot be intensified infinitely. Hirschauer talks about a "technical adaptation of large streams of information to fit a *finite* psychophysical entity" (ibid: 124). This finiteness is also an issue for paramedics, who talk about a "media overload" because they not only have to interact with the patient, who is physically present, they also have to interact with the emergency physician in the control center:

"The media overload is draining. When you have to talk to the patient, to the emergency physician, AND communicate with a colleague, and on top of that also have to work, there are four things that you have to do at the same time; that's very exhausting for the paramedic in charge."

In a typical EMS situation, the paramedics are often secondary to the emergency physician administering care to the patient at the scene. Many paramedics thus do not see themselves as the main person responsible for the emergency situation, but rather as playing a merely implemental role. With an emergency physician practicing telemedicine, while the physician may still seem like the one giving the orders around which the situation and the flow of information is organized, the physician's virtual presence also more clearly forces the paramedic into a position of managing and establishing connections. The paramedics, who are involved in both situations, connect the two ends of interaction. First, they make it possible for the emergency physician to receive digital data and continuously pass on information about the patient to the physician. Second, paramedics inform the patient about the virtual presence of the physician and tell them when they are talking to the physician, when the physician can observe the patient through the camera in the ceiling, and what the physician has decided. It is the paramedics who make the other people present for one another according to their medical relevance: To the physician, the patient appears in the form of his or her health records and current vital signs, to the patient the physician appears as medical expertise.

This double involvement of paramedics requires new media skills (communication culture) as well as new norms regarding the use of media, the latter of which still need to be developed.[4] Paramedics who are experienced in telemedical situations should ideally recognize whether they are feeling overloaded and be able to solve this problem by notifying the emergency physician that they will be cutting the connection and exclude him or her from the emergency situation. Paramedics thus not only build bridges of communication via audio-visual media to make two people present for each other along the lines of their medical roles; they also have the job of blocking or dismantling these bridges and building them again. This has also consequences for how EMS telemedicine is organized, which we will discuss in the following section.

IV The Organization of EMS Telemedicine

In the first part of this analysis, we described the problems that were detected in the previous evaluations of this project as symptoms of general changes that were triggered by the implementation of telemedical tools. These difficulties arise from (1) the fact that what is being experienced is conveyed through media, (2) situations are pluralized, (3) this pluralization results in presence becoming complicated, and (4) there are physical limitations to being able to pay attention in constellations involving audio-visual media. In this second step, we will turn to the organizational framework in which these general changes occur. We will investigate how telemedicine alters the collaboration between paramedics and emergency physicians. We already discussed the two aspects of communication and hierarchy in the initial analysis of the problem (part II). EMS telemedical organizations have since reacted to these issues, first, with an increased formalization of the emergency procedures and, second, with a shift in responsibility to personnel at the scene. As we will demonstrate in the following, both approaches do not necessarily appear in concert in the management of emergency situations, but exist alongside one another.

In a standard emergency response, when paramedics and an emergency physician are both at the scene, their collaboration takes one of these two forms. Either the emergency physician remains in the background, delegating treatment and letting the paramedics "do their thing," or the emergency physician take over control entirely, becoming actively involved, and letting the paramedics "only" assist.

"There are physician who let us do EVERYTHING; they stand next to us and only say: 'yes, do this or that' and we DO it. That's GREAT FOR US, of course. And then there are physicians who say: 'NO, this is all MINE,' and nothing." (a paramedic)

[4] Also during our exercises with the smart glasses for AUDIME, it became clear that users not familiar with the teleinteraction format were extremely distracted and were unable to interact adequately with the patient.

The implementation of audio-visual media in telemedicine means that the possibilities of interaction are changing, along with the two forms of cooperation. In our observations, this results in (1) an increased *remote control* of the paramedics by the emergency physician practicing telemedicine, or (2) the emergency physician's advisory support of the paramedics, which increases their scope of practice and their responsibility. Incidentally, both forms of collaboration can be found in the official project descriptions, all of which over time emphasize different aspects of the telemedical service. During the development phase, there was still talk of an "EMS telemedical system" – in other words, the supportive character of this system was stressed – but ultimately, "emergency physician practicing telemedicine" prevailed, which focuses on the physician as the person in charge. Both forms of collaboration are not necessarily mutually exclusive, however. During our participant observation phase, we certainly noticed there were mixed forms being used. In the interviews, however, only one of the two types was highlighted as being important. In the following, we will only outline these two types and not the mixed forms. In between these two types, we will discuss the principle of delegating responsibility.

First Feature of Telemedical Organization: The Increased Importance of Formal Guidelines

The emergency physician practicing telemedicine often tries to control the remote situation with the help of formal guidelines. In order to acquire a precise impression of the situation at the scene, he or she uses medical protocols – so-called prehospital treatment algorithms – as well as checklists. These provide the basis for making decisions and are predefined for both the physician as well as the paramedics at the scene. Unlike the emergency personnel at the scene, however, the emergency physician's conduct follows these scripts much more closely. The visible reference to, precise focus on, and strict implementation of formal guidelines clearly differs from the approach of the paramedics at the scene, who are also aware of these guidelines, but for whose working process they play a much smaller role. The paramedics' approach is much more defined by the situation they are confronted with and must necessarily follow formal guidelines to a much lesser degree. For this reason, paramedics at the scene take a much more flexible approach to these guidelines and adapt them to extraordinary circumstances: "'Going by the book' may hamper or constrain EMTs from doing what is actually needed at the scene" (Palmer and Gonsoulin 1990: 213). Because they also do not have these required guidelines directly in front of them and therefore cannot refer to them, mistakes can happen and certain steps can be accidentally overlooked or implemented incorrectly: "These circumstances may also be covered up in the field and omitted from reports" (ibid.).

The emergency physician practicing telemedicine, on the other hand, is in a different situation, and he or she therefore follows the guidelines more strictly. There are several reasons for this. For one, the physician can see the guidelines on the screen in front of him or her, which significantly reduces

the risk of unintentionally deviating from them. Additionally, the telemedical consultation is usually recorded, which makes it more complicated and risky to deviate from the prescribed approach. Instead, the emergency physician should expect that the course of events may be reviewed in detail at a later time, and that any deviations from the protocol will need to be justified, meaning he or she will be held accountable. Following the formal guidelines closely thus also serves as a safeguard against legal issues. Generally, with the introduction of telemedicine, the practice of prehospital care becomes monitorable in a dense way for the very first time. This is an important side effect embraced by emergency managers.

Another factor from the emergency physician's point of view is that the events at the scene *do not* compete as much with the formal guidelines. These guidelines and the patient data shown on the screen are often the key reference points needed for the emergency physician to consider and plan the sequence of actions. In the same way that transcripts of EMS responses can be read later to review a past event under certain aspects, transcripts, algorithms, and checklists also enable the emergency physician to comprehend the current situation at the scene from a distance. In EMS telemedicine, the emergency physician's increased orientation toward formal guidelines not only compensates for his or her missing presence; what is decisive is that these guidelines provide a *specific* reading of the situation that also has the legitimacy of being the *medically correct* perspective.

An essential function of formal guidelines is their coordinating and guiding aspect (Stinchcombe 2001). As a basis for making decisions that apply to an organization, officially predetermined guidelines define a space of experience shared by everyone in the team, thus structuring what they can mutually expect of each other (Luhmann 2018). The guidelines make it possible to predict what will be done, asked, and expected next by others. It therefore seems obvious that the use of prescribed guidelines in telemedical settings in which members of an organization must work together is increasing greatly. This is because, although members of a telemedical organization are only present for each other by gradual degrees, they are not strangers. Even if they do not know the other person personally, their roles are familiar, and they can roughly predict how the others will act. The formal frame of reference thus makes a common workflow possible that does not need to be agreed on beforehand.

The gains of coordination that can be achieved through formal guidelines can be clearly observed in settings based on audio-visual media. In the interprofessional work relations of physicians who only exchange information through telemedical means, the requirements for coordination also go hand-in-hand with a greater level of formalization of work processes (Meyer and Paré 2017). While the physicians involved in this form of communication are on the same level of hierarchy, the increased

formalization in EMS telemedicine is confronted with more hierarchical work relations. Formalization not only has a coordinating, but also a supervising function in this case, because the emergency physician has *legally guaranteed access* to the paramedic, and through the paramedic to the situation. By implementing measures in strict adherence to the guidelines, the emergency physician practicing telemedicine moves within a medically and legally protected framework, of which jurists also approve (Katzenmeier and Schrag-Slavu 2010: 60). Because the physician cannot provide care in person, the paramedic becomes the physician's executing agency.

The technical character of this telemedical form of work is therefore especially prominent. The formal structure limits the action of both parties involved. In order to implement the scripts, the emergency physician *acts through* the paramedic, who experiences this technological process as being supervised. Paramedics describe this coercive organizational character (Adler and Borys 1996) as follows: *"Yes, you have to follow this manuscript in a reasonable way, so that we can give the emergency physician in the control center what he needs. Personally, I always feel like if the emergency physician always has some follow-up questions, then I didn't do a good job, because I feel like I could have thought of that, too. Sometimes he'll also remind me of things, and he doesn't mean it in a bad way – it's a good thing – but I always think, dammit, I could have thought of that myself, you know?"* (a paramedic)

The technicity of the collaboration in EMS telemedicine, being supervised by and subordinated under the emergency physician, causes significant problems in the obedience of paramedics. This was observed and discussed early on by Palmer and Gonsoulin, who point out that, in some cases, paramedics do not consult the emergency physician practicing telemedicine, although they are required to do so. In order to not make themselves legally vulnerable, they will apparently even go so far as to feign technical difficulties with the connection to justify not consulting the emergency physician (Palmer and Gonsoulin 1990: 212). The ongoing question concerning telemedical projects is therefore how to prevent the prohibited non-use of the emergency physician on standby in the control center.

Reconsidering delegation

Discussions regarding the possible difficulties of the collaboration between emergency physicians practicing telemedicine and paramedics have often revolved around the idea of *delegation*. The legal basis of telemedical systems in EMS services rests for the most part on the distinction between the responsibility for giving orders, or accountability, which lies with the physician, and the responsibility for carrying out these orders, which lies with the paramedics at the scene. The use of formal guidelines is precisely intended to allow this division: the diagnostic competence lies with the

physician, who makes decisions regarding treatment, while the implementation of these decision is delegated to the paramedics. What is often forgotten in discussions about collaboration is that, in addition to the responsibility for giving orders and the responsibility for carrying them out, there is the additional legal concept of responsibility for accepting the physician's decisions on the part of the non-physician personnel. That having been said, in the following, we will not be focusing on the legal framework, but on organizational practice.

Whether a true form of delegation exists in practice is questionable in that closely following detailed scripts of action does not actually correspond to the idea of delegation. This is because, first of all, delegation should be distinguished from forms of making joint decisions that imply equality; second, delegation essentially entails the transfer of the authority to decide (Leana 1986, 1987; Strauss 1963). Thus, delegation applies less in cases when subordinates act as the mere instrument and extension of the decisions of their superiors. But yet, the delegation of decisions cannot work without a formally established hierarchy in the organization. Also the decision to delegate or withdraw the power to make decisions is structured in a hierarchical manner (Klein et al. 2006). However, contexts in which people work together closely and "in sight" in a hierarchy might reduce the ability to delegate responsibility substantially.

The Second Feature of Telemedical Organization: The Shift in the Burden of Responsibility

Telemedical collaboration does not need to exclusively take the form of remote control. It can also operate as a form of support and take an entirely different course in which the physician becomes a consultant for the paramedic. In the beginning, the *Telemedizinische Rettungsassistenzsystem* (EMS Telemedical System) was especially advertised as "*supporting* paramedics through the competence of an emergency physician" (Uniklinik RWTH Aachen 2017, emphasis ours). One of the paramedics we interviewed described the collaboration with the emergency physician practicing telemedicine accordingly:

"So far, I've never had the feeling that I'm being supervised or that my work is being scrutinized. It was really, I mean theoretically, as if he was there and we were a team. And that was the way it really was."

Later in the interview, the paramedic added that he regards the emergency physician "*definitely as an expansion of competence*." He said he uses him "*to make sure I'm on sound legal ground when I'm not allowed to do certain things, my scope of practice, but I also use him when I am not sure about things."*

The paramedic's explanation of his own actions here is fundamentally different from the form of collaboration in the highly formalized, remote control model. While in the remote control model the

emergency physician acts through the paramedic, in this model, the paramedic sees him or herself as responsible for his or her own actions and the use of the emergency physician as the expansion of his or her own competence. The difference between the two forms of collaboration is marked by this reversion of agency. The paramedic actively obtains additional expertise, thereby broadening his or her scope of practice and responsibility. He or she "uses" the emergency physician, even though the physician must ultimately delegate the required procedures to the paramedic, who is then obliged to "to verify the measure for plausibility" (Büscher et al. 2014: 25). However, on closer inspection, the paramedic appropriates more than the "responsibility for carrying out orders" legally granted to him or her. The paramedic at the scene alone decides whether or not to contact the emergency physician and initiate the telemedical situation and thereby acquire additional competence. If we regard the delegation of responsibility merely from a purely legal perspective, or in terms of the formal hierarchy in the organization, it is easy to overlook the fact that the *practical prerogative* to establish the telemedical situation is the paramedic's decision. He or she *initiates* the telemedical delegation of responsibility. This substantially alters his or her position. Whereas the telemedically unsupported paramedic might either hesitate or take the decision to overstep his/her legal given medical competences at his/her own risk, now s/he commands the means that will give him/her the competence to do so.

This is not all, however. In some situations, it is also up to the paramedic to decide whether to remove the emergency physician from the telemedical situation. It is mainly up to the paramedic to either neglect, suspend, or even cut off the connection to the emergency physician in the control center. Physical presence counts more in an emergency than hierarchical structure, and this gradient of importance is also acknowledged by emergency physicians practicing telemedicine. For example, an emergency physician may receive a call from a paramedic who might then quickly end the call by saying "we've taken care of it." What "it" could be remains unclear, and the emergency physician does not ask.

It is also the emergency physician who must show patience. The physician is often kept waiting by his or her interaction partner – without explicitly being asked to wait – because the partner has something "more important" or "more urgent" to do or "has their hands full." This also expresses the decisive difference between the physician, who is less involved in the events at the scene, and the paramedic. This means that the paramedic does not need to be as polite or considerate toward the physician as he or she would normally be if physically co-present. As has been demonstrated already, this permissible lack of consideration can even go so far in some cases that the paramedic cuts off the telemedical connection because the paramedic is too overwhelmed from being pulled in too

many directions (we can now say: situations). In this case, we can therefore clearly identify a redistribution of possible actions as compared to joint collaboration at the scene (Knorr Cetina 2014).

Conclusion

Our discussion is intended to present several fundamental sociological considerations regarding teleinteractions, using telemedicine as an example. In part III, we referred to newer media theories regarding intersituativity in our argument that we should not talk about absence, but instead a graded scale of presence. This is because (1) experience via media no longer allows for direct visual insights and for making eye contact with an interaction partner, although it does change the use of semiotic channels; (2) the communication between physician, paramedic, and patient in telemedicine is not based on a single situation, but on several; (3) as a result, the presence of those involved is distributed across several sites, which makes the degree of (the perceived) involvement of each individual much more complicated; and finally, (4) the physical limits of attention in constellations based on telemedia also become more prominent.

On the organizational level (part IV), telemedicine increases the adherence of EMS systems to formal rules. By closely following predefined scripts, the emergency physician is able to access the situation through the paramedic. This model of action, which we refer to as “remote control,” allows the emergency physician practicing telemedicine to play a largely autonomous role in emergency care management. He or she compensates for the lack of bodily presence at the scene by working through the paramedic according to predefined rules. The second action model is characterized by a shift in responsibility in favor of the paramedic, who takes over the work of the physician after requesting his or her permission to do so. In this case, the telemedical delegation of responsibility is thus initiated by the paramedic, who (as the subordinate) acquires and appropriates additional competence. What also becomes clear in this situation is that the virtual presence of the physician via telephone takes a backseat to the demands of the situation. Hierarchy becomes less important than presence and the ability to intervene. The focus of attention is on the emergency situation, meaning it is permissible to be inconsiderate toward superiors in the telemedical constellation.

A large majority of current media sociology research studies so far has explored the influence of ICT on social relations and investigated how modern society is changing as a result of social media. Very few of these sociological studies have addressed the significance of these developments for work relations, however. Only recently have there been attempts to understand the digitalization of organizations and companies from the perspective of the transformative influence thereof on work relations. In these cases, digitalization is not regarded as the mere automation of processes and

thereby the endangering of jobs. It also cannot be simply understood as only a learning challenge and that the workforce only needs to acquire new knowledge. The incorporation of information and communication technologies in organizations leads to new forms of interaction through which structures of presence, supervision, and responsibility are shifting with the result that members of organizations are supplementing or transforming older work relations with new ones.

References

Adler PS, Borys B (1996) Two Types of Bureaucracy: Enabling and Coercive. Administrative Science Quarterly 41:61–89

Ayaß R (2005) Interaktion ohne Gegenüber. In: Jäckel M, Mai M (eds) Online-Vergesellschaftung?: Mediensoziologische Perspektiven auf neue Kommunikationstechnologien, 1st edn. VS, Wiesbaden, pp 33–50

Bång A, Herlitz J, Martinell S (2003) Interaction between emergency medical dispatcher and caller in suspected out-of-hospital cardiac arrest calls with focus on agonal breathing. A review of 100 tape recordings of true cardiac arrest cases. Resuscitation 56:25–34. doi: 10.1016/S0300-9572(02)00278-2

Bergrath S, Rörtgen D, Rossaint R, Beckers SK, Fischermann H, Brokmann JC, Czaplik M, Felzen M, Schneiders M-T, Skorning M (2011) Technical and organisational feasibility of a multifunctional telemedicine system in an emergency medical service – an observational study. Journal of Telemedicine and Telecare 17:317–377

Bergrath S, Czaplik M, Rossaint R, Hirsch F, Beckers SK, Valentin B, Wielpütz D, Schneiders M-T, Brokmann JC (2013) Implementation phase of a multicentre prehospital telemedicine system to support paramedics: feasibility and possible limitations. Scand J Trauma Resusc Emerg Med 21:54. doi: 10.1186/1757-7241-21-54

Bruni A, Gherardi S, Parolin LL (2007) Knowing in a System of Fragmented Knowledge. Mind, Culture, and Activity 14:83–102. doi: 10.1080/10749030701307754

Büscher C, Elsner J, Schneiders M-T, Thelen S, Brodziak T, Seidenberg P, Schilberg D, Tobias M, Jeschke S (2014) The Telemedical Rescue Assistance System "TemRas" - Development, First Results and Impact. In: Jeschke S, Hees F, Isenhardt I, Henning K (eds) Automation, Communication and Cybernetics in Science and Engineering 2013/2014. Springer Science and Business Media, Heidelberg, pp 17–32

Clarke M, Fursse J, Brown-Connolly NE, Sharma U, Jones R (2018) Evaluation of the National Health Service (NHS) Direct Pilot Telehealth Program: Cost-Effectiveness Analysis. Telemed J E Health 24:67–76. doi: 10.1089/tmj.2016.0280

Gherardi S (2010) Telemedicine: A practice-based approach to technology. Human Relations 63:501–524

Gibson B, Boiko O (2012) Luhmann's social systems theory, health and illness. In: Scambler G (ed) Contemporary theorists for medical sociology. Routledge, New York, pp 49–70

Goffman E (1961) Encounters. Two Studies in the Sociology of Interaction. Penguin, Harmondsworth

Goffman E (1983) The Interaction Order. American sociological review 48:1–17

Gonzales Armengol JJ, Carricondo, Francisco., Mingorance, Carlos, Gil-Loyzaga P (2009) Telemedicine in emergency care: methodological and practical considerations. Emergencias 21:287–294

Haggerty KD, Ericson RV (2000) The surveillant assemblage. British Journal of Sociology 51:605–622

Henderson C (2018) An economic evaluation of telehealth and telecare in England
Hirschauer S (1991) The Manufacture of Bodies in Surgery. Social Studies of Science 21:279–319
Hirschauer S (2015) Intersituativität. Teleinteraktionen und Koaktivität jenseits von Mikro und Makro. In: Heintz B, Tyrell H (eds) Interaktion – Organisation – Gesellschaft revisited: Anwendungen, Erweiterungen, Alternativen. Lucius, Stuttgart, pp 109–133
Katzenmeier C, Schrag-Slavu S (2010) Rechtsfragen des Einsatzes der Telemedizin im Rettungsdienst: Eine Untersuchung am Beispiel des Forschungsprojektes Med-on-@ix. Kölner Schriften zum Medizinrecht, vol 2. Springer, Berlin
Klein KJ, Ziegert JC, Knight AP, Xiao Y (2006) Dynamic Delegation: Shared, Hierarchical, and Deindividualized Leadership in Extreme Action Teams. Administrative Science Quarterly 51:590–621
Knorr Cetina K (2009) The Synthetic Situation: Interactionism for a Global World. Symbolic Interaction 32:61–87. doi: 10.1525/si.2009.32.1.61
Knorr Cetina K (2014) Scopic media and global coordination : the mediatization of face-to-face encounters. In: Lundby K (ed) Mediatization of Communication. de Gruyter Mouton, Berlin, pp 39–62
Langabeer JR, Gonzalez M, Alqusairi D, Champagne-Langabeer T, Jackson A, Mikhail J, Persse D (2016) Telehealth-Enabled Emergency Medical Services Program Reduces Ambulance Transport to Urban Emergency Departments. West J Emerg Med 17:713–720. doi: 10.5811/westjem.2016.8.30660
Laryionava K, Kreucher S, Groß D (2011) Physician Perspectives on Telemedicine in Pre-Hospital Emergency Medical Services. In: Brukamp K, Laryionava K, Schweikardt C, Groß D (eds) Technisierte Medizin - dehumanisierte Medizin?: Ethische, rechtliche und soziale Aspekte neuer Medizintechnologien. Kassel Univ. Press, Kassel, pp 27–32
Latour B (1996) On Interobjectivity. Mind, Culture, and Activity 3:228–245. doi: 10.1207/s15327884mca0304_2
Leana CR (1986) Predictors and Consequences of Delegation. Academy of Management Journal 29:754–774
Leana CR (1987) Power Relinquishment Versus Power Sharing: Theoretical Clarification and Empirical Comparison of Delegation and Participation. Journal of Applied Psychology 72:228–233
Lindemann G (2002) Die Grenzen des Sozialen: Zur sozio-technischen Konstruktion von Leben und Tod in der Intensivmedizin. Übergänge, vol 48. Fink, München
Luhmann N (1972) Einfache Sozialsysteme. Zeitschrift für Soziologie 1:51–65
Luhmann N (1990) Der medizinische Code. In: Luhmann N (ed) Konstruktivistische Perspektiven. Westdeutscher Verlag, Opladen, pp 183–195
Luhmann N (ed) (1995) Social systems. Writing science. Stanford University Press, Stanford, Calif.
Luhmann N (2013) Theory of society. Stanford Univ. Press, Stanford, Calif.
Luhmann N (2018) Organization and decision. Cambridge University Press, Cambridge, United Kingdom, New York, NY
Mannon JM (1992) Emergency encounters: EMTs and their work, 2nd edn. Jones and Bartlett Publishers, Boston
Meyer C (2015) "Metaphysik der Anwesenheit". Zur Universalitätsfähigkeit soziologischer Interaktionsbegriffe. In: Heintz B, Tyrell H (eds) Interaktion – Organisation – Gesellschaft revisited: Anwendungen, Erweiterungen, Alternativen. Lucius, Stuttgart, pp 321–345
Meyer J, Paré G (2017) The Transformative Role of Telemedicine on Coordination: A Practice Approach. Proceedings of the 50th Hawaii International Conference on System Sciences

Natafgi N, Shane DM, Ullrich F, MacKinney AC, Bell A, Ward MM (2018) Using tele-emergency to avoid patient transfers in rural emergency departments: An assessment of costs and benefits. Journal of Telemedicine and Telecare 24:193–201. doi: 10.1177/1357633X17696585

Palmer CE, Gonsoulin SM (1990) Paramedics, protocols, and procedures: "Playing doc" as deviant role performance. Deviant Behavior 11:207–219. doi: 10.1080/01639625.1990.9967845

Psathas G, Waksler FC (1973) Essential features of face-to-face interaction. In: Psathas G (ed) Phenomenological sociology: Issues and applications. Wiley, New York, NY, pp 159–183

Saake I (2003) Die Performanz des Medizinischen. Soziale Welt 54:429–459

Schneiders M-T, Herbst S, Schilberg D, Isenhardt I, Jeschke S, Fischermann H, Bergrath S, Rossaint R, Skorning M (2012) Telenotarzt auf dem Prüfstand. Evaluation des Projekts Med-on-@ix aus Sicht der Rettungsassistenten. Notfall + Rettungsmedizin 15:410–415

Schneiders M-T, Schilberg D, Jeschke S (2014a) Einführung eines Telematischen Rettungsassistenzsystems in die Organisation Rettungsdienst – zur Rolle der Akzeptanz im Implementierungsmanagement. In: Jenki M, Ellebrecht N, Kaufmann S (eds) Organisationen und Experten des Notfalls. Technik und Kultur von Rettungswesen und Feuerwehr im Wandel. LIT, Berlin, pp 269–286

Schneiders M-T, Schilberg D, Isenhardt I, Jeschke S (2014b) Technological Changes in High Reliability Organization: Implementation of a Telematic Rescue Assistance System into German Emergency Medical Services. In: Jeschke S, Hees F, Isenhardt I, Henning K (eds) Automation, Communication and Cybernetics in Science and Engineering 2013/2014. Springer Science and Business Media, Heidelberg, pp 111–123

Schubert C (2006) Die Praxis der Apparatemedizin. Ärzte und Technik im Operationssaal. Campus Forschung, vol 908. Campus, Frankfurt am Main

Schütz A (1972) The phenomenology of the social world, 1st paperback ed. Northwestern University studies in phenomenology & existential philosophy. Northwestern University Press, Evanston

Schütz A (1976) Collected Papers. Phaenomenologica, vol 15. Nijhoff, The Hague

Skorning M, Bergrath S, Rörtgen D, Brokmann JC, Beckers SK, Protogerakis M, Brodziak R, Rossaint R (2009) "E-Health" in der Notfallmedizin - das Forschungsprojekt Med-on-@ix (E-health in emergency medicine - the research project Med-on-@ix). Der Anaesthesist 58:285–292. doi: 10.1007/s00101-008-1502-z

Stinchcombe AL (2001) When formality works: Authority and abstraction in law and organizations. University of Chicago Press, Chicago

Strauss G (1963) Some notes on power-equalization. In: Leavitt HJ (ed) The social science of organizations: four perspectives. Prentice-Hall, Englewood Cliffs, N.J., pp 40–48

Uniklinik RWTH Aachen (2017) TemRas - Telemedizinisches Rettungsassistenzsystem. https://www.ukaachen.de/kliniken-institute/telemedizinzentrum-aachen/projekte-und-kompetenzzentren/temras.html. Accessed 10 October 2018

Whitten PS (2002) Systematic review of cost effectiveness studies of telemedicine interventions. BMJ 324:1434–1437. doi: 10.1136/bmj.324.7351.1434

zur Nieden A (2017) Helden oder Cyborgs? Datenbrillen und Wearables im Rettungsdienst. Arbeit und Bildung:180–191

zur Nieden A, Ellebrecht N (2017) Inklusion und Exklusion durch Telemedizin. Zu neuen Formen der Interaktion im vernetzten Rettungsdienst. Geschlossene Gesellschaften. Verhandlungen des 38. Kongresses der Deutschen Gesellschaft für Soziologie