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Understanding the Role of Technology in Care: the Implementation of GPS-Technology in Dementia Treatment

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Abstract
Earlier literature on "welfare technologies" in general – and the use of GPS devices in dementia care in special – has been overwhelmingly focused on either individual (user-centric), technical or ethical challenges related to technology implementation. This paper argues for a relational analysis to supplement and adjust shortcomings in the existing research literature and introduces the concept of "techno-organizational networks" for the task. Through an analysis of a post-pilot period of a pilot-project with GPS-tracking of dementia patients, it is shown how a relational approach contributes to a better understanding of the dynamics and obstacles of developing technology-assisted health-care services. An original contribution of the article is also the argument for studying transitional, post-project or in-between project phases of technology implementation, which as a rule tend to be project driven, also in terms of research.

Keywords Dementia · Dementia treatment · Health system organization · Welfare technologies · Ambient assisted living · E-health · Sociology · Science and technology studies · Actor-network theory

Dealing with «Wandering Behavior»

This article analyzes the end or the aftermath of a trial with GPS tracking of demented people in the municipality of Trondheim in Mid-Norway, what we will call a post-pilot phase. The goal of the trial was to test out the use of GPS

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devices in dementia care and suggest national guidelines for the implementation of this technology. In this article, we suggest a new conceptual framework for analyzing the challenges connected with the development of technology-based elderly care – aiming to supplement and adjust shortcomings in the existing research literature. We will argue that implementation of technology should be seen as relational, networked phenomenon, introducing the concept of "techno-organizational networks" to gain a better understanding of the dynamics and obstacles of developing technology-assisted health-care services. Furthermore, we will argue that technology adaption is a continuously evolving phenomenon, pointing at the need to also study post-project or in-between project phases of technology implementation.

In Norway, the implementation of GPS tracking of demented people takes place as part of the discourse around the highly profiled investment in so-called "welfare technologies". The political interest in the employment of technologies in elderly care accelerated when the Stoltenberg II Government published the white paper on future challenges in the care sector in 2006 (White Paper 25 2006). The paper warns about the "elderly boom" predicted from 2020 to 2030. If no action is taken, there will be less health personnel to take care of the elderly, leading to lack of medical and psychosocial follow-up.

It is on this backdrop that the White Paper argues for an increased utilization of new technologies in the health services. The term "welfare technologies" came to be the common label for this initiative a few years later, when The Norwegian Health Directorate launched a programmatic long-term plan with this title (NOU 2011). The term originates from Denmark and is employed mainly in the Nordic countries (Nakrem and Spilker 2014). In other countries, terms such as "telecare", "e-health", "m-health", "ambient assisted living" and "active assisted living" are used for similar initiatives (Nakrem and Nervik 2017).

Typically, it is argued that increased use of technical aids will be beneficial both for the persons in need of care and their relatives and for the health service system and society in general. Welfare technologies can provide its users with new and improved possibilities to master their everyday life, experience safety and live independently. At the same time can technological innovations improve the efficiency of today's health services (White Paper 16 2011). On the other hand, it is pointed out that welfare technologies raises clinical, technical, organizational, economic, social, legal and ethical challenges (Wiik et al. 2012; Nakrem and Nervik 2017; Kiran 2017).

We are witnessing a much more extensive, ambitious and coordinated investment in technologies in the health care than ever before. These new large investments in and the great expectations for "welfare technologies" makes the research question that we are using in the title of this article importunate: How should we understand the role of technology in care?

We will use a case study of GPS tracking of demented people as a departure point for answering this question. Dementia is sometimes, with a more refined and less stigmatized phrase, called "wandering behavior", because a typical characteristic for many patients with this suffering is to embark on long walks at quaint hours, often improperly dressed, ending up disorientated and lost. GPS tracking of dementia patients is supposed to open up for a different, softer

control of this activity than today's alternatives, which are often confinement and institutionalization. The use of GPS technologies in dementia care has been seen as some of a "spearhead" and "flag ship" for the welfare technology program – since it involves quite ready available technology and is thought to be easy to implement (Nakrem and Spilker 2014).

Our case study analyzes the roundup of the pilot trial "Safe Tracks" that went on in Trondheim (and four other municipalities) in the period from 2011 to 2015. We base our analysis on documentary material and in-depth interviews with involved parties – both relatives of the trial patients and health personnel with different responsibilities with regard to the technology. The focus for our analysis has been to identify the relations between the technology and the organization, what we will denote "the techno-organizational network".

Previous Research on GPS-Tracking of People with Dementia

We find that earlier literature are dominated by individual-based (user-based) explanations of challenges related to the implementation and adoption of new welfare technologies, or ethical discussions on surveillance and privacy issues, or on "pure" technical hindrances. In comparison, the literature has given much less attention to relational, organizational and infrastructural issues.

In a literature review one of us conducted (Nordby 2015), we investigated what earlier research could tell us about factors preventing or facilitating the uptake of welfare technologies. The four data bases Cinahl, Medline, ScienceDirect and Web of Science were used for the search. The terms "Elder Care" and "Elderly Care" was paired with relevant search phrases. The search was limited to articles after 2010 in international, peer-reviewed journals and should be based on empirical studies of practice – excluding pure technical or theoretical publications. 29 articles ended up being picked out for the final analysis.

In the articles, the following factors were identified as important for the uptake of welfare technologies:

1. *Earlier experience with technology*. The studies in this category is about how elder people's technical knowledge and experience influences the uptake of technologies.
2. *Perceived need for technology*. In this category, the studies are concerned with how lack of information and motivation prevents the elder people's uptake of technologies.
3. *Importance of human contact*. These studies take as a starting point the need for personal contact and follow-up.
4. *Technology causing social stigma*. Articles here discusses how elder people connect the use of welfare technologies with weakness, dependency and social stigma.
5. *Importance of user-friendly design*. In this category, the necessity for user-friendly design to meet elder people's physical and cognitive deficiencies is stressed.
6. *Importance of privacy and security*. The final theme identified in the articles is a concern for breaches of privacy and intrusive surveillance connected to the use of tracking and monitoring equipment.

A common thread for all these articles is that they give individual-based (user-based) explanations of challenges related to the implementation and adoption of new welfare technologies.

In another literature review, Schaathun et al. (2014) have looked exclusively on the literature on GPS tracking and dementia – covering both engineering (through the IEEExplore base) and social/health science research (through Cinahl) from 2007 to 2014. Schaathun et al.'s review employs a narrower thematic scope (GPS and dementia), but broader inclusion criteria (including conference proceedings, technical reports, news briefs and discussion papers) compared to NN. In the 18 articles from Cinahl, they find an overwhelming, almost exclusive concern for ethical issues, basically related to issues of privacy and security (NN's sixth category). A few articles also deal with the danger that technology could replace human contact, that there may be stigma associated with wearing a tracking device, and one even discusses the risk that the wearer could become a target for theft. The 10 articles from IEEExplore are – not surprisingly – mainly concerned with technical challenges and limitations, such as cost of the device, user-friendliness, technical stability, size of the device, battery charging and location readings.

The dominance of ethical and technical discussions are probably related to the fact that the use of GPS technology in dementia care was still in an early stage (up to 2014). There was little actual experience with the use of such services in any scale. At the same time, the legal framework in many countries has limited or prevented usage. In addition, Moser and Thygesen (2014) ask if the strong focus on ethical concerns is an ulterior motive, covering a skepticism in the health profession (and health research) towards technology-based care and accompanying competence requirements – a theme also touched upon by Nilsen et al. (2016) and Kleiven (2017).

With regard to the legal hindrances, the demands for informed consent has now become less rigid in Norway concerning GPS tracking (Nordby 2016). The Trondheim-pilot – that we have investigated – is one out of five, now completed national pilots. Other pilot studies have been carried out on local initiative. A number of research reports have been generated from these pilots, including Ausen et al. (2013), Berg et al. (2014), Schaathun et al. (2014) and Våge (2015).

The early reports of Berg et al. (2014) and Våge (2015) is very much in line the international literature, taking a critical stance towards GPS tracking and focusing on ethical dilemmas and immature technology. Ausen et al. (2013) – reporting from the Trondheim-pilot – has a broader thematic scope, dealing with organizational and competence issues as well. We will come back to this report later.

The aforementioned article of Schaathun et al. (2014) – with the literature review – also contains a second part where the authors analyze a trial with GPS tracking of demented people in the town of Ålesund in Western Norway. This analysis is interesting for our study for a couple of reasons. First, they identify a discrepancy in ethical viewpoints: "In the literature, the dominant view is of tracking as a form of restraint. In our trial, the dominant view of users and informal carers was that trackers gives greater freedom" (ibid: 84). This is in line with the positive attitudes we found among our informants as well.

However, in spite of positive attitudes, the Ålesund-trial experienced that the deployment of the tracking technology and integration into the daily routines of the users and their carers proved very difficult. Out of sixteen test persons, only five were

still using the GPS after six months. Through a dropout analysis, six reasons for these little uplifting results were discerned: Four of these were of technical character, related to user interface, technical functioning, battery charging and dislike of extra device to carry. The fifth reason was deteriorating health of the user, making tracking superfluous. The sixth reason is called "procedures" and was identified in four of the eleven drop-out cases.

Some more recent studies focus on relational and organizational aspects, when exploring the role of caregivers in adoption of welfare technologies. Friends, family members, and care professionals have a significant influence on older people's adoption of technology and their possibility of partaking in an increasingly digital society (Peek et al. 2017). This is especially evident if they offer support, guidance and training (Bouwhuis et al. 2012, Peek et al. 2017).

It is also argued that care professionals sometimes can act as gatekeepers and prevent older people's exposure to new technology (Hinder and Greenhalgh 2012; Sjölinder and Scandurra 2015; Sjölinder et al. 2017). However, this is not due to negligence, but rather misguided help given to the elderly (because they perceive them as uninterested, reluctant or not capable of adopting new technologies) in order to protect them, this view is based on an underestimation of the elderly's abilities to learn how to use new technology (Sjölinder and Scandurra 2015).

These newer studies point at the need for a more contextual approach to technology implementation. Schaathun et al. (2014) note that "reliable use depends not only on the technical system but also on good habits and interplay between the user and the formal and informal carers" (ibid: 82). Exactly this will be the starting point for our analysis. As we have seen, the research literature has so far been concerned with individual, ethical and technical challenges regarding GPS tracking – but has only recently started to give attention to relational, organizational and infrastructural issues. As Schaathun et al. comments: "Problems relating to procedures are much more fundamental than technical problems" (ibid: 83).

In the following, we will suggest a theoretical framework for performing a relational analysis of technologies in care that addresses these challenges.

Understanding Techno-Organizational Networks

In this article, we will use the term "the techno-organizational network" to denote how the implementation of the GPS technology involves the establishment and maintenance of a network where actors of various kinds are delegated different roles and responsibilities. Our approach is derived from Actor-Network Theory (ANT) and similar approaches within the interdisciplinary field of Science and Technology Studies (STS). As an introduction, we will point out two defining characteristics of ANT: it is a relational and a socio-material approach.

Firstly, ANT is not interested in identifying a priori qualities of actors, but how actors receive and change capacities through the relations they enter into. ANT is not interested in individual, but in relational explanations. Thus, we can already here see how this approach differs from much of the literature on welfare technologies, with its focus on lack of competence or motivation or the like as causes of implementation failure (Nordby 2015).

Secondly, ANT is concerned with understanding technologies not as detached devices, but through how they, correspondingly to the first point, enter into and obtain capacities through relations. ANT wants to counteract the separation of the technical and the social by analyzing its entanglement. We will argue that this offer an important adjustment and supplement to the understanding of technology that commonly underlies welfare technology projects. Either because of lack of awareness or language, the technical and the social are usually treated disparately and asymmetrically, with unfortunate consequences – a point we hope to elucidate through our analysis.

A concept that highlights the entangled and interwoven character of technical and social entities is the concept of "mutual shaping" (Oudshoorn and Pinch 2003). This concept is meant to highlight the double-sidedness of processes of technology implementation. On the one side, new technology transforms the social settings they are placed in. On the other side, the placement of technologies in new settings changes the technologies. Sometimes, the users of new technologies will modify the technology or give feedback that leads the producers to change the technology. But the point of "mutual shaping" is a more general and wide-ranging point – it includes, but is not confined to such "direct" interventions. When focusing on relations, the technology will be re-created whenever it enters into new contexts and surroundings. New meanings are ascribed, new tasks created, new effects produced, new networks established.

In its simplest form, the processes of "mutual shaping" can be studied through the relations developed between one technology and one user – as Latour (1992) has done in his example-studies of the hotel doors/keys and hotel guests. Similarly, Aaland (2014) has studied the relationship between mobile apps for GPS carers and the carers of the dementia patient. However, these technology-user relations are parts of larger networks. For a more comprehensive understanding of the range and crucial elements of effects created by placing new technologies in new contexts, it is usually necessary to study these networks in more breadth – a point completely in line with the general formulations of actor-network theory (Callon 1986; Latour 1987).

It is this we denote "the techno-organizational network", a term we have chosen because we will study the way the GPS technology becomes integrated in a network of different technological and social actors. We want to explore how changes in one part of the network – for example, the introduction of a new battery type and the inclusion of a new patient – not can be perceived as isolated events, but has effects in other, sometimes "remote" parts of the network. The term is cognate with other ANT and STS terms such as socio-technical networks (Callon 1986), socio-material networks (Latour 1987), heterogeneous networks (Law 1994), mixing of humans and non-humans (Latour 1993), cyborgs (Haraway 1991) and hybrid collectives (Latour 1993) – all developed to capture the mutual, entangled relations of the social and the technical. We use the "network" term instead of newer terms such as "assemblages", "collectives" and "cyborgs" because of its familiarity. "Techno-organizational" is chosen because our focus is on technology implementation that involves formal organizations and their structure, policies, culture, values, norms and beliefs.

ANT has developed a rich tool-kit of concepts to analyze the construction of such networks. We will accentuate our analysis around the concept of "delegation", which denotes how the various human and non-human entities are ascribed different roles and responsibilities in the network. In Latour's (1992) famous example-article, he illustrates the concept by showing how different types of hotel door and key designs delegates

different roles and responsibilities to the doors/keys and the hotel guests respectively. However, in more complex setting, it is obviously not only the relations between the user and the technology that are changed. When a new technology are introduced in care, a more extensive delegation of roles and responsibilities among all involved actors takes place.

Moser and Thygesen (2013) make the pertinent point that introducing new technologies in care is about much more than a transposition of roles from humans to non-humans. When some tasks are delegated to technological artefacts, other new tasks appears that has to be delegated (e.g. charging the battery of the GPS device, reading and interpreting the movement of the GPS, maintaining and repairing the device). Fundamentally, introducing new technologies implies that the networks involved in care will be altered and extended and have to be redefined and delineated anew. New types of actors enter, and roles, responsibilities, rights and relations change. Ultimately, this creates new forms of care, with new content, values and ideals (Moser and Thygesen 2013; Kiran 2017).

Along with the introduction of new technologies come some (more or less) specified goals, e.g. improved quality of the patient's life for, better quality of home care, more rational resource allocation etcetera. Whether these goals will be achieved, are, in actor-network terms, dependent on a successful delegation of roles and responsibilities. In turn, the acceptance of the ascribed roles and responsibilities hinges, according to Callon (1986, 1991) on the interessement and enrolment of the necessary actors and the alignment of the different interests and expectations of the various actors in a shared scenario, so that the network works towards the same goal.

In the classical formulations of ANT, such as Callon (1986, 1991) and Latour (1987), the ultimate goal of network construction is stabilization. According to later, internal criticisms, this represents a theoretical defiance or weakness of the analytical framework, partly because it in many cases will be a practically unattainable and/or politically undesirable outcome. Thus, later formulations of the theory has focused on how networks cope with changeability and uncertainty (Law 2004; Asdal et al. 2007).

The Techno-Organization of the Post Safe Tracks Phase

In the spring of 2016, when we did our interviews, the GPS service in Trondheim was in a transition phase. The municipal service had been established on a project basis as part of the national research program "Safe Tracks", which ran from 2011 to 2015 (see Ausen et al. 2013; SINTEF 2015; Svagård et al. 2015). It was formally finished in December 2015. The GPS pilot had also been part of "The Mid-Norwegian Welfare Technology Program", that ran from 2012 until 2014 (Våge 2015). However, in Trondheim the service carried on as a small-scale service being offered to the patients recruited during the Safe Tracks period and the occasional inclusion of (a very small number of) new patients recruited on requests from relatives or field-workers. At the time of our interviews, the service was offered to nine patients in total.

The goals for the GPS pilot in Trondheim, from the perspective of the municipality, was bipartite. As part of the Safe Tracks program, they should contribute to the development of national guidelines for the establishment of GPS services in the dementia care. In parallel, the goal was to establish a permanent service locally.

In the following, we will give a brief sketch of how the service came to be organized in Trondheim, with an overview of the most important actors and their roles and responsibilities.

The GPS device is usually a small unit that placed on the dementia patient, either attached to a walker, around the wrist, used as a necklace or laid in a pocket or purse. At the time of our study, there were several vendors developing and delivering GPS devices and associated support systems to the project in Trondheim, differing somewhat in design, set-up and features. All devices have *an alarm button*. When the user presses the button, a text message is sent to a predefined phone number with the device's location. Many devices are set up with a listening feature. In case of a difficult situation, the recipient can call the device and thereby create a voice connection without the user actively responding to the call. Some devices are also set up so that the GPS user can dial out.

Today, *the battery* capacity of the devices is limited and requires regular charging. This means that the GPS device must be moved away from the user and placed in a docking station every day. For some users, it may be necessary to create *a geofence* of *RFID readers*, these are "electronic fences" that define areas a person can use. A user may more or less move freely within this area, but if he moves outside the fence, an alert will be sent to a predefined recipient. For these users, a device with *a built-in RFID chip* is offered.

The recipient of the GPS alerts depends on the set-up of the user's actor network. Recipients can be relatives, nurses at an elderly home or the Signal Receiver Unit at the Safety Alarm Patrol. Location information is communicated, either in the form of the nearest address or as highlighted on a digital map that can be read through authorized smartphones, tablets, or computer monitors. In addition to map information, the GPS device can provide SMS and email alerts to notify if the device has low battery, no communication or that the user has triggered the device's alarm button and needs assistance.

The responsibility for deciding whether a potential user will be offered the GPS service, rests on *The Health and Welfare Offices* in Trondheim's four city districts, which consider the needs of the users and take decisions on which services are to be granted. *The Occupational Therapy Unit*, an intercommunal unit, are then given the responsibility for conducting a throughout and detailed mapping of the user. This is done through interviews with the dementia patients and their relatives, together with observations of the patients' functional level and movement patterns. This unit, together with the Health and Welfare Offices, will later do follow-up evaluations as well.

The detailed mapping are then handed over to *The Safety Alarm Patrol*, a unit responsible for the various types of safety and health alarm services offered by the municipality. The Safety Alarm Patrol are responsible for the deployment of the GPS device in first hand, usually together with The Home Care Service, and for instructions and training of the dementia patients, their relatives, other care persons and the home care employees. Furthermore, they run a round-the-clock alarm service and co-operate with the emergency clinic, the ambulance service, the police and the fire brigade.

The Safety Alarm Patrol are not supposed to assist in health-related tasks, but expected to relieve *The Home Care Service* for maintenance tasks related to the. GPS technology. The Home Care Service, in turn, is responsible for the daily follow-up of

patients living alone. This involves ensuring that the GPS device is functioning, that it is charged, turned on and carried with the patient out.

Relatives can be responsible for both the reception and the daily follow-up of the patient. In such cases, relatives often live with the user and have the possibility to locate the person using the mobile phone. In such arrangements, The Safety Alarm Patrol act as a backup. In the next section, we will look closer at two cases that illustrate the variety of such arrangements.

Then there is *the dementia patient*. A typical candidate is in the early stages of the disease, but the disease has started to make physical activity unsafe. The main purpose of the service is to provide increased safety for the patients and give them the opportunity to uphold their level of physical activity. It is desirable that the patient as far as possible is able to operate the equipment himself.

While this can be depicted as the core set-up of the techno-organizational network, other actors can have a more or less permanent or important role in some circumstances or related to specific tasks. We have already mentioned *the other emergency services*. Among these additional actors are also *other healthcare professionals*, e.g. in auxiliary or rehabilitation institutions, day care centers and retirement homes. *Legal expertise* in the municipality and county administration needs to be consulted on matters about informed consent and other legal and ethical issues. Cooperation with *technology equipment and network providers* are needed both for the implementation and running of the service.

We have tried to visualize the range of human and non-human components of the techno-organizational network in the table below:

The techno-organizational network

Technical elements:	Organizational elements:	Surrounding elements:
The GPS device	The Dementia Patient	Other Emergency Services
The Alarm Centre	Relatives	Other Healthcare Professionals
The Battery	The Safety Patrol Unit	Technology Equipment and Network Providers
The Alarm Button	The Home Care Service	Legal Expertise
Geofences	The Occupational Therapy Unit	Convalescences Homes
The RFID Chip	Health and Welfare Offices	More peripheral relatives
Homes		
Physical Surroundings		

The table gives us an indication of the complexities involved in the establishment of a service that at first glance may seem easy to put up. It is not only about bringing in new technology, but involves the arranging of a highly compound network where a broad range of human and non-human actors are delegated new roles and responsibilities. Also, it has been necessary to interest and enroll new actors and new competencies, thus redefining who and what are engaged in healthcare.

We can understand the techno-organizational network outlined above as a temporarily attempt at aligning and stabilizing a GPS service in Trondheim. The goal of the Safe Tracks Program was to use the experiences from Trondheim and the four other pilot municipalities to develop national guidelines for the use of GPS tracking in

dementia care. These have been published in a SINTEF report (SINTEF 2015), and have the form of generative procedures and principles accompanied by lists of questions that each municipality must assess and adjust in relation to local conditions and resources.

It has also been published a more technical report, with advice to the municipalities with regard to acquisition and purchase of GPS equipment (Svagård et al. 2015). These guidelines are more specific, e.g. that the GPS device must be able to attach to the user, should be easy to use, with as few buttons as possible, must allow for two-way communication and have high battery capacity. Furthermore, the support systems have to be open and compatible with other systems, and the receiver interface has to be intuitive and easy to use for health workers and include alerts for "low battery" and "no communication". In the spring of 2016, Trondheim was, together with a couple of other municipalities in Mid-Norway, in the process of collecting tenders from different suppliers of GPS systems, using the technical report as a basis for specifying requirements.

However, there was more uncertainties related to the maintenance of other aspects of the techno-organizational network. So far, the network had continued along the tracks lied down in the Safe Tracks Program. The local project manager Pernille was still employed on a temporarily basis to uphold the operation of the service. Still, while the project had contributed to the development of the national guidelines, these were, as said, of a general nature, and there was no publicized descriptions of local roles and procedures. Delegation of roles and responsibilities had been done, but documents with explication of who should do what in which circumstances was not available in the network. Information about roles and responsibilities flowed orally between the project manager and the other human actors.

Thus, Pernille had the role of an "obligatory passage point" (Callon 1986; Latour 1987). Much of the communication and all important decisions had to pass through her. In the spring of 2016, Pernille had all the necessary knowledge to run a GPS service, and had to mediate and translate that knowledge throughout the network. However, since she had to act as an intermediary in the communication between the actors, that meant that interaction sometimes became cumbersome and created instability. Pernille herself acknowledged that the lack of formal delegation and clarification could be problematic:

> We have many experienced employees. Sometimes, I experience that they chose to do in another way than they have been told, because they think themselves that the way they have always done things are the best. And then it gets troublesome, because they do not know why they have to do things differently. We rely on tasks being done in a special way so that the next person on duty can do her job.

Another source of uncertainty and instability was related to the transition phase the running of the service was in. The network we studied built on the remains of the Safe Tracks network. In Safe Tracks, the local project management could interest and enroll actors with reference to the national research initiative. However, when the program ended in 2015, the actors' concrete motivation in generating knowledge about the practical use of GPS technologies and its effects vanished. Thus, the original reason for the establishment of the associations between the actors disappeared. Trondheim was

left with a network that was only partly enrolled and aligned, without a clear strategy for the maintenance and continuation of the network's knowledge, competence, resources and experience.

An appropriate description of the network we studied is perhaps not a pilot network, but an in-between pilots network – representing in some respects a transitional or liminal phase, a vacillating point in the longer story of the construction of GPS tracking as a healthcare service (Turner 1969). However, the liminality in this is possibly not unique, as transitions between different network phases seems to be the rule of such service developments. It is possible to present a quite long list of network projects that went prior to the one we studied: The work of the Stoltenberg II Government, The Hagen Committee, the two projects of The Norwegian Health Directorate, both the preparatory study and the main study of The Safe Tracks Program, preparation of changes in the Norwegian legislation, technology development and testing by the technology providers.

All these could undoubtedly have been analyzed in line with the techno-organizational approach we have taken here – as complex efforts of tying together technology development, societal healthcare needs, organizational structure and competence, and the more. Furthermore, more network projects are awaiting: The next step in Trondheim would be a new pilot phase, where the goal is to scale up from the nine users of 2016 to forty users, testing the technology offered in the tender. All this planned to lead towards the end result – a permanent service in 2020.

It is possibly quite typical for such projects that the technological objectives are well specified, while less effort is put into the explication and documentation of the requirements for having the technical and social/organizational elements to work together (see Moser and Thygesen 2014). Another observation we have done – presumably not unusual either – is that each of the network efforts have usually well-defined – but often quite narrow – goals, while the goals for the transmission of knowledge and competence from one project to another is at best vague or lacking altogether.

From inside the Network

So far, we have given an account of the techno-organizational network from, so to speak, *above*. We have pointed at some deficiencies in the network and indicated that these can have been caused by infirmities in the management of the project, or, more precisely, an insufficient perspective on the complexity of the implementation of technology in care. However, we have not yet problematized the assumption that such networks can be stabilized (given the right identification and remiditization of deficiencies).

In this second part of the analysis, this is exactly what we shall do – by going *inside* the network and see how it is experienced from the perspectives of two dementia patients and their carers. First, we will give a description of the life situation of the individuals in the two cases and use the differences between them to make a point about variety. Second, we go in some detail into two episodes that uncovered breaches in the techno-organizational network and use these episodes to make a point about uncertainty and indeterminacy.

Patient Per-Anders and Carer Katrine Per-Anders and Katrine are married and live together, both are retired and around 80 years of age. Both have been in reasonably good health up to now and led an active life after retirement with a lot of physical activity and travelling. One year ago, Per-Anders was diagnosed with dementia. The sickness has made it difficult for both to uphold these activities. For Katrine, the GPS service has been a great relief. It allows her to continue living a relatively active life, and it provides a feeling of safety, because when her husband is out walking or when she is out herself, she has the opportunity to locate him.

It is Katrine and Per-Anders who is responsible for charging the GPS, making sure it is with Per-Anders when he goes out. To ensure that the GPS device is used properly, routines were established early on. Per-Anders is in charge of placing the GPS device in the charger when he goes to bed, and put the device in his pocket when he gets up in the morning. But he does not always remember, so Katrine has to have an eye on him. Besides the phone calls Katrine receive when the GPS device is out of reach, they have little contact with the Safety Alarm Patrol. To Katrine and Per-Anders, the Safety Alarm Patrol act as a security and a back-up. If Per-Anders is in need of help and pushes the alarm button, and Katrine is unable to locate him, the patrol assists.

Patient Petra and Carer Kari-Anne Petra is retired, she lives alone, but has her daughter nearby. The GPS service has enabled Petra to keep living in her own home, even after she had been diagnosed with dementia. Her carers are her daughter and the Home Care Service. In Petra's situation, it is the Home Care Service that has the daily responsibility to charge the GPS and make sure that Petra has the device with her when she goes out. The Signal Receiver Unit receives notifications from the device, such as low battery, no communication or when the alarm goes off. Kari-Anne's responsibility is to locate Petra if the alarm goes off or if the home carers cannot find Petra. Unlike Katrine and Per-Anders, Kari-Anne does not have a location system on her mobile phone so she cannot locate her mother by markings on a map, but has to be guided by the Patrol if this is needed.

We have now given a short outline of the life situation of two patients. Even if Per-Anders and Petra have the same disease and are offered the same technology, other differences in their life situation has led to a very different set-up of the local techno-organizational network. The disease creates different effects, their general health situation is different, activities and interests are different. Not least, their care situation is very different. Per-Anders lives together with his wife Katrine and can rely on her for the daily follow-up of the GPS service, with supplementary back-up from the Safety Alarm Patrol. In Petra's case, a more complex delegation of roles have been necessary, involving a detailed arrangement of times and tasks between her daughter Kari-Anne, the Home Care and the Safety Central.

Despite the differences, there are some common traits in these two stories. Obviously, there is a point here about the importance of relatives as carers (see Nakrem and Nervik 2017, for a discussion). At a more general level, we should note that the GPS in itself does not solve any problems neither for Per-Anders nor for Petra. It is only through the establishment of a carefully designed delegation of roles and responsibilities and in a fine-tuned interplay between the technical and organizational elements that the service works.

However, it is difficult to be careful enough.

The Charging Incident Per-Anders was in some respects the "ideal" GPS patient. At least, he had developed an «ownership» to the GPS technology, in the sense that he himself took care of some of the daily routines related to the device, including charging. Each night when he went to bed, he placed the device in the docking station located at the bedside table. When Katrine went to bed, usually one hour later, the GPS was fully charged. But she allowed it to remain in the dock through the night, so that Per-Anders would remember wearing it the next morning.

However, at one point Katrine received an alert call from the Safety Alarm Patrol, warning that they had lost contact with the GPS device. Per-Anders and Katrine live in a flat with concrete walls, and the reason for the signal drop-out was poor indoor signal coverage. She was told to place the docking station in the windowsill, two small meters away from its current placing. However, this relocation caused a breakdown in their routines:

> Then he didn't remember to place the device for charging, because the docking station was no longer were it used to be.

This story illustrates how minor changes can cause major impacts. From the Security Patrol's point of view, the obvious solution was to reestablish the connectivity of the GPS device. But to reestablish the technology's connectivity meant breaking down the user's routines. With a relational perspective, it is easier to identify how this incident can be handled in different ways, e.g. by adjusting the agreement between the carer and the patrol. However, all solutions implies that the network is flexible and open for change.

The Convalescence Incident In the next example, the breakdown occurs at a completely different site in the network. As Katrine, Kari-Anne was positive regarding the GPS service. Her mother, Petra, was not as "adventurous" in her walking as Per-Anders, but since she lived alone, Kari-Anne expressed a great relief in knowing that it was possible to locate her anytime. However, she complained that the service appeared to be fragmented, based on her experiences when her mother was going away on convalescence stays.

As we saw, the daily responsibility for the service rested on the Home Care Service. But when Petra was going on convalescence, it was Kari-Anne's responsibility to make sure the GPS equipment was brought along. It is this passage from daily routines taken care of by the Home Service to convalescence stays that Kari-Anne found to be a defiance of the service. She experienced the communication between the different units in the network as poor:

> When mum was going at convalescence, the Home Care knew this, and I took it for granted that they would inform the Safety Alarm Patrol. But that didn't happen, and they called me to get information about where mum was […] The service seems very separated, the Safety Patrol is one thing, the Home Care is another, and Convalescence yet another.

From before, the Home Care Service and the Convalescence Home have had a taken-for-granted relationship with established routines. However, the introduction of new

actors, such as the GPS device and the Security Alarm Patrol, introduced some new elements in this relationship that had not been clarified. Likewise, from the view of the GPS network, convalescence introduced challenges not taken into account – both the need to re-delegate roles and responsibilities to ensure necessary communication flows and to enroll (potentially numerous) new actors, the staff at the Convalescence Home, in the network.

In the first part of the analysis, we gave a quite detailed account of the set-up of the techno-organizational network. In this part, we have seen how this set-up is challenged and made subject to negotiations and redefinitions in the encounter with practice. Basically, this is not happening because the set-up is defect, but because of the indeterminate variety of actors, relations and situations the network encounters. We have seen how the different life situations for the patients Per-Anders and Petra and their carers Katrine and Kari-Anne were very dissimilar and required a completely different accommodation of the service with regard to everything from roles to routines to responsibilities to relations. Furthermore, we have seen how seemingly minor displacements and omissions can cause breakdown. When roles, routines, responsibilities and relations are not in place, technology becomes an extra burden and concern instead of a relief and a gain.

The establishment of a techno-organizational network is not a drawing-board exercise, not a once-and-for-all task, not a finished or finish-able project. For every (little) new actor or every little change taking place – the docking station that is moved two meter, the patient that are granted a convalescence – the network is prone to alternation. Of course, thousands of other things than the two incidents we have reported could have happened – a new employee at the Safety Alarm Patrol, a relative taking a holiday, a leakage from a battery, a satellite falling from space. The real test for GPS tracking as a service in healthcare is whether one succeed in establishing a techno-organizational network that is robust, open and flexible enough to handle this variety and indeterminacy.

Conclusions

We started this article with a question about how we shall understand the role of technology in care. In the literature review, we showed that from a health-centered point of view, this question was often treated as a question about replacement. A strong ethical concern has been seen as a smokescreen for skepticism in the health profession and health research towards technology-based care (Moser and Thygesen 2014; Nilsen et al. 2016; Kleiven 2017). From a technology-centered perspective, focus has basically been on challenges of implementation. As a rule, this has been interpreted as failure or deficiencies with either the technology or the patient (see Nordby 2015; Schaathun et al. 2014).

Our alternative has been to argue for an analysis that understands the introduction of new technologies in care as the formation of new relations and new types of associations between technology and the organization of health care. This is what we have termed techno-organizational networks. Throughout the analysis, we have tried to point out and exemplify some of the concrete gains of such a perspective both for practitioners and researchers in this field. We will now assemble our arguments in three cumulative points.

First, there is the argument about *thinking about the implementation of technologies in care as relational, networked phenomena*. Implementation of new technologies cannot be understood as stand-alone events. We have tried to underscore this point by showing how a seemingly simple introduction of GPS devices in dementia care involves the set-up of a complex techno-organizational network. This set-up implies an extensive delegation of new roles and responsibilities, the development of new routines and practices, requires the enrolment of new actors and competencies, and demands interplay and alignment of a broad range of human and non-human actors. Fundamentally, introducing new technologies implies that the networks involved in care will be altered and extended and have to be redefined and delineated anew.

Second, our argument is that we have to *understand networks of technologies and care as continuously evolving phenomena*. In the second part of the analysis, we saw how Petra's convalescence stay caused uncertainty with the Safety Alarm Patrol about where she way and which routines to follow if an alert or alarm was activated. This, in turn, resulted in extra burdens and concerns for Petra's daughter Kari-Anne, who had to tackle the unforeseen breakdown of routines, and it resulted in negotiations and re-delegations of roles and responsibilities with the Home Care Service. Similarly, the charging incident Per-Anders and Katrina experienced shows us how changes in one actor causes changes throughout the network. Such changes takes place all the time. There is a continuous influx of new actors with new competencies, experiences and needs that demands a more or less continuous reconstruction of the network. Thus, we need to follow the development of techno-organizational networks over time to assess whether they are robust, open and flexible enough to deal with variations and alternations.

Third, our last argument is an argument about *paying special attention to transitional phases*. This is a more specialized argument that come out of our study of what we suggested could be called an "in-between pilots phase". We pointed at how our network had a number of precursors in projects that had addressed specific aspects of the construction of a GPS service – and how more follow-up projects were being planned or under way. Based on our case study, it seems that each of the projects usually have well-defined – but often quite narrow – goals, while the goals for the transmission of knowledge and competence from one project to another is at best vague or lacking altogether (see e.g. White Paper 16 2011; Ausen et al. 2013). We have found support for our observations in an article by Moser and Thygesen (2014) where they criticize what they call "narrow projectery" – an obsession in the Norwegian health care system to launch new projects without following them up. Our argument can be seen in the prolongation of this critique, pointing at a special need to investigate the transition and transfer between projects – and to not let our interest vanish as projects eventually enter into regular operation. "Regular", that is.

Compliance with Ethical Standards

Conflict of Interest We state that there is no conflict of interest related to this work.

Informed Consent Informed consents were received from all informants.

Ethical Treatment of Experimental Subjects (Animal and Human) All procedures performed in this research is in accordance with the ethical standards of and with approval from NSD (The Norwegian Social Scientific Data Handling Organization).

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