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EDITORIAL

Spaces between: qualitative and quantitative research epistemologies

By Roger A. Søraa

There is an increasing interest in Science and Technology Studies (STS), as the field experiences growth with respect to the scope of topics, methods and theories deployed to learn and uncover epistemic practices for scientific knowledge production, technological innovations, users and producers. Traditionally, STS has been interested in fascinating case studies – often investigating and/or utilizing qualitative research method-ologies to explore quantitative methodological epistemologies – while also absorbing these, e.g. in innovation studies. In the early stages of the field, this related to the 'cultural turn' and the untangling of the ruling epistemic positivism, giving birth to a mode 2 rephrasing of how to understand the complex entanglement of epistemic practices of scientists and technologists.

In this Issue 7(2) of the Nordic Journal of Science and Technology Studies, we present to you two articles, one book review and one opinion piece that each have their own take on how knowledge is produced. Whereas the articles focus on the health domain, the book review and opinion piece focus on energy and climate – both fields that are highly relevant to STS, perhaps now more than ever due to health and environmental crises threatening anthropocentric ontologies.

The first article of this issue: "It is not a pill: Uncertainties and promises in the entanglements of qualitative and quantitative medical research" by Doris Lydahl juxtaposes a seemingly paradoxical Swedish case in which a randomized controlled trial – the golden standard of quantitative research in medicine – was used to evaluate person-centered care – which is a rather experimental qualitative approach to medical practice.

A somewhat similar focus can be seen in the second article by Dixi Louise Strand: "Reframing translational research as transactional research: An analysis of clinician-scientists' work practices in a Danish hospital setting," which looks into the everyday work practices and commitments of clinician-scientists in Denmark. The article problematizes the space between academia and clinical health care by asking both how multiple domains are integrated and translated by clinical-scientists and how they continually negotiate these complex interactions.

These two articles inspired our frontpage for the issue, featuring "Just a Pill." Pills have a long history in STS research, unsurprisingly, as pills have been used as long ago as 1500 BCE. One of the drawbacks of pills is that they are hard to swallow. Medieval remedies for this difficulty suggested coating them in gold or silver. This would, however, render them useless, as they would go directly through the digestive system with little effect. In a similar way, society today seems to be screaming for pills for a multitude of challenges– e.g. health and climate, as is the focus of this issue – even when such solutions are not easily packaged and absorbed into the system.

The issue also features a book review by Antti Silvast, who discusses two books: "The Promise of Infrastructure" (2018) and "Electrifying Anthropology: Exploring Electrical Practices and Infrastructures" (2019). The review is concerned with how anthropological approaches can address energy issues and sustainability transitions, asking how different interdisciplinary approaches dilutes different answers to these large and important questions.

These threads are also important in Anders Blok's opinion piece "How to deploy STS to re-imagine sustainable ways of instituting climate expertise?" Working from a Danish perspective, he illustrates post-normal science discourses in the framing of the un-sustainability of industrial society, drawing on Latour to emancipate STS scholars from the "science-against-policy" discourse we often find ourselves trapped in.

The four papers each contribute to different parts of understanding the liminal spaces in which STS scholars are experts in uncovering practices, frames and epistemologies that are often overlooked by more conservative disciplines. If society and policymakers want science and research to produce comfortable, easily digestible pills as remedies to modern ailments, it is our job as STS scholars to unpack these phenomena. Only then can we begin to make meaningful distinctions between true panacea, and gold plated promises made to pass through the system without bringing about any meaningful change.

References

Nikhil Anand, Akhil Gupta and Hannah Appel (eds) (2018) The Promise of Infrastructure. Durham, NC: Duke University Press. 264 pages. ISBN: 9781478000181

Simone Abram, Brit Ross Winthereik and Thomas Yarrow (eds) (2019) Electrifying Anthropology: Exploring Electrical Practices and Infrastructures. London-New York, NY: Bloomsbury Academic. 214 pages. ISBN: 9781350102651

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'IT IS NOT A PILL':

Uncertainties and promises in the entanglements of qualitative and quantitative medical research

by Doris Lydahl

Person-centered care seeks to improve health care by recognizing the individual patient's unique experience and by acknowledging the patient as an active and responsible participant in their own care. It is also conceptualized as a reaction to evidence-based medicine, opposing its alleged reductionist and exclusionary tendencies. Therefore, person-centered care is often conceived as different from evidence-based medicine, taking into account the combined biological, psychological and social identity of the patient which evidence-based medicine reduces to a set of signs and symptoms.

In this article, I analyze a paradoxical case in which a randomized controlled trial was used to evaluate person-centered care. Drawing on five interviews with researchers involved in this trial and on research documents and articles, I examine the entanglement of person-centered-care and evidence-based medicine from an STS perspective of standardization, uncertainties and promises. I first discuss the uncertainties and promises that emerge when trying to follow a research protocol. Second, the article illustrates the uncertainties and possibilities in knowing exactly what one measures. Finally, the article discuss the creation of a standard person. The article concludes that while the relation between person-centered care and evidence-based medicine is more complex than we might assume, the randomized controlled trial also transformed person-centered care in the process of evaluating it.

Keywords: Person-centred care, evidence-based medicine, standardization, uncertainty, promise

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> *For the master's tools will never dismantle the master's house.* They may allow us temporarily to beat him at his own game, but they will never enable us to bring about genuine change. (Lorde 1983: 27)

Introduction

Standardization in general and in clinical practice in particular has long been a subject for discussion and controversy in the social sciences. Evidence-based medicine is a movement of standardization in health care and medicine that has been especially controversial. While the phrase evidence-based medicine was first coined in the 1990's, it has been argued that it has a longer, and somewhat turbulent, history (Timmermans and Berg 2003). The methods of evidence-based medicine were already in use 70 years before it was coined and furthermore, some writers have argued that the 11th century physician Avicenna's approach to medicine resembles the principles and practice of evidence-based medicine (Shoja et al. 2011). Since the beginning of the 1990s when evidence-based medicine was established as a new paradigm, it has spread like 'wildfire' to every facet of the healthcare system of OECD countries, including the Nordic countries (Bohlin and Sager 2011: 13). Today, evidence is often seen as synonymous with evidence-based medicine. However, it has also long been a subject for discussion in the social sciences and humanities. Proponents of evidence-based medicine argue that it provides an unsurpassed way of integrating individual clinical experience with the best available evidence in making decisions about the care and treatment of patients. Opponents, on the other hand characterize evidence-based medicine as furthering a 'standard approach to health care problems advocated by the guidelines, in which every patient problem would be addressed generically, as one more instance of the same' (Timmermans and Berg 2003: 19). Moreover, evidence-based medicine has also been described as discriminatory towards women, by having medical procedures, instruments and samples being primarily of and for men (Epstein 2007).

Person-centered care is often depicted partly as a reaction to the rise of evidence-based medicine, opposing its allegedly reductionist and exclusionary tendencies. Although there is no universally agreed upon definition of person-centered care (Harding et al. 2015), it is commonly described as way of improving the health care system by recognizing the individual patient's unique experience, values and preferences while acknowledging the patient as a responsible participant in the development and evaluation of their own care (Hughes et al. 2008; International Alliance of Patients' Organizations 2007). Therefore, person-centered care is often conceived of as the antonym of evidence-based medicine; it takes into account the combined biological, psychological and social identity of the patient which evidence-based medicine reduces to a set of signs and symptoms (Mead and Bower 2000). For this reason, evidence-based medicine and person-centered care have been described as belonging to separate worlds which are not easily brought together (Bensing 2000).

In this article, I analyze a paradoxical case in which a randomized controlled trial was used to evaluate person-centered care. While randomized controlled trials are sometimes used to evaluate person-centered care in the OECD and the Nordic Countries, the most common assessment method is surveys and interviews with patients and professionals and observations of clinical encounters (De Silva 2014; Skudal et al. 2012). In contrast, the case under study in this article used a randomized controlled trial to determinate if the introduction of person-centered care in the management of patients with acute coronary syndrome – such as myocardial infarctions (also known as 'heart attacks') – would improve self-efficacy, reduce the duration of sick leave, decrease morbidity and increase activity compared to conventional care.

Person-centered care is commonly associated with a form of experiential qualitative medical knowledge rooted in clinical experience and worked out in everyday clinical practice, whereas evidence-based medicine draws on experimental quantitative knowledge generated in for example randomized controlled trials 'and worked out through the production of different kinds of clinical guidelines for practice' (May et al. 2006: 1022). Therefore, there is an interesting complexity to the case studied in this article. The randomized controlled trial analyzed in this article was set up because previous research on the benefits of person-centered care was conceived of as being too abstract and descriptive, and therefore not able to provide evidence of the potential benefits of person-centered care or how to implement it. The motivation for the randomized controlled trial was therefore to produce concrete and straightforward evidence for the benefits of person-centered care. Although person-centeredness can be argued to be a response to the proliferation of evidence-based medicine, the tools of evidence-based medicine were in this case used to test the benefits of person-centered care.

Drawing on interviews with researchers involved in conducting this trial and on research documents and articles, I examine how person-centered care and evidence-based medicine were interwoven and what uncertainties and potentials emerged. More specifically, I discuss how these uncertainties and promises were understood, reflected upon and handled in practice. How did

researchers combine an ambition to emphasize the uniqueness of the individual with the aim of extrapolating from knowledge about a few to produce guidelines for the many? Finally, I address the consequences: what comes out of the mutual interference of evidence-based medicine and person-centered care, as they are examined and performed together?

Standards, uncertainties and promises in care and medicine

To understand the puzzling relationship between and the entanglement of standardization and person-centered care I draw on Science and Technology Studies (STS) theories of *standardization, uncertainties* and *promises* in research and medical practice.

STS researchers have suggested that the relationship between evidence-based standardization and person-centered care is more complex than suggested above. For example, van Loon and Zuiderent-Jerak (2012: 122) argue that person-centered reflexivity and standardization need not to be opposed, but can rather be intertwined. Zuiderent- Jerak (2007; 2015) has made a similar argument in his research on integrated care pathways. He argues that standards developed in practice that take into account local organizational complexities can actually further person-centered care. Lydahl (2019) has similarly argued that mundane standardization technologies can be integral components of person-centered care.

STS-scholars have further noticed that standards are ubiquitous in health care at large and argue that they are 'a fundamental prerequisite of scientific medical practice' (Berg 1997: 25; Bowker and Star 1999). Timmermans and Berg (2003; see also Timmermans and Epstein 2010) divide such standards into four ideal-types: design standards, terminological standards, performance standards and procedural standards. The first specify the desired properties of tools and systems. The second establish uniformity in the meaning of concepts. The third specify expected outcomes, and the fourth are used to govern the way different things should be done. This last type of standard has been especially important in modern medicine in the form of clinical guidelines.

Clinical guidelines are one of three main components of evidence-based medicine (Bohlin and Sager 2011). The first is the randomized controlled trial, also known as the 'gold standard' of modern medical research because it is regarded as superior to other means of assessing the results of an intervention (Timmermans and Berg 2003: 27; Timmermans and Berg 1997). Randomized controlled trials are experimental research for testing new treatments or interventions. The test subjects in a trial are randomly allocated either to a group receiving the intervention, or to a control group, not receiving the intervention. Often these trials are double blind, meaning that neither the test subjects nor the researchers know who is getting the intervention and who is not. Researchers use randomized controlled trials to evaluate both the effects and the effectiveness or efficacy of an intervention. Randomized controlled trials have become increasingly popular both in medicine and, for behavioral studies, in social science (Deaton and Cartwright 2017). The second component of evidence-based medicine is the meta-analysis: a statistical technique used to combine the results of several randomized controlled trials. Advocates of meta-analyses claim that such analysis provides more accurate estimates of the effects of an intervention than an individual randomized controlled trial. Lastly, clinical guidelines translate the knowledge gained in randomized controlled trials and meta-analyses into protocols and checklists to be used in clinical practice (Bohlin and Sager 2011: 14).

In this article I build on Epstein's (2007) theories about diversity in medical research to understand how the researchers in the case I study combined the uniqueness of the individual with an aim to extrapolate from knowledge of a few to produce guidelines for the many. In relation to this, it is important to keep in mind the critiques of randomized controlled trials. One such critique is that randomized controlled trials build on a biased and exclusionary approach to knowledge making. In his study on changes in biomedical policy in the U.S, Epstein (2007) argues that politicians, activists and medical professionals in the 1980's joined forces to form an 'antistandardization resistance movement'. This movement accused biomedicine of generalizing results and constructing a non-representative standard human: a white middle-aged man. Biomedicine is one of the most notorious producers of standard humans as medical experiments imply that knowledge gained from limited groups of individuals can be considered generalizable to the human population as a whole. Even the limited groups of individuals participating in experimental arrangements like randomized controlled trials must be standardized if the results of different tests are to be accepted as comparable. Thus, if human subjects are to successfully serve medical research purposes they must be transformed into standardized 'working objects' (Epstein 2007: 33). To achieve this, Epstein argues that three ideal typical strategies are regularly used. Either researchers assume that possible variations are of little consequence for their purposes, or they use very specific inclusion criteria and only enroll individuals with a controlled set of characteristics. Finally, different subpopulations of humans can be subject to separate or comparable study – a strategy also known as niche standardization (Epstein 2007: 33).

Standard humans are however not only created in medical research. Standards in general always imply the idea of a uniform user (Epstein 2009). Feminist STS-scholars have also theorized about the consequences of standards. Notably, Star (1991) argues that as standards produce their own standard users, they will also produce their own 'monsters' or abnormalities – those who do not

fit the standard. These abnormal users are either otherized or they are silenced.

In her study on the *promises* of telecare technologies, Oudshoorn (2011) similarly shed light on those whose perspective are silenced or made the other. According to Oudshoorn, promises are important object of study because technologies – such as standardization tools – cannot exist without promises. Promises are performative because they can be considered enactments of a sought-after future (Oudshoorn 2011:36). In this article, I draw on Oudshoorn to analyze the promises that emerge from the entanglement of person-centered care and evidence-based medicine. In particular, Oudshoorn argues for the importance of a sensitivity concerning what problems a promise aims to solve, whose need and worries are addressed in a promise and whose perspective are taken into account. In every promise or expectation, she argues, 'some actors are foregrounded whereas the perspective of others receive less attention or are silenced' (Oudshoorn 2011:45).

Finally, I build on Singleton's (1998) theories about uncertainties and instabilities in medical research. In her groundbreaking work on the role of the laboratory in the cervical screening program in the UK, Singleton (1998) discuss the importance and potentiality of instabilities and uncertainties. Rather than undermining the cervical screening program, Singleton argues that instabilities actually contributed to its continuity (see also Singleton and Michael 1993). Singleton contends that while a lot of uncertainties and instabilities characterized the laboratory practice of the cervical screening program, the laboratory continued to play its assigned role in the program. In other words, the laboratory continued 'to analyze samples and to make definitive diagnoses and recommendations' (Singleton 1998: 96). Moreover, she argues that the instabilities actually helped by creating flexibility and in making things doable. In addition, uncertainty is not necessary a sign of decreased validity, it can instead be interpreted as a commitment to the research and to the importance of discussing methodology. By redefining its role as complex rather than simple and straightforward, Singleton argues, 'the laboratory emerges as worthy of increased status and resources' (Singleton 1998: 98).

In what follows, I first outline my methods and materials. Thereafter I offer a description of a randomized controlled trial of a person-centered care intervention. In the subsequent sections, I discuss the uncertainties and promises emerging out of the combination of person-centered care and evidence-based medicine, as well as the consequences of such a combination.

Methods and materials

To study how person-centered care and evidence-based medicine were interwoven in a randomized controlled trial, I draw on a combination of document studies and semi-structured interviews. To understand the technicalities of the trial itself I rely on research protocols, research applications and articles published in the trial. I gathered this material through regional R&D databases and literature searches. I also build on materials used internally in the trial, which were subsequently published. This material consists of a fictive care plan used for educational purposes, and an assessment protocol used in interviews with patients.

In order to examine how the uncertainties and promises that emerged were handled in practice, I draw on interviews with five researchers engaged in the trial: one PhD student, one junior researcher, one senior researcher and two senior professors. The interviews were conducted as part of a larger research project on the definition, operationalization, barriers and facilitators to person-centered care in research and clinical practice (for more information see Britten et al 2017; Moore et al 2017; Naldemirci et al 2018). I initially approached the researchers via email. The interviews were then carried out between September 2012 and May 2016. Four of these were recorded and transcribed verbatim, while I held the fifth over the phone while taking notes. Most interviews took place at the interviewee's workplace out of respect for their tight schedules, but one interview was conducted at the Department of Sociology, University of Gothenburg. The interviews generally lasted for about one hour (ranging from 20–78 minutes).

As the study does not include sensitive medical or personal information, ethical approval from the Regional Ethical Review Board was not deemed necessary. The study follows and utilizes the Swedish Research Council's ethical guidelines with its principles of information, consent, confidentiality and utilization (Vetenskapsrådet 202). To secure the anonymity of the participating researchers I have assigned each of them a pseudonym. Informed consent was received from all participants. The participants received written information before the interview which was discussed before the interview started. As this article is part of my PhD thesis, all researchers in the trial were invited to my public defense to discuss the results and analysis. However, no one chose to do so.

I used a purposive sampling strategy aimed at capturing several types of researchers, ranging from professors who were more or less only involved in the analysis of the material, to PhD students who were working more hands-on in the trial. The purpose of this sampling strategy was to get a broad view of the different kinds of uncertainties and consequences to be managed and negotiated. Still, it should be acknowledged that the interview material in this study is limited. When drawing on a small sample, it is not possible to make extensive generalizations. However, findings from the

analysis may be generalizable to theories that have a wider scope than the material presented here. Carrying out the interviews over a period of four years allowed me to gain insight to different phases in the trial. For example, I interviewed one researcher in May 2016 when the trial was finished. His account of the trial is therefore retrospective and reflective. In contrast, I interviewed another researcher during the first year of the trial. Her account is filled with hopes about the promises of the trial and of person-centered care at large.

For data analysis, I have made use of an abductive approach. Timmermans and Tavory define abductive analysis as a 'qualitative data analysis approach aimed at generating creative and novel theoretical insights through a dialectic of cultivated theoretical sensitivity and methodological heuristics' (2012: 180). As a form of reasoning, abduction depends on the interplay between observations and the researcher's theoretical disposition. Consequently, the researcher must begin with a familiarity with existing scholarship and theories while also having a willingness to abandon theories and think differently (Tavory and Timmermans, 2014: 42). Abductive inferences may be strengthened by 'actively look[ing] for cases that may challenge both the possible hypotheses they [the researchers] came to the field with and the framework they began with' (Tavory and Timmermans, 2014: 75). In this vein, I initially analyzed the material using a coding framework inspired by Epstein's (2007) perspective on standardization in medical researchers. I began with codes such as *challenges*, *tensions* and *consequences* and with sub-codes such as *method-challenge*, *tensions in evidence* and *standard humans*. After this round of coding, I noticed that I needed theory to understand the promises visible in the material. These promises challenged my initial ideas concerning tensions and challenges. I also decided that I needed a deeper understanding of the tensions in the material. Therefore, I reread and coded the material against Singleton (1998) and Oudshoorn (2011), after which I merged the *challenge* and *tension* code into a single code called *uncertainty*, with sub-codes such as *do-ability*, *strengthening validity* and *weakening validity*. Additionally, I coded the material for *promises*, with sub-codes such as *perspectives* and *silences*.

A randomized controlled trial for person-centered care

In recent decades, there have been numerous calls for greater patient involvement in the planning and delivery of care and an emphasis on taking patients' experience, knowledge and preferences into account. These calls have both been patient initiated (Lydahl 2017), and institutionally driven (Gerteis 1993). To date there have been several concepts responding to these calls. Person-centered care (McCormack and McCance 2010), patient-centered care (Balint 1969) family-centered care (Platt 1959), and client-centered care (Rogers 1951) all favor increased patient involvement, partnership and an improved social, psychological, cultural and ethical sensitivity to patient-professional encounters (Hughes et al. 2008). There are also a variety of frameworks and models for the operationalization of these concepts.

In this article, I study one such model of person-centered care developed at a University Hospital in Sweden and the endeavors to produce evidence for this model. This model involved a particular approach to patient participation and shared decision-making coordinated through the three person-centered routines of narrative, partnership and documentation. It was argued that adopting these routines would facilitate and safeguard the transition from existing health care to person-centered care. In summary, the model took its starting point in the patient's personal account of her illness. Building on this narrative and other relevant clinical information, a partnership in the form of a care plan was to be established and agreed upon. Both narrative and partnership were to be secured through the practice of continuous documentation.

Researchers had already attempted to produce an evidence-base for the person-centered care model for some years before the randomized controlled trial for person-centered care (from now on the PCC-RCT) was set up. This was done through a 'before and after design study' to investigate person-centered care in patients with chronic heart failure at five hospital wards. In this study, one group of patients received the 'usual' chronic heart failure care, and another group received care according to the person-centered care model in addition to usual guideline-based care procedures. Activities of daily living and health related quality of life were assessed when patients were enrolled in the study and when they were discharged from the hospital. The study found that person-centered care led to shorter hospital stays and better maintained levels of daily living activities. However, while this study pointed to the benefits of person-centered care, because it was not randomized, it did not live up to the gold standard of a randomized controlled trial.

It is commonly argued that randomization reduces bias, especially selection bias and confounding. Selection bias, i.e. when the research participant is not chosen at random, is argued to increase the risk of having a sample that is not representative of the population. Randomized controlled trials usually measures the association between two variables: the intervention and the outcome measure. Confounding refers to a third variable – one that is not tested in trial – that has an effect on the outcome measure. Therefore, studies aim to have a random distribution of confounders between the intervention group and the control group. In sum, randomization is thought to deal with the difficulties related to the fact that patients vary (Epstein 2007: 49).

Following the 'before and after design study', the researchers therefore decided to continue their research by undertaking a

randomized controlled trial design in order to implement and evaluate person-centered care.

Myocardial infarctions are one of the most common forms of acute illness in Sweden and one of the third most common causes of prolonged sick leave. Therefore, the researchers decided to design their randomized controlled trial for patients with acute coronary syndrome. This also enabled the testing of person-centered care over the complete care chain, i.e. not only in in-hospital care but also in outpatient and primary care.

The trial thus carried a lot of promises and expectations. It promised to solve the potential biases of the previous study and to provide an evidence-base for a newly developed model of person-centered care. Those whose needs and worries were primarily addressed in this promise were the researchers and the developers of the model of person-centered care. While the model itself promised to improve the situation for the patient, the perspectives of patients and healthcare professionals were less visible in the promise of the trial (For a discussion about the assumptions of this model see Naldemirci et al. 2018).

The trial hypothesized that the introduction of person-centered care in the management of patients with acute coronary syndromes would improve self-efficacy, reflected by reduced sick leave and morbidity and/or increased activity compared to conventional care. To test this hypothesis, 199 patients from two hospitals were randomly assigned either to an intervention group receiving person-centered care or to a control group receiving 'usual care'. In the following, I shall describe the intervention of the trial in more detail.

Intervention – implementing person-centered care

The PCC-RCT took its starting point in a structured process of narrative elicitation. According to the trial's research protocol, this was to take place at the hospital where a caregiver interviewed the patient. To organize narrative elicitation, an assessment protocol was developed for use in all patient interviews. The protocol began with four questions that aimed to define opportunities and problems in rehabilitation after acute coronary syndrome. Following these questions, patients were asked to judge their own medical condition and state of health using a variety of scales.

The narrative documented during these interviews formed the basis for an individualized care plan. According to the trial's research protocol, this plan should contain information regarding all follow-up actions, where these would take place, who the patient would meet and when, as well as what would happen – including the objectives about returning to a particular activity level. The protocol also emphasized that the care team and patient should both agree to the plan, which would then follow the patient and be updated and worked with throughout the care chain. It also emphasized that all caregivers needed to familiarize themselves with the care plan.

However, while the PCC-RCT aimed at implementing person-centered care over the whole care chain, it turned out to be quite a challenge to train all the hospital staff involved. Therefore, another approach was taken in practice:

> Since the PCC-RCT mostly focused on primary care we said: 'Okay how much should we train the hospital staff?' (…) we [knew we] would have to make a big effort. Therefore, what we did was that the research nurse elicited the patient narratives and wrote the care plan which was later sent to primary care (…) Every primary care team had to meet with the patient at least once, and then they could decide if they wanted to meet on more occasions (Researcher 1)

Consequently, rather than having a 'person-centered approach' over the complete care chain, in practice the intervention became focused on two particular actions. First, an interview between the research nurse and the patient after which the care plan was formulated. Second, a meeting between the patient and the doctor or nurse at the primary care center in which the care plan was further refined. In other words, designing tools like assessment protocols and care plans and getting the intervention to work was prioritized over training hospital staff – who might then end up failing to perform person-centered care in accordance with the approach defined in the PCC-RCT.

This instability in the trial can be interpreted in two ways. On the one hand, one could argue that the researchers contributed to the instability digressing from the research protocol by focusing the intervention on the two specific meetings rather than having an overall person-centered approach over the complete care chain. From this perspective, it seems as if person-centered care was so different from what the design of the randomized controlled trial depicted, that it could not be imposed on standard medicine without issues.

On the other hand, I would also argue that what could be seen as a digression from person-centered care could also be interpreted as a commitment to person-centered care and to make the trial doable (Singleton 1998; see also Fujimura 1987). From this perspective, the temporary instability, and thereby the do-ability, was necessary in order to achieve stability for person-centered care in the longer run. In the hierarchy of evidence, meta-analysis of randomized controlled trials is given the highest grade (Greenhalgh 1997), while qualitative research does not even qualify for the hierarchy. To gain impact and to be listened to the researcher felt that they needed to produce evidence that qualifies and ranks high in the hierarchy of evidence. From this perspective, it makes perfect sense to prioritize the development of the technologies of person-centered care enabling the production of evidence.

This can also be interpreted as a promise of the PCC-RCT. Several researchers emphasized how if there was a standard for

person-centered care, such as a clinical guideline, dictating what person-centered care is and how it should be performed it would facilitate the uptake of person-centered care:

> I think what would be valuable, would be some kind of a certification like the one you have with other quality standards. Because then people or wards or care centers could request to become certified and then someone else would find out if they are working according to person-centered standards and I think that not only would this speed the uptake of this but it would also help us doing research and applying for funding (Senior Professor).

This account imagines a desired future (Oudshoorn 2011) where the person-centered standard would act like an obligatory passage point (Callon 1984) for anyone doing research or funding research on person-centered care. The promise – that person-centered care organization and research would gain legitimacy – is chiefly reflective of the organizational and research perspectives. While this by extension includes patients and healthcare professionals, they were not clearly visible in this articulation of the promise of person-centered standards.

'It is not a pill' – on the problem of intervention variation

One of the main uncertainties in the PCC-RCT was in relation to variation, control and effect. One of the researchers very aptly described the problems that arise from using a method developed to test the effects of drugs on something that concerns relations and partnership:

> ...because person-centered care, it is not a pill. In other studies, like when you have studies on medication, so testing new medication, one will have like a sugar pill and one will have [an] active [substance]. Then you know that you have one group that will take this control sugar pill and the other one is eating the active substance. Then you will know when you are evaluating, 'okay, it must be the pill that is responsible for changing the blood pressure in a positive direction'. But person-centered care it's not a pill that you, like, swallow; it's more complicated, it's about philosophy (Researcher 2)

In other words, when testing person-centered care through a randomized controlled trial there was a problem of knowing exactly what it was that gave effect. Although the PCC-RCT was built as a proper randomized controlled trial with one control group and one group receiving the intervention, it turned out to be difficult to decipher which of the different, interwoven, relational and contextual components of the intervention produced an effect:

> I still have no idea what it is in person-centered care that gives effect. Is it that we have structured the care path? Is it that a patient feels recognized? Is it that the professionals get to work more in accordance with their capabilities? I do not know. Moreover, because it is so complex – I have said that this is a complex intervention. We have to evaluate it holistically; we cannot remove any parts. A biomedical randomized controlled trial does not want to see the whole picture, they just see the part that they are testing and if it has any effect. (Researcher 1)

This account nicely mirrors a tension present in research about person-centered care. This tension concerns the relation between the whole and the parts of person-centered care, for example between seeing person-centered care as an overarching holistic approach or something that can be operationalized. Several well-cited scholars in the health care sciences have argued that while person-centered care is widely used it is also poorly understood and ill-defined and have therefore called for a specification and/or operationalization of person-centered care (Stewart 2001; Mead and Bower 2000). Similarly, it has been claimed that person-centered care is a 'fuzzy concept' that is often recognized but 'difficult to operationalize in measurable elements' (Bensing 2000: 21).

Against this background, there has been a plethora of articles that attempt to pin down the core elements or indicators of person-centered care (Hughes et al. 2008). In the excerpt above, the researcher offered three potential explanations of what it was in person-centered care that gave effect. Perhaps it had to do with the continuity of care and the importance of having a structured care path. Another explanation was that it had to do with patients feeling recognized. Finally, it could be related to how the professionals work more according to their profession. All of these have been argued as important aspects in both the implementation and evaluation of person-centered care (Hughes et al. 2008; Gerteis 1993). At the same time, others argue that person-centered care is part a holistic paradigm best understood as 'complex phenomena, and multidimensional concepts, lacking single definitions' (Harding et al. 2015: 15). The researcher above was torn between wanting to identify discrete components of person-centered care and also wanting to keep the whole intact. Keeping the whole intact comes with the price of uncertainty – of not being able to specify what it was in the PCC-RCT that gave effect.

However, this uncertainty can also be put to use as an advantage. The researcher above distinguishes between what he called 'biomedical randomized controlled trials' and randomized controlled trials that take the whole into account. In this sense, he used the holistic perspective to criticize biomedicine. In other words, while the PCC-RCT made use of a biomedical method there was still an implied critique of biomedicine for not seeing the whole but only the parts. In saying 'We have to evaluate it holistically; we cannot remove any parts', the PCC-RCT is positioned as a non-biomedical trial. Not knowing what it was that had an effect was thus mobilized as advantage. Uncertainty is therefore not necessarily a problem; it can rather be seen as a confirmation of rejecting reduction and simplicity. Again, like in Singleton's study (1998), uncertainty can be seen as a commitment to validity and, more generally, as a commitment to the importance of discussing research design.

The standard person

There was significant ambivalence in the PCC-RCT between the demands posed by evidence-based medicine – in terms of who is eligible for an intervention – and the desire to value each patient as a unique person that is at the heart of person-centered care.

As argued by Epstein (2007) human subjects must be transformed to standardized working objects if they are to successfully adhere to the rules of medical research. Therefore, in accordance with the rules of evidence-based medicine, not all persons could be considered eligible for the PCC-RCT. To decide which persons to enroll in the trial a set of inclusion and exclusion criteria was formulated. Persons eligible for the study were men and women under 75 years of age hospitalized for acute coronary syndrome who have a diagnosis of acute myocardial infarction as defined by a set of medical criteria confirmed by a physician. Yet, to conform to these criteria was insufficient to ensure inclusion. A patient could also be excluded from the study if one or more of the following exclusion criteria applied:

- Not willing to participate
- No registered address
- Currently a patient in private primary care
- Severe disease with morbidity as expected outcome
- Severe disability like cognitive impairment or mental disability
- Abuse of alcohol or drugs
- Migration from the municipality
- Performed coronary bypass surgery during hospitalization

Following Epstein's theories, it is clear that the PCC-RCT created a standard person in this process of creating a working object through inclusion and exclusion-criteria. This imagined standard person was rather young (given that myocardial infarction is more common in patients over 75 years), had a home, did not have any substance abuse problems and did not suffer from any cognitive or mental disability such as dementia. To cope with the problem of having human subjects as working objects the PCC-RCT consequently made use of the second ideal type strategy identified by Epstein: only enrolling individuals with specific characteristics (Epstein 2007: 33). One of the researchers discussed the reason for insisting on specific criteria in the following way:

> You need to have a homogenous group because otherwise you will compare apples and oranges. (Researcher 1)

If the control group and the intervention group were too different then comparison of the results would be difficult, if not impossible. This is a general principle in randomized controlled trials. While the randomization partially takes care of the problem of variation, strict inclusion and exclusion criteria are, according to Epstein, often mobilized to:

> create a more standardized and homogenous research population for a study, based on the argument that the more researchers succeed in reducing the number of variables that might affect a study, the easier it will be to distinguish 'signal' from 'noise'. (Epstein 2007: 49)

By using strict inclusion and exclusion criteria the researcher hoped to be able to separate out the apples from the oranges. He thus returned to the idea of measuring the effects of person-centered care but this time he viewed uncertainty of knowing what gave effect as more negative than positive. Uncertainty thus seems to have a dual position in the PCC-RCT. Sometimes uncertainty was argued to be a rejection of simplicity, but at other times, it was seen as making the production of evidence more difficult.

Several issues can be raised in relation to the question of inclusion and exclusion. Following feminist science studies (Haraway 1988; Moser 2005; Oudshoorn 2011; Star 1991), we can ask: What bodies are made silent? Moreover, what are the spillover effects or consequences of constructing such a fitting person for person-centered care? I will address this topic below. First, however, I wish to highlight an additional issue.

As I have previously emphasized, person-centered care is often depicted as a response to the rise of evidence-based medicine, with its alleged reductionist and exclusionary tendencies. In an article on 'the separate worlds' of evidence-based medicine and person-centered care, Bensing (2000), a clinical psychologist, argues that randomized controlled trials by nature are not patient-centered since patient characteristics are often considered to be 'noise' that might disturb the results of a study:

> Patients who are too old, too young, too illiterate, or suffer from comorbidity or concurrent psychiatric disturbances are excluded from the study, because the statistical power could be reduced by those characteristics. (...) Randomized clinical trials are performed on homogeneous patient groups, that are artificially constructed by banning many patients, while the consultation room is filled with patients that show a wide diversity in related symptom patterns and an even wider diversity in the way they evaluate and cope with these symptoms (Bensing, 2000: 19).

The critique that Bensing raises against evidence-based medicine could more or less be directly applied to the PCC-RCT. Patients who were too old, homeless or too disabled were excluded from the study. They were excluded precisely because it was much more difficult to get them to answer surveys and questionnaires, which could lead to problems when statistically analyzing the material.

> We have to be pragmatic when it comes to homeless persons; it is so difficult to send questionnaires to them. Cognitive impairment is the same. Persons with cognitive impairment are usually excluded from controlled trials because they have so many difficulties in answering surveys (researcher 1)

Again, the do-ability of the trial was prioritized, which called for pragmatism in relation to the underlying principles of person-centered care. While this, again, can be interpreted as a digression from person-centered care, it can also be interpreted as a commitment to it.

Another example of the tension between do-ability and how person-centered care was envisioned relates to one of the core values of person-centered care – that all persons are capable[1]:

> I am totally convinced that it [person-centered care] works for all patients. In other words, the basic assumption is that all people are capable, including the small child and the elderly person – well, they need not to be elderly, the dementia patient is capable. People are capable of different things, but everyone is capable. (Project Coordinator)

However, in the PCC-RCT not everyone was deemed capable of participating in the randomized controlled trial, as both elderly patients and patients with dementia were excluded. In this way respecting the rigorous requirements of a randomized controlled trial and prioritizing do-ability, led to the partial suspension of core values and beliefs of person-centered care.

...and the 'abnormal'

Star describes – in a now classical essay on the standard hamburger eater – how standards create suffering and moments of friction for the people 'who must use the standard network, but who are also non-members of the community of practice' Star 1991: 42). Similarly, Moser (2005; 2019) uses this argument when inquiring into the different modes of ordering disability. She argues that while standards create order for those inside the norm they also 'make trouble for, disable or exclude others with non-standardized bodies and subjectivities' (Moser 2005: 677). Standards, therefore, render standardized bodies invisible, letting them disappear into the background, while non-standardized bodies are performed as problematic and visible. Like Star, Moser points to the fringes of the standard convincingly arguing that '[t]he normal implies the abnormal, the deviant and lacking. However, they not only build upon it, but also help produce and reproduce it' (Moser 2005: 678).

The PCC-RCT also produced its own abnormalities. This can be traced in relation to the inclusion and exclusion criteria. One of its consequences was, as previously mentioned, that persons who were too ill, too old, suffered from the wrong complaints, who were cognitively or mentally impaired, who had substance abuse issues or were homeless, were positioned as persons unfit for the PCC-RCT.

However, the standard person-centered care person and her others were not only produced through the study protocol, but also through the intervention and its tools. The standardized version of person-centered care performed a particular type of person:

> Usually it's like you are listening to the health care professionals, to the nurses, to the doctors and they are, like the patients have a lot of respect, also, for the staff, and they are explaining and the patients are just passive, listening to what they are saying, what they are told to do [...] Person-centered care is more like we begin 'What do you think? What is your opinion? What do you believe? What can you, how can you'... the focus is shifting from the health care professionals to the patient, as a person (Researcher 2)

As seen in this account, 'usual care' produced docile and passive patients who were expected to respect and obey health care professionals. Person-centered care, on the other hand, invited the patient to offer their thoughts, beliefs and opinions. Pols (2005) connects these types of endeavors to a deliberative democratic view of the patient wherein the patient is enacted as having a 'perspective'. However, to have a perspective, Pols argues, one needs to have a language and therefore 'if a patient is not able to produce words, he or she is excluded from inquiries into the patient perspective' (Pols 2005: 206). Similarly, the PCC-RCT excluded persons without language, homeless persons, persons over 75, persons with substance abuse problems and persons with disabilities, thereby making them 'the other'.

Conclusions

While person-centered care and evidence-based medicine have been described as belonging to separate worlds (Bensing 2000), STS-scholars have argued that standardization and person-centered care can be intertwined (Lydahl 2019; van Loon and Zuiderent-Jerak 2012 Zuiderent- Jerak 2007; 2015). While building on a somewhat small empirical case study, this article adds to that discussion. By exploring an attempt to evaluate person-centered care with a randomized controlled trial this article shows that the entanglement of person-centered care and evidence-based medicine gives rise to both uncertainties and promises.

The uncertainties related to the problem of following research protocols, with the fact that person-centered care is not a pill and that it therefore is difficult to know what the active ingredient in the intervention is. They also related to the problems of creating a standard person for a type of care that aims to value everyone as unique and capable. However, as argued by Singleton (1998: 101)

1 For a more elaborate discussion on capability in person-centred care see Naldemirci et al 2018

uncertainties and instabilities do not necessarily lead to conflict or decreased legitimacy. Instead, exposure and discussion about uncertainties can be a sign of researchers', or in her case laboratory workers', commitment to the validity and the indispensability of the research in question. In addition, the uncertainties can be employed to increase do-ability. By putting some part of the person-centered care model in brackets, and thereby destabilizing person-centered care, the researchers succeeded in designing and performing the randomized controlled trial.

The promises related to hopes of creating unbiased evidence for a specific model of person-centered care and of creating a standard for person-centered. They also related to employing the uncertainty concerning what gave effect, seeing this as a proof of a holistic approach. In every promise however, some perspectives are foregrounded, and others are made silent (Oudshoorn 2011). In the PCC-RCT the needs and worries of the researches was visible, while the perspective of patients and healthcare professionals was less so.

Importantly, the interference of evidence-based medicine and person-centered care has consequences. The methodological demands of evidence-based medicine have consequences for the description and definition of person-centered care. The person-centered care carried out in the PCC-RCT was different from the person-centered care described in the introduction of this article. It was not inclusive and anti-reductionist but instead – due to the efforts of increasing statistical power – had to be rather exclusionary. In other words, the randomized controlled trial transformed person-centered care in the process of evaluating it. If person-centered care implies a partial de-medicalization of care by emphasizing the patient narrative and partnership, randomized controlled trials for person-centered care risk medicalizing care anew. It does so by standardizing the person in person-centered care in order to better evidence the outcome of changes in care delivery.

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REFRAMING TRANSLATIONAL RESEARCH AS TRANSACTIONAL RESEARCH:

An analysis of clinician-scientists' work practices in a Danish hospital setting

by Dixi Louise Strand

Translational research (TR) is subject to increasing attention and demand in research and health policy in the Nordic countries as well as internationally. While clinician-scientists are often positioned as key actors in both policy and academic debates on TR, less is known about the clinician-scientists' everyday work—their practices and commitments at the interface of academia and clinical health care. Drawing on the framework of arena analysis, developed in situational analysis, this article presents an empirical exploration of the everyday practices of clinician-scientists by extending research into a Danish hospital setting. The findings shed light on hospital-based translational research as constituted by clinician-scientists' practical integration of and transactions across many different work practice arenas. This paper depicts these arenas and the complex of commitments and capabilities involved. The analysis converges with existing Science and Technology Studies approaches to translational research as mutually reconfiguring clinical and scientific practices. In addition, it adds to this debate by providing an empirical work practice account of hospital-based TR and by suggesting a conceptual reframing of translational research as transactional research.

Keywords: Clinician-scientists, translational research, situational analysis, organizational ethnography

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Introduction

"Translation" of scientific research into clinical care and measurable health outcomes are desirable in health policy debates as a way of ensuring that public investments in health science are paid back in the form of improved care practice and improved public health. Policy documents and studies in this area have pointed to the crucial mediating role of clinician-scientists as hybrid professionals with expertise in both clinical practice and scientific research (Michael et al., 2007; Wainwright and Williams, 2009; Wilson-Kovacs and Hauskeller, 2012). By virtue of this dual role, having a foot in both worlds, they potentially facilitate the paths and adaptations of knowledge across what is often perceived as disparate institutional logics or translational gaps between research and clinic.

This paper explores how individuals employed as clinician-scientists and engaged in translational research (TR) carry out the day-to-day hospital-based research work in a Danish setting. Methodologically, the study draws on theory and methods from the field of organizational ethnography and Science and Technology Studies (STS) (Clarke, 2005; Law, 2017). As the empirical study and analytical mapping evolved over a one-year period, a key characteristic of clinician-scientists' TR work was the ability to bring together multiple capacities, match the skills needed and continuously meet the differing and divergent demands and performance requirements.

The paper therefore seeks to shares this complex of work practices, using the concept of arenas from situational analysis (Clarke, 2005; 125). The analysis sheds light on the organizational and technical complexity involved in TR as well as the scope of the specialized knowledges involved. As such, the analysis converges with other STS studies in this area and adds to this debate by providing an empirical work practice account of hospital-based TR. Subsequently, a reframing of TR as *transactional research* is proposed as a conceptualization that points to the highly complex and multiple practices of clinician-scientists through which connections and transactions between research and clinic can emerge.

The paper is structured as follows. The first part provides a brief review of how research translation is depicted in the normative policy-related TR debate and within the field of STS. The second part introduces the setting for the empirical case studies, the methodological framework of the study and the theoretical underpinning for the empirical study and analysis. Then an analysis of the arenas is presented followed by a discussion and conclusion.

Translational research

The term "translational research" (also referred to as translational medicine, translational science, and academic medicine) was first used in a US national cancer program in the 90's and has since become a very popular concept in medical and health research (Fudge et al., 2016; Woolf, 2008). The concept appears in research programs, research strategies, academic articles and journals, policy reports, educational programs etc. and is the subject of much debate in the fields of medicine, nursing and public health studies. The main interest underlying the concept in this normative policy oriented debate derives from a perceived series of gaps between life sciences, medical research, clinical practices, and effects in the form of e.g. measurable health improvements. Literature reviews of the TR debate reveal a wide range of ways in which the concept is used (Greenhalgh and Wieringa, 2011; van der Laan and Boenink, 2015). Yet, an overarching trope of bench and bedside recurs in the health literature and policy; that of research and clinic as two different worlds or logics (Dunn and Jones, 2010). Here the logics of care are often characterized by clinical experience, diagnostic testing and other "arts" of medicine (Malterud, 2001), whereas science logics grow out of a different and separate researcher profession and a different set of academic norms (Miller and French, 2016).

Science and Technology Studies

In the field of Science and Technology Studies, interactions of "bench and bedside" have also been the object of interest and study. Seminal historical science studies in this area include Knorr-Certina on epistemic cultures (Knorr-Cetina, 1999), Löwy's historical bench-to bedside study of immunology's path into the cancer clinic (Löwy, 1996), Fujimura's study of networks between basic researchers, clinical practitioners, and funding agencies and their coordinated "crafting" of new genetic approaches to particular forms of cancer (Fujimura, 1996), and Mol's study on the multiple nature of arthrosclerosis (Mol, 2002). Noteworthy studies in this field have also analyzed how the "adoption" of scientific results is dependent upon the building and extension of social and technical networks (Latour 1987; Timmermans & Berg, 2003). More recent research has focussed on the socio-technical, regulatory and ethical practices of working across research and clinic (e.g. Moreira, May, and Bond 2009; Michael, Wainwright, and Williams 2007) and has established a new understanding of scientific research and clinical work as performed and intersecting within biomedical collectives (Bourret, 2005; Keating and Cambrosio, 2012). This work has served to disrupt the notion of research and clinic as two separate domains and to shift focus to how these very categories are contingent and relational.

Research within STS has pointed to the crucial positioning of clinician-scientists as key professionals with expertise in both clinical practice and scientific research. The notion of boundaries and boundary work is a prevalent theme in the existing studies, e.g. positioning the clinician-scientist as a boundary spanner or broker across boundaries of clinic and science (Löwy, 1996; Swan et.al. 2007; Wilson-Kovacs and Hauskeller, 2012; Lander, 2016a, 2016b; Miller and French, 2016). Another notable analytical theme within this line of empirical studies is the notion of hybridity, the clinician-scientist as a "hybrid professional" (Brosnan et al., 2013; Brosnan and Michael, 2014; Wainwright and Williams, 2009) or "user-producer

hybrid" (Douglas et al., 2015; Dunn and Jones, 2010; Hendriks et al., 2019). These studies of boundary work and hybridization call for new analytical conceptualizations that cut across assumed divides of knowledge users and producers – and separate worlds of clinic and research. They also point to a professional field of practice in the making and in reconfiguration. The study presented converges with and adds to this body of literature by providing an empirical account that views these boundary practices and hybridity through the analytical lens of situational analysis and employing an empirically grounded practice approach. Crabu offers a thorough meta-analysis of sociological research examining translational medicine and finds that empirical work has mainly focussed on laboratories and crossovers between the laboratory and the clinic (Crabu, 2018). The paper thus also adds to empirical hospital-based studies of translational research, since few STS studies take hospital-based clinician-scientists as the starting point for examining translational medicine (Rabeharisoa and Bourret, 2009).

Theory

Situational analysis is based on Haraway's understanding of situated knowledge (Haraway, 1988), Michel Foucault's discourse analysis (Foucault, 1990), and Anselm Strauss' social world/arena theory (Strauss, 1993) and is an important methodological and theoretical contribution to the interdisciplinary STS research tradition. Situational analysis rests upon a theoretical understanding of knowledge as always embedded and enacted in the situations of which it is a part (Clarke, 2005). In this understanding, knowledge is always incorporated in practices, procedures, techniques and technologies. The focus here is therefore specifically on practice, on what clinician-scientists do and how they do it. In situational analysis, contextual and macro elements are understood as actually present in practice, or the analytically delineated "situation". Context, or macro, is thus not mapped as being outside, something exterior to a situation, but as part of and constitutive of practice. This approach has as a main unit of analysis the relations among actors including non-human actors. In Clarke's terms situational analysis is not a grand sociological theory, but rather a "theory/method package" in which a series of analytical tools and sensitizing concepts are put forward to be adjusted and refined in relation to the particular study (Clarke, 2005; 125). I apply "arena analysis", one tool in situational analysis, as a form of complexity mapping of the way in which commitments and capabilities were organized around the clinician-scientists. What are the patterns of collective commitment? How do the clinician-scientists go about fulfilling these commitments? Arenas are characterized by Clarke as multiple, complex and layered discursive and material constructions, groups of actors (human and non-human), knowledges, and practices that persist over time (Clarke, 2005; 125). They are sets of practices (committed to and bounded by collective action/work of some kind) and not necessarily formal organizations.

Setting

The setting for the research here is Region Zealand in Denmark and in particular two research networks based in the hospitals in the region. These research networks connect different research projects or research protocols within a joint vision of changing and improving diagnosis and/or treatment within a given area. The two research networks lie within two very different medical areas, child and youth psychiatric diagnosis and cancer treatment. I selected these two research networks based on a completed research evaluation of all departments in 2017 in which research and translational activities have been mapped (Region Zealand Operations Research and Innovation, 2017). The networks are exemplary in that one network is at an early career start-up phase based in a department with sparse prior research, and the other comprises more established researchers in departments where research capacity was stronger and expanding. In this way, the two cases illustrate a breath across two different medical specialties and "stages of research maturity" at a department.

The cancer treatment research network aimed to develop electroporation treatment for cancer, a technique that applies an electrical field to cells in order to increase the permeability of the cell membrane, allowing chemicals, drugs, or DNA to be introduced into the cell. A range of related projects sought to refine the technique in relation to specific cancer types, and in relation to different types of chemicals, as well as to explore systemic immune responses found clinically as an unexpected outcome of the treatment. The psychiatric research network studied examined autism disorders in children and youth through a "translational" research design combining clinical and biological methods, questioning and potentially informing the very disorder category, current diagnostic criteria and classification. Although several of the projects within both of these research networks included industrial partners, the initiators themselves stressed that the research was "investigator-initiated" and thus different in nature from clinical trials and medical research driven by industry, another type of research also on the rise at the hospitals in question. The lead researchers themselves defined the research as "translational research".

A politically driven effort to expand and utilize research activity at the hospitals was relatively new in this region compared to some

of the other regions in Denmark. In fall 2013, a centralized research support unit was established in Region Zealand along with plans for an increase in the hospitals' research budget. Funding for research projects, research infrastructure, and clinical-scientist research positions, shared between a hospital and a university, have since grown expansively. In March 2016, two hospitals were merged and entered into a stronger collaboration and formed a new joint organizational structure with a university. These initiatives mark the increased organizational commitment towards research and education as an integral part of a clinical care agenda. At the end of 2018, the region had approximately sixty employees holding the formal position of clinician-scientist, having a part-time academic employment alongside a clinical position, and strategic plans were underway to greatly increase this number in the coming years – as well as to involve and engage additional clinical staff in research.

Methods

Data collection was conducted between January 2018 and March 2019 and comprised interviews, observations, and collecting of organizational and project documents. Observations included research team meetings, departmental meetings, public presentations of research, two academic conferences, patient testing and treatment, and lab visits, and informal conversations (approx. 100 hours). A guiding focus of the observations was an exploratory research question: what characterizes translational activities and situations in the hospital-based research networks. Observations and informal conversations provided data on daily experiences and were linked to formal interviews that were conducted in parallel. 20 in-depth interviews were conducted with primarily clinician-scientists (n11) as well as research team members such as Ph.D. students (n4), biologists (n2), an engineer (n1), and department managers (n2). The interviews lasted 1-2 hours, were recorded and transcribed with the respondent's consent. All interviews were conducted at the hospitals and were semi-structured around questions about professional background, research activities, and in particular the selected focus project. The interviews also included questions about the participants' understanding of TR and their role and the project's role in the clinical department at the hospital. In addition, questions were asked about the conditions, challenges, and opportunities related to conducting hospital-based research. I developed interview questions iteratively based on prior interviews, observational data, and the study of documents. Documents, such as research protocols and drafts, journal publications, ethics and funding applications, were analyzed to gain an understanding of the research projects and the work issues involved. A key informant also shared two years of email correspondence regarding the research project. Ethical approval and consent was obtained in writing from the principle investigators of the research networks and from informants.

Throughout the research project, I was simultaneously working as a consultant in a crosscutting research and innovation support unit at the hospitals. This involved weekly visits, meetings, workshops, and communication with staff and management at the hospital departments on issues related to research development and support in the region. This concurring consultancy work gave me a background understanding of the organization and the research infrastructure of the hospitals, but it is not included as a formalized part of the data set due to research ethics of a dual role of employee and researcher. This dual role in the field also positions my research as situated and intervening in the practices studied (Haraway, 1988; Zuiderent-Jerak, 2015).

The interview, transcripts, notes, and documents were analyzed using situational maps (Clarke, 2005) as an analytical tool for grasping and mapping out the research networks and the practices of clinician-scientists. Following situational analysis, I created three types of maps - situational maps, arena maps, and positional maps - iteratively to visualize and organize data. The maps also served as fruitful artefacts to allow for discussing ongoing analysis ideas with colleagues and informants. Data was stored, organized, and coded in the qualitative data analysis software NVivo. The coding frames were developed iteratively in NVivo, alongside the situational maps, and consisted firstly of descriptive, inductive codes and further on in the analysis process of analytical codes that were guided by a synthesis of the descriptive codes and the situational analysis maps.

Analysis

This section presents selected findings from the mapping and analysis of the arenas in which clinician-scientists engage in their daily work. Focus is on how clinician-scientists work within and meet demands of multiple arenas. Fourteen arenas were mapped in the study through iterative situational mapping, yet detailing the commitments of all these arenas however lies beyond the scope of this paper. Following Clarke (Clarke, 2005) the arenas could be analyzed in more detail into a number of sub-arenas depending on the scope and interest of the study.

The four arenas, designated as *Hospital clinical, Hospital management, Cross-disciplinary collaboration* and *Patients* are foregrounded in the present paper as they are empirical selections particularly specific to health care research and focus area of TR. The selection serves

to exemplify that the research-clinic relationship materializes itself in multiple ways in the various arenas and how research and clinic play into one another in numerous and varying ways. All fourteen arenas are merely mentioned here to highlight the way in which clinician-scientists are engaged in a complex of multiple arenas. In a discussion of a preliminary arena mapping, a clinician-scientist pointed out; "all the arenas contribute to moving research forward and into the clinic". The way in which this multiplicity of commitments and capabilities is *brought together* by clinician-scientists is suggested to be constitutive of TR (Michael et al., 2007).

1. Hospital clinical arena

Firstly, I will present the analytically delinated *hospital clinical arena* with examples from the data material to illustrate how research in the clinic is formalized organizationally, established through material arrangements, but also continually a space of negotiation "under pressure". The clinician-scientists in the present study describe their clinical work as related to their formal written contract according to which they are allocated a certain percent of their time to patient consultations and other clinical tasks. The formal conditions of this contract are described below by a clinician-scientist recently employed in the oncology department as professor. The research related responsibilities of her employment consist of both building the research capacity at the department as well as further developing international research on the cancer treatment technique electroporation. This is combined with clinical duties at the oncology department and she identifies herself as both a clinician and a scientist, interested and deeply engaged in both the basic microbiological understanding of electroporation as well as in the manifestations of cancer and possible treatments in the clinic.

> They have me on the schedule 2 days in the clinic. There, I have a set of tasks that are not necessarily related to what I know and can, but I add to production. That is the formal agreement with the university for most clinical professors and clinical associate professors. When a clinical department hires you, those are the terms, and then in turn they receive research support and development in the department. (interview, clinician-scientist, oncology)

To her, a hospital clinic arena can be outlined as a place of production where clinician-scientist and other staff members are committed to moving patients through somewhat standardized flows of diagnosis and treatment. This work, however, is not necessarily understood as connected to her more research specific competencies – "what I know and can". Also, as noted in the quote above, there is a transactional exchange. The clinical department buys into a given contract upon hiring a clinician-scientist, receiving a part time clinical production resource *as well as* research support and research based development of the clinic from within, since the clinician-scientists work alongside the clinical staff and become an integrated part of the clinical team.

Clinician-scientists and their managers stress that the clinic is a setting of work where time and finances are under pressure due to yearly cutbacks in the hospital and in departmental budgets. The concern of clinical departmental managers is making budget ends meet and achieving target production requirements for numbers of patients diagnosed and treated. Research is thus continually "squeezed out" and under pressure from the demand of clinical production. The oncology professor explains:

> During my time as a doctor, clinical work has moved towards more and more requirements for what one has to do. Both the number of patients one has to see, but also all the other things one has to do, for example registration and documentation work in the clinic. A day of a doctor is just packed to the max now. So it is more difficult to find time to do other things such as research. (interview, clinician-scientist, oncology)

The clinical hospital environment was busy and often noted as a place where staff are just too few to carry out the necessary and required clinical tasks. In this setting, the work of securing research time for one's own research activities and for research related interactions with clinical staff required persistence and continuous effort.

A clinician-scientist in the children and youth psychiatric department, also a team leader of a clinical team, describes how the situation in her clinical team is fraught and fragile due to insufficient resources and a constant overbooking of patients. One clinician in her team has recently resigned, and another is on sick leave due to stress. She has, since the onset of her employment as a clinician-scientist, been engaged in an ongoing negotiation concerning how much clinical work she herself and the two Ph.D. students in her project can take on. She explains how this negotiation is a balancing act between securing protected research time for her own research tasks and for the research time of her Ph.D. students - and at the same time showing willingness to help alleviate the critical clinical situation of a lack of resources and overbooking of patients. During the entire period encompassed by the present study, negotiations were ongoing between this clinician-scientist and the department management concerning which kind of clinical tasks lie within or outside of her scope of work, as well as the work of her Ph.D. students.

Another clinician-scientist went to work in the department at seven in the morning to have time "before work starts at 8", before the first medical conference meeting. In these outer "time-for research-slots", the younger doctors in the department could drop by her office and ask questions, for example in relation to starting up research projects. Here, a space for research-related interactions with and among clinical staff was created.

In relation to getting the other staff members interested and involved in research, many of the clinician-scientists invested time and effort in establishing new meeting structures where research

could be presented and shared, various seminars, and, for example, educational events that could "upgrade" staff members in relation to research – in part in order to fulfil the barter of research support and development in the department. However, convincing "non-research" staff (and management) to set time aside to participate in such activities was a continual challenge in this production setting maxed with clinical tasks and time pressure, and characterized by a very different flow of work tasks than that of discussing an article in a journal club meeting or jointly exploring preliminary research results.

At the same time, clinical work was highly valued and something most of the clinician-scientists referred to with pride and viewed as part of their professional profile. "Staying in touch with the patient in the clinic" was seen as crucial to ensuring relevance of their research work, and variations of "making a difference for the patient" was often mentioned as motivation for the career choice as clinician-scientist versus a university-based research career. A younger researcher embarking on a clinician-scientist career in psychiatry noted the following:

> The research (carried out in a previous university position) is to a large extent isolated from clinical work, and when I came out and into the clinic and saw the discrepancies, well, that's why I applied for a clinical position, because the research I was working on is just not practically applicable. (interview, clinician-scientist, psychiatry)

Besides the accounts of personal motivation and making a difference for patients, having a good network and maintaining close collaborative relations among the staff in the clinic was also crucial. A "network in house" was necessary in order to have other staff members willing to assist in carrying out research activities or willing to help recruit and refer patients to a study protocol. In this way, the clinical arena and the work relations of the clinical department were conditional for conducting research projects, for the referral of patients to the study and for producing research results. Access to and recruitment of patients was somewhat competitive, as departments had many ongoing research projects, and patients were in high demand.

To summarize, the hospital clinical arena of the clinician-scientists can be characterized as a set of clinical/research border crossing and transactional practices. The role of research in the clinic was in part formalized in contracts and agreements, but also continually under negotiation. Pressures of production "squeezed" and challenged research activities and research-clinic relations. The practices constituting this arena thus entailed a creative and continuous negotiating of time and space for research, e.g. percentages in formal contracts, definition of relevant/irrelevant tasks, physical spaces and equipment, roles of assisting staff and new meeting structures. Likewise, building and maintaining the relations among staff members in the clinic was necessary in order to carry out hospital-based research projects.

2. Hospital management arena

The second analysis section presents an arena where research is positioned, on the one hand, as a solution, and on the other hand, as a disturbance. Focus is on how the clinician-scientists navigate this tension. Hospital management concerns formed part of the clinician-scientists' orientation in formulating research issues and in thinking about how research findings might find relevance in the clinical work setting. For example, the clinician-scientists incorporated managerial concerns as part of the research problem formulation. In a presentation for the hospital management, part of the application process for funding as a prioritized hospital "elite consortium", two clinician-scientists working together across specialties of surgery and oncology refer directly to departmental budgets at the opening and closing of their research pitch and presentation:

> The budget for medicine at the Oncology Department is only going up and up. How can we avoid the large rate of relapses? What can we do to ensure that these patients are not referred on to oncology? How can we avoid that they become oncological patients? The presentation moves on to show how the research with its new treatment modalities aims to prevent cancer relapse. The presentation likewise closes with the statement: We are going to see this in the clinic. We are going to see the effects on the bottom line. (meeting notes, meeting where potential cross departmental "elite consortiums" presented research proposals)

Here, in their presentations, the clinician-scientists are speaking directly to the acute management agendas of rocketing medicine expenses and the departmental budget crisis. The clinician-scientists stipulate that if the project leads to lower recurrence rates, the budget implications could be great because treatment for extensive cancer is very expensive. Here, in the planning of a new research project, research is translated into a possible solution to a hospital management dilemma.

A clinician-scientist in the psychiatric department expresses another type of concern in relation to his department management and fellow clinical colleagues – concerns that the research project they have underway might be used as a tool for further cutbacks and reductions in consultation time between clinician and patient.

> Our research could really take part in saving resources here at the clinic. However, this could also be unpopular, really. Imagine that we presented a set of tests that made it possible to cut down on clinical time with the patient. The clinicians already feel so pressured, and our research could become a tool for management, so to say, instead of a knowledge tool. (interview, clinician-scientist, psychiatry)

The clinician-scientists expressed a concern that the research results could be used to alleviate or cut back on staff, possibly leading to less consultation time with the psychiatric patients, but perhaps also freeing up time for research and development. The quote above points to the inherent uncertainty regarding for whom and for what purposes new research knowledge is related to the department and the various ways in which it becomes part of clinical practices and possible agendas of optimization. Navigating and tinkering with multiple interests and agendas of e.g. management and colleagues thus constituted a part of clinician-scientists' work practices.

Another theme mapped as part of the hospital managerial arena was an "academization of the clinic". This theme cut across the political and strategic documents of the region and hospital. It was present as a topic in meetings as well as among the clinician-scientists' own reflections on their role in the clinical department. This is, in part, concerned with making the clinic more "evidence-based", about improving the competencies of the clinical staff and the overall quality of care by implementing the newest research knowledge and evidence in the clinic (Moreira, 2007; Timmermans and Berg, 2003).

> We have these people with surplus energy that come in and are both clinically and research-wise super talented, they have a network-based and positive approach to what is possible and what isn't. And they are quick to pinpoint, when something is tradition or habit, this is what we have always done. But what is the data and evidence here? And where do we need more research? So really, it changes the culture. (interview, department manager, oncology)

Hospital managers and staff also referred to a fruitful "academic stimulation of the clinic and the clinicians not working directly with research". For example, discussions recurred on how research can lift the qualifications of the entire clinical staff – create "curiosity" or "humbleness" with regard to evidence.

> With research you create a curiosity among colleagues that might not have been there before. This might influence how you diagnose a patient, maybe research can spark a curiosity so I have to check out how they do it in England or something like that… I suppose the research environment creates a general humbleness with regard to evidence. You learn to interpret data and interpret publications – so you learn about the issues involved in creating good evidence for clinical practice. (interview, research engineer, medical imaging)

Here, creating an understanding among the staff about how evidence is created and about different kinds of evidence, promotes a work environment of curiosity and questioning, consequently improving quality of care in the light of newest evidence. Having the clinician-scientists in the clinic alongside the other staff members in the oncology department was highlighted as the way in which the clinician-scientists and other staff members meet each other, where they have interactions, where they get to know each other. One clinician-scientist gives an example of young doctors, who, without the clinician-scientists, would have continued their medical training, but instead were encouraged to pursue a research idea.

> That happens because we now have people (clinician-scientists) who stimulate their ideas… and then the ball starts rolling because these young people have also been in the clinic before they started researching, they have a good network, and now they have gotten involved in doing the morning educational sessions for their colleagues, ensuring further education because they want to give something back. It is a positive spiral, what I see happening. (interview, clinician-scientist, oncology)

So here, a reinforcing ripple effect is eluded, that research orientations and interest has spread and grown in the department through the presence and activities of the clinician-scientists employed there. Research was also brought forward as linked to professional pride and a motivational work factor for the entire staff. In a situation of high work pressure, research was noted as something that could "keep the higher goal in mind" and "make us want to be among the best".

Another way research was discussed as a way of optimizing the clinic is the way in which research could improve recruitment of personnel to the department. Research was, for example, often mobilized as an effective tool in the competition for qualified staff. It was somewhat difficult for the hospitals of Region Zealand to recruit for clinical positions and an issue of general concern. At departmental meetings, the recruitment of clinical staff was discussed in various situations. The possibility of new staff getting involved in research projects was highlighted as an important parameter for recruiting young, qualified clinical staff. It was noted by a department manager in the children's psychiatry department that people involved in research projects might stay on in the clinic after a project ends.

> Their employment (a clinician-scientist) lends recognition to this department, so when you as a young doctor are applying, it is one of those things that says ok, this is a good place to be. It is getting easier for us to recruit younger doctors. (interview, department manager, psychiatry)

Research was thus in various ways posed as the key, *a solution* to some of the current challenges of the hospital; increasing productivity, keeping the clinic up-to-date with the newest evidence and best practice, keeping staff motivated and engaged, recruiting talented staff. The clinician-scientists position themselves in relation to these opportunities and possibilities. They thereby constitute an arena, where management concerns are relevant and a necessary part of their professional repertoire and where research in a number of ways can improve and develop the department. At the

same time, in other situations, research constituted a potential *disturbance*, interfering with the planned flow of patients through a set of standardized diagnosis and treatment modalities. One clinician-scientist explains how the research aims of the project clash with a political managerial agenda in which cancer treatment must adhere to a certain limited time frame. Anything that can prolong the time of cancer treatment, such as an additional experimental treatment intervention, must be negotiated in relation to short and definite diagnosis and treatment time limits that a department must live up to. It was thus necessary for the clinician-scientists to continually communicate the relevance and importance of a research project – sometimes in a setting of little mutual interest from overworked colleagues or in a setting of many research projects and the associated clinician-scientists "competing" to recruit the same patients to their study.

3. Cross-disciplinary collaboration arena

This third analysis section depicts how clinician-scientists simultaneously deploy their work across various disciplines and medical specialities. The TR projects studied here are at the outset and by definition transdisciplinary, involving collaboration within the region, nationally within Denmark, as well as internationally. The autism research network, for example, spanned different departments and disciplinary specializations of child and youth psychiatry, psychology, psychophysiology, radiology, neurology, engineering, and screening software/IT development. The cancer project likewise cut across a number of medical/research specializations; oncology, surgery, dermatology, pathology, biochemistry, molecular biology, immunology, physics, engineering, IT, and palliation. Thus, a complex of specialized knowledges and practices were joined together.

Hospitals in Denmark, as abroad, are primarily organized in departments and medical specializations. The clinician-scientists explained how different styles or cultures of research exist among these departments, and elsewhere the historical separation, or "narrowing"" and the hierarchy of medical specializations has been discussed (Hindhede and Larsen, 2018; Nancarrow and Borthwick, 2005). In the networks studied here, the clinician-scientists were continually attempting to connect and integrate these different disciplines and the different investigational procedures and techniques. When explaining the translational design of the research projects, the informants from both research networks had different ways of referring to a "bigger picture", "holism", "a helicopter perspective", or "pieces in a puzzle" – when discussing their way of working across disciplines and techniques.

In one interview, a clinician-scientist from the psychiatry project draws the research design spanning different "translational levels" on the white board. She explains the methods and TR design of the project discussed, the different procedures and examinations the patients and control subjects go through, ranging from clinical screening and tests and electroencephalography (EEG) to magnetic resonance imaging (MRI). These methods provide knowledge on different translational levels from the "psychosocial down to something more and more biologically based". A version of this model was also refined for the project description and funding applications as a way of illustrating the different knowledge types that the project aims to connect and translate between.

> A lot of the research that is carried out today is just not informed by complexity-based theories about how things are connected…. So you have to create new knowledge that involves connecting all of these levels (points to translational model on the board) (interview, clinician-scientist, children's psychiatry)

In the cancer project, a similar aim was explained as part of the TR design by a clinician scientist from the surgical department.

> It is about designing the study so you see the bigger picture and get at 360 degree view… If you want to make a difference and do research that moves the way we think, then you have to include all the parts and include the whole spectrum. (interview, clinician-scientist, surgery)

Here, for example, results from patient-reported outcomes, molecular biological examinations of blood samples, and immunological investigations of tumour material are linked up in the research project – as are different stages of cancer and phases of cancer treatment, for example pre, during, and post operation. Thereby encompassing the "whole spectrum" by working across and joining together differing techniques and niches of research.

This required collaborative and transactional capabilities in order to work across medical specializations and departments as well as internationally. For example, for the EEG in the autism project or the immunological analysis of tumors, expertise and equipment involved collaboration and partnerships with researchers and companies abroad. Finding the right partners and mentors, at earlier stages, was highlighted as crucial to establishing a TR project, and linking up to the right laboratories and expertise to enable for example Ph.D. students to be co-supervised and exchanged was also important. Arranging joint seminars and establishing or contributing to international working groups were all part of the ongoing work of the clinician-scientists framed here as involving a cross-disciplinary arena. A lot of time and effort was put into such networking activities as seminars and conferences, meetings, and workshops in order to share and align research concerns. Shared work objects included research protocols, collaboration agreements, contracts, funding applications, journal articles, data and analysis materials, access to/sharing equipment, and joint supervision of Ph.D. students – and the translational models and visualisations explained above worked to tie these projects together as coordinating work objects.

Clinician-scientists were either skilled in or learning to navigate in this cross-disciplinarity – both by creating research designs that connect different disciplinary contributions as well as in analyses

that bring different types of techniques and results together. So here, the realization of TR is not only concerned with establishing the integrations or pathways between clinic and research, but very much also about creating dynamic collaborations across disciplines and techniques. This work of building and maintaining relations, developing one's understanding of or communication across specializations, and across other clinical-research networks was an ongoing and continuous part of the clinician-scientists' work practices.

4. Patients' arena

"The patient is everything" is the motto of the university hospital, in line with political streams of more patient-centred care regimes in Denmark and internationally (Smith et al., 2019). In conversations and interviews, most of the clinician-scientists also place patients at the core of their work. The health of their patients was in various ways framed by all of the clinician-scientists as "the ultimate target" of their work, thus resonating a therapeutic promise embedded in their research aims (Pickersgill, 2011). At the same time, patient data and patient materials also constituted their material work objects to be collected and analyzed. Tumor tissue, normal tissue, blood, medical images, tests results, and recorded experiences etc. comprised the substance of the research projects without which the research aims and this ultimate target could not be fulfilled. As noted earlier, a major issue was having enough patients enrolled in the individual research study. In various ways, the clinician-scientists paved the way for recruitment by involving internal staff members and perhaps looking to other departments for patients to include in their study. They also continuously monitor the number of patients acquired by means of different tools.

The presentation of a research project to the patient and family and their preparation for inclusion in a research project was also brought forward as a skill in itself. A Ph.D. student responsible for a related research protocol explains how she always has a patient consultation the day before the operation to talk about what the operation entails. Also, she is there alongside the patient throughout and after the operation and prefers to take the blood samples for the trial herself. She stresses that this is important "so the patient does not feel insecure about being part of an experimental trial." Here, the relations to and around patients were cared for in order to ensure patients and patient data for research purposes.

Likewise, efforts also went into preparing patients for "inclusion" in a study in order to keep them throughout the entire research flow of patient examinations. One of the research projects involved five very different types of examinations and tests of children diagnosed with autism, and here, in particular, the MRI brain scan and EGG testing was considered a challenge. Clinician-scientists referred to "pedagogical skills" of preparing the children and their parents for the examinations, explaining what they could expect, an open house Sunday where the children could visit and see the equipment beforehand, and extra EEG caps that the families could take home to play with etc.

As such, the patients' arena was constituted by yet another set of transactional orientations and capabilities that the clinician-scientists used to organize their work practices. This arena constitutes TR alongside the previously analysed arenas of hospital clinical, hospital management, and cross-disciplinary collaboration.

Discussion

The empirical analysis presented here sheds light on a complex of practices and situations where research and clinic play together and into one another. The multifaceted character of the clinician-scientist's work is unfolded in the account along with the ability of clinician-scientists to navigate this complex of multiple arenas, to meet many varying demands and to deal with the dilemmas and tensions involved. The paper depicts selected arenas of *hospital clinical, hospital management, cross-disciplinary collaboration,* and *patients* through examples and excerpts from the data. I have analytically delineated other arenas such as *ethics, funding industry* as part of the study, but a detailed presentation of all the arenas mapped are beyond the scope of the present paper. Following situational analysis, these arenas were mapped visually and thus provided a spatial view of the practices that contribute to moving research forward and to making it relevant. I found that these visual mappings served as very fruitful artefacts for sharing and discussing the findings with informants and other stakeholders in the region studied.

Further analysis could provide more detail on how the arenas overlap and intersect. For example, the *patients arena* is categorized here as a separate arena distinct from *hospital clinical,* although clinical work, of course, involves interactions and commitments to patients. The analysis is thus the result of the analytical mapping technique and aim of opening up and detailing the multiple character of the clinic-research relationship. Also, the study includes two quite different research networks within oncology and psychiatry. Further analysis could explore the different patterns of practice within different the specializations and the specific areas of research in question – for example also how these practices form part of broader biomedical collectives (Bourret, 2005; Keating and Cambrosio, 2012).

For now, this paper adds to existing STS literature and to efforts of opening the black box of TR from an empirically informed hospital-based viewpoint. Where previous STS studies in this area have focussed on laboratory, materiality, ethics, and regulation, I have applied situational analysis as of one delimited setting in which hospital-based clinician scientists carry out TR work and presented a selection of these multiple work domains. Working with and

bringing together multiple arenas is an aspect of work as a clinician scientist engaged in TR that tends to be overlooked in a dualistic understanding of TR as the bridging of two separate domains – clinic and research - or in the understanding of the clinician-scientist as a translator between the two. This prevalent policy conceptualization may render other aspects of a research-practice relationship less visible as well as obscure the multiple ways in which a research-clinic relationship can play out in the organizational hospital setting. The analysis presented in this article also turns our attention towards the relations, interactions, and exchanges that seem to move research forward while also making it relevant. In this sense, TR might be reframed *transactional research* in order to better address these collaborative relations and transactions. In the TR debate the concept of translation continually revokes the image of two worlds or logics to be transversed and translated between – clinic and research. Based on the study, it seems this the social and material work practices of TR more adequately might be characterized as a set of assembling and transactional practices across multiple (not only dual) arenas. The concept of transaction can help foreground this subtle aspect of clinician-scientists' work that seems difficult to grasp with existing dominant tropes and characterizations of translational research – e.g. bench-to-bedside, boundary work across worlds and logics.

Another interesting path for further inquiry is the very definition of translational research (Rushforth, 2016) and the very definition of clinician-scientists, how this professional position differs formally and practically in different countries, different political contexts, and historically. In Denmark the political demand for translational research is currently explicit in regional and national policy and is supported by various present public and privately funded initiatives such as educational programs and dedicated research programs. This resonates policy related discussions on translational and applied science internationally, involving for example initiatives for how the crucial role of clinician-scientists can be better supported through education, how the training of clinician-scientists can and should be improved, and how to provide career incentives as well as better infrastructure support (McKinney, 2017). A recent research report in the journal *Academic Medicine,* opens with the statement "Physician-scientists – academic physicians who devote a substantial proportion of their time to conducting research – are a population in decline globally" (Lingard et al., 2017), and as mentioned, policies in e.g. USA, UK and Germany also aim to alleviate this apparent deficiency.

A contribution from an STS perspective to this policy debate could be to explore the ways in which organizations and policy and can recognize and make visible the transactional practices that make up an important part of the work of clinician-scientists. These subtle commitments and capabilities, as exemplified in this paper, are difficult to delineate and measure in the form of, for example, performance indicators. Current indicators tend to apply to academia on the one hand and clinical work on the other and cannot account for the ongoing complex of practices illustrated in this paper. The transactional work of clinician-scientists seems difficult to make visible and accountable short term with the frameworks available (Rushforth et al., 2016). Also, it seems that adding more performance demands, more obligations and expectations for this groups of actors to live up to, might not be fruitful in a situation where clinician-scientists already are strung out by multiple arenas. In fact, more performance demands might actually impede the productive transactional practices of building and sustaining relations, negotiating exchanges, and continually dealing with unforeseen tensions and difficulties that arise in such processes. How policy can account for, evaluate, and support this type of transactional work thus calls for further research. And here STS approaches and theoretical sensibilities of, for example, situational analysis, actor-network theory, and practice theory are highly relevant.

On a more critical note, further STS informed research on TR might also focus on how translational/transactional work of clinician-scientists, and the political support for this work, is entangled with broader changes in biomedical research politics and shifting hierarchies of expertise. As touched upon in this paper, the clinician-scientists' profession is simultaneously presented in the TR literature as an uncertain and daunting career, and at the same time, this role is positioned as key leaders of change holding a privileged professional status in relation to the TR high hopes and visions (Vignola-Gagne, 2014; Wilson-Kovacs and Hauskeller, 2012). In this way, the work of clinician-scientists is located in a shifting professional landscape where authority and political prioritization currently is contested for different kinds of research and different kinds of researchers. This broader political landscape constitutes the backdrop and works as legitimizing for the local work practices discussed in this paper. Wilson-Kovacs and Hauskeller (2012) and Vignola-Gagne (2014) have focussed on TR's political and professional shifts and tensions in UK, USA, and Germany and their work likewise calls for similar questioning of Nordic TR visions and professional reconfigurations in the Nordic countries.

Conclusion

This research paper has reported from an empirical study of the practices of hospital medical staff in Denmark who hold combined positions as clinician-scientists in which they are expected to do both research and clinical work. In the paper I have shared selections from an in-depth analysis and situational mapping of the daily practices of these actors, who are framed in the field as "clinician-scientists". The paper outlines the work of these clinician-scientists as a case of translational research and as a set of practices and commitments that take place at the interface of academia and clinical health care. The paper thereby aims to increase our understanding of the local and specific *doing* of translation research in a current situation in

which both the societal and the hospital sector demands for—and funding for—applied and translational research is growing. The paper documents selected aspects of the everyday work of clinician-scientists, in particular how their work constitutes, and is constituted by, multiple arenas and a complexity of commitments and capabilities. The findings of the exploratory study presented in this paper thereby show the ability of the clinician-scientists to continuously perform in these multiple arenas and to live up to the multiple demands and capabilities required. I suggest that this multiple—*transactional*—performance and the situations in which research and clinic play into one another and together in different ways constitutes TR. This view of the practices of clinician-scientists adds to present understandings of TR in a hospital work setting. Rather than an image of the clinician-scientist as an actor with a foot in two worlds, as is prevalent in the TR literature and, in part, in STS literature (i.e. focus on boundary work), the analysis sheds light on multiple domains that are integrated, translated, and continually negotiated by clinician-scientists in order to move their own careers and hospital-based translational research forward. In conclusion, the paper suggests a reframing of translational research as *transactional research* in order to foreground the relations, interactions, and exchanges that seem to characterize the work of clinician-scientists. This reframing could be elaborated in further work to support these practices, thus informing and supporting the political TR agenda, or it could be used more critically to shed light on shifting hierarchies of knowledge and expertise, thereby questioning the very premises of the current societal and political demand for TR.

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OPINION PIECE

How to deploy STS to re-imagine sustainable ways of instituting climate expertise?

By Anders Blok

In one of many recent reflections on the politics of the Anthropocene, anthropologist, philosopher, and science and technology studies (STS) eminence Bruno Latour (2014) asks us to consider if one can speak in a disengaged and dispassionate way about the objective measurement that industrial civilization in 2013 passed 400 parts per million of CO_2 in the atmosphere. Is this science-based statement, he ponders, more like "water boils at 100 degrees" or like "there is a cat on the bus seat (you are about to sit on)", or perhaps akin to "the Reds are threatening us with nuclear holocaust"? When those very scientists who are supposed to talk dispassionately about the objective facts of climate change are also those most worried and passionate about them, this speaks, Latour argues, to the unexpected confusion of geology and human action that now confronts us. A situation in which climate scientists speak about geo-historic events of which they, and all of us, are parts and parcels – much as was the case for so-called 'social' situations – and for all of the socio-cultural sciences, in the recent past.

Latour's assertion forms an interesting backdrop, I think, against which to consider the more specific and practical question concerning the many forms and types of engaged climate expertise that seems to exert itself these years all over the world. My native Denmark is a case in point: here, in the late spring of 2018, 301 climate researchers (myself included) drafted and signed a joint public statement of concern, published in one of the country's leading newspapers (Lund et al. 2018), calling for rapid, concerted, and ambitious political action. In an alarmed (but not alarmist) tone, the statement called for a reconsideration of societal priorities in which sustainability would trump economic growth in the hierarchy of public concerns. As such, it anticipated and joined similar public efforts by concerned researchers in other European countries, including Scientists4Climate in Belgium and the 'Climate SOS' from 700 scientists in the French Líberation newspaper on September 7 2018, not to mention the public face of the latest, dire report by the Intergovernmental Panel on Climate Change (IPCC 2018). The circle of concerned climate researchers ready to take a public stance seems widening.

Based on my joint familiarity with the 2018 Danish case and STS research on the topic, I would like to use this case as an opportunity to briefly revisit and invite discussion on the question of science-based advocacy and its interface with public debate and policymaking. This topic, of course, has been empirically studied and conceptually debated in STS for the past 40 years, often in reference to environmental issues. Given this terms' currency in such debates, I want in particular to raise a few questions about the adequacy of 'post-normal science' (PNS) as an analytical lens with which to conduct such inquiries. This lens is interesting, I think, in part because it enjoys some life outside of narrow STS circles. However, I will argue that the lens underestimates the extent to which initial problem framings – akin to the space of performative utterances traced by Latour's example – involves value-laden and contested processes in *both* science *and* politics, necessitating a more thorough rethinking of their interface. This is a rethinking to which, in turn, a publicly engaged STS ought to consider itself obliged.

In essence, Silvio Funtowicz and Jerome Ravetz (1993: 739) coined the notion of post-normal science with a view to how "science is now called on to remedy the pathologies of the global industrial system of which it forms the basis". As such, ecological destruction and contestation, and the search for more sustainable alternatives, was integral to PNS from the very start, as also signaled in how ecological economics acted as an epistemic home-base for the argument. While this remained implicit, the backdrop to the PNS argument here resembles closely what German sociologist Ulrich Beck (1999) termed the advent of 'world risk society': a society now confronted, in Beck's terminology, with the unwanted side effects and manufactured uncertainties stemming from the techno-economic prerogatives of industrial society. In risk society, science is at once de-legitimated by its involvement in ecological destruction and attains new political significance as the authoritative source of problem – and often solution – framing. PNS is best read as one interesting attempt to grabble with this twin conundrum.

The main tenets of post-normal science are fairly simple. In a diagnostic sense, the approach is well-known through its 'mantra' that with today's sustainability challenges, science no longer functions according to its 'normal' Kuhnian discipline-based and epistemic problem-solving mode, but rather must contend with how "facts are uncertain, values in dispute, stakes high and decisions urgent" (Funtowicz & Ravetz 1993: 744). While this will require new and interdisciplinary procedures, Funtowicz and Ravetz insist (ibid.: 751) that "post-normal science is indeed a type of science, and not merely politics or public participation". Nevertheless, in its prescriptive sense, PNS is known for suggesting a process of 'extended peer communities', whereby scientists invite "all those affected" by a situation and those who desire to participate in the resolution of an (un-)sustainability issue to enter into conversations on 'quality' in problem resolution

(Funtowicz & Ravetz 2003: 6f). The 'normal' knowledge base of value-free, universal facts are no longer enough.

As many have noted (e.g. Wesselink & Hoppe 2011), taken in a broad and rather undemanding sense, such commitments to new and more inclusive procedures tend to find support amongst experts in sustainability-related policy arenas. Similarly, several key commentators, among them Mike Hulme (2007) in *The Guardian*, have suggested that global climate science as instituted in the IPCC is *already* an example of post-normal science. The exact sense in which this is the case remains unclear in Hulme's analysis, however. He seems to find evidence in the way the process of science – who gets funded, who evaluates quality, who has the ear of policy – are now matters of dispute, and he criticizes the way matters of social values, such as over confidence in technology and the distribution of obligations, masquerade as disputes about scientific truth and error. Hulme is right on both accounts, I believe, but it is unclear how that has much to do with extended peer communities discussing a new sense of scientific quality – as opposed to the observation that *everything* about climate policy is contested.

The basic trouble here, I would argue, is the way a conversation framed around post-normal science is liable to proceed *as if* the definition and socio-political position of 'normal' science was itself unproblematic, and *as if* the role of scientific knowledge in policy making (whether 'normal' or 'post-normal') was already well defined. Neither is the case, as 40 years of STS inquiry and discussion has shown. First, Paul Edwards (2010) and many others have shown time and again how bits of modern science, including climate modelling, exert enormous powers of socio-material re-composition, in that they help co-constitute and change rather than simply 'represent' the environment around us. As Gert Goeminne (2011) argues, this means that value-laden questions about what has been taken into account in such scientific composition work and what has not are *already* at work under 'normal' circumstances.

Far from a purely philosophical issue, the consequence for climate knowledge is palpable. As David Demeritt (2001) and others show, values of global homogeneity and prediction capacity in the global climate modelling community writ large have led to a narrow focus on universal physical and aggregate economic properties to the exclusion of all the more unwieldy social, cultural, and political relations that drive greenhouse gas emissions. Small wonder that, as Sheila Jasanoff (2010) argues, people, publics, and institutions everywhere find themselves struggling to accommodate the radically uprooted global view precipitated by climate science within more humdrum concerns of everyday life and society. Beyond the narrowly construed problems of the global role of anthropogenic greenhouse gasses in heating up the atmosphere on the one hand, and the economic costs and benefits of doing something about it on the other, climate expertise arguably remains surprisingly disorganized. Where is the scientific forum for debating what the framing concerns should be in the first place?

Here, the lens of PNS arguably presumes too much by way of its own problem framing – that of the inherent un-sustainability of industrial society – which in the actual world of climate science for policy can hardly be taken for granted as shared by all parties. Indeed, that such is *not* the case, and that *other* framing commitments to things like 'green growth' and 'decoupling' tend to shape elite approaches to climate change in a country like Denmark (e.g. how such frames are instituted in dominant expert institutions like this country's Climate Council) arguably forms the backdrop to the 2018 advocacy initiative of the 301 concerned scientists. Here the researchers proposed, albeit in subdued ways, an alternative problem framing, one in which 'economic growth' as such would stand in the way of sustainability efforts. Unlike the well-structured problem of anthropogenic warming, however, this is clearly a much more unstructured problem, one that is very far from any agreement on knowledge *or* values. If anything, the subsequent debates and contestations served to make this point apparent.

Rather than focusing on sweeping statements to the effect that some undifferentiated Science with a capital S either is or is not 'political', or either is or is not 'post-normal', it seems to me more prudent to start from acknowledging the multiplicities of *sciences* relevant to the climate problem and their *varying* roles in relation to policy-making. Corresponding to how Michel Callon (2009) portrays anthropogenic global warming as a complicated 'stem issue', divided into all sorts of sub-problems to do with economic growth models, development policies, justice requirements, financial mechanisms, agricultural production modes, urban transitions and so on, one should ask how climate expertise is and could be instituted in relation to such more well-defined problem-spaces. In doing so, one would start acknowledging the *many* important roles played by scientific expertise, depending on the wider politics of policy-making – as problem recognizer, as mediator, as analyst, as advocate and, sometimes, as problem solver.

In light of such an ideal of pluralism in climate expertise and its ways of connecting to policy-making and public debate, the Danish case of public advocacy by concerned climate researchers strikes me mostly as a symptom of just how far we still have to go, as a society, in instituting climate expertise in democracy-enhancing and sustainable ways. *In place of* a widespread and informed public debate involving civic learning networks, NGO-science collaborations and other such practices of democratized expertise, a small group of concerned scientists took it upon themselves to act as problem recognizers when it comes to the role of present-day economic growth commitments in perpetuating un-sustainability. They did so, presumably, out of frustration with the narrow and technocratic ways in which climate expertise has become instituted in Danish society, itself shaped by the constrictions of the IPCC. However, the manner in which they did so – placing a statement of concern in a newspaper – hardly, on its own, lives up to ideals of

extending and democratizing expertise, based as this would be on informed and sustained debate across the many divides separating sciences from public life.

What might one learn from such an experience, and what alternative routes ahead for instituting climate expertise in sustainable and democratic ways does it suggest? In particular, might some kind of STS imagination on the variabilities of the science-policy interface help generate new and publicly committed proposals? I will end this short opinion piece by exercising a little bit of that politics of the imagination that, in my view, ought to be integral to a viable, democracy-enhancing climate expertise – and for which STS writ large provides ample fodder. Two suggestions come to mind, to which I remain practically committed, and around which I hope to spur critical and constructive debate also among publicly engaged STS scholars.

First, in a shifting political setting in which new coalitions of green NGOs and grassroots groups of climatically concerned citizens are emerging, the time seems ripe for concerned climate experts to start re-imagining their own commitments as oriented more durably and strongly towards a democratic politics of *joint* civic-science issue articulation and problem framing. Presumably, such an alliance might come about via new forms of organizing and committing interdisciplinary climate expertise, roughly based on 'reversing' the commitments of the Danish Climate Council and similar existing institutions upholding rather narrow and technocratic frames. Here, climate expertise would make itself accountable to the concerned climate public in place of the government. Rather than centering on economic expertise, it would re-frame itself as truly interdisciplinary. And rather than concerning itself with a narrow national perspective, it would orient itself towards elaborating and democratically testing versions of global climate justice in situated social settings. With colleagues, I dub this *The Climate- and Transitions Council,* simply to give imaginative institutional shape to a proposal yet to be fully realized.[1]

Second, and perhaps on a more utopian note, questioning the science-policy interface might well lead climate experts to take up the more far-reaching role of proposing new ways of not only re-instituting science, but also of re-instituting how politics is done. Proposals are nowadays on the table for augmenting representative democracy through a return to ancient practices of sortition-based decision-making. Imagine that we decided to augment, say, the Danish parliament with a second, sortition-based chamber oriented to screening all lawmaking from the point of view of its long-term compatibility with global sustainability goals. In such a situation, present-day bureaucracy would need to be supplemented with some version of experts exercising their civic duty by submitting assessments at the request of citizen lawmakers. Once again, this time in more fundamental ways, such an initiative would serve to make climate- and sustainability expertise accountable to democracy in new ways, while at the same time empowering such knowledge through a process of civic learning. Such a *Sustainability Chamber*, as I would call it, would thus seriously reconfigure the whole science-policy interface.[2]

I know these are just ideas that have yet to be subject to more demanding tests of reality, let alone informed debate and critique. My point, however, is a wider one: to put it with Latour (2014) again, once we liberate ourselves from the strictures imposed by an ill-conceived notion of science-*against*-policy – which, in my view, the lens of post-normal science still risks perpetuating – then we are free to debate what kinds of science-*with*-policy we might need and want. Put more strongly, I argue that STS scholars in particular ought to consider this task one of their core professional duties in a world of imminent climatic threats. By doing so, we might come up with more sustainable notions of climate expertise to work on, especially now that the climate sciences writ large have come to share in the predicament of inevitable 'social' participation that seemed, until recently, restricted to their socio-cultural colleagues.

1 I refer interested readers to the following building site (in Danish), which contains also information about the collegial, interdisciplinary nature of our initiative: https://www.klimaogomstillingsraadet.dk/.

2 For an arts-based beta-version of what such a chamber might look like (to which the author of this text also contributed), visit the following (Danish-language) site: http://kunstklimademokrati.dk/.

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THE ANTHROPOLOGIZATION OF ENERGY

Book Review

The Promise of Infrastructure. Nikhil Anand, Akhil Gupta and Hannah Appel (eds), 2018.

Electrifying Anthropology: Exploring Electrical Practices and Infrastructures. Simone Abram, Brit Ross Winthereik and Thomas Yarrow (eds), 2019

Reviewed by Antti Silvast

Introduction

Over the past years, research on energy and infrastructure has engaged with a number of disciplines from the social sciences and humanities including economics, geography, sociology, social psychology, environmental humanities, Science and Technology Studies (STS), and anthropology. A growing literature in the new field of anthropology of infrastructure has explored the full potential of anthropological approaches to address energy issues and sustainability transitions and to generate new insights to these discussions.

The activity in this field has been evidenced by several recent publications, special theme issues, conference panels, research projects, and the formation of international networks. The active institutes and networks include Durham University's Durham Energy Institute, which has been closely associated with anthropological research and teaching, and the Energy Anthropology Network that is part of the European Association of Social Anthropologists. Rice University in Houston, Texas, hosts the Center for Energy and Environmental Research in the Human Sciences. Another network, the Anthropology of the Contemporary Research Collaboratory, started engaging with topics concerning infrastructures more than a decade ago (Collier & Lakoff, 2008; Collier, 2008; 2011).

These collaborations have resulted in two new collected volumes published almost exactly one year apart. *The Promise of Infrastructure*, edited by Nikhil Anand, Akhil Gupta, and Hannah Appel, stems from an Advanced Seminar in the School for Advanced Research in Santa Fe, New Mexico, followed by panels on the anthropology of infrastructure at American Anthropological Association conferences. The newer volume, *Electrifying Anthropology: Exploring Electrical Practices and Infrastructures*, edited by Simone Abram, Brit Ross Winthereik, and Thomas Yarrow, expands upon research presented at a Wenner-Gren sponsored workshop called "Electrifying Anthropology" at Durham University, supported by the Durham Energy Institute.

Having two volumes appear almost simultaneously offers necessary resources for scholars of this field. Their publication is particularly useful when reflecting on the new fields of anthropology of infrastructure and electrifying anthropology. They generate important views on how a field defines its own research objectives, its intellectual resources, and its empirical concerns. Discussing what infrastructures are and how the social sciences and humanities might study them has been the subject of decades of research, especially in various strands of STS and socio-technical systems perspectives on energy (see e.g. van der Vleuten, 2004; Silvast et al., 2013; Silvast & Virtanen, 2019), as the readers of this journal will know. These two volumes offer a way to address a question in this situation, namely: What insights does this new research in anthropology bring to the long-standing discussions on large socio-technical systems and infrastructures?

A second, closely aligned parallel to this work runs through anthropology itself. An anthropological focus on infrastructures and energy is not new. As the volume by Anand et al. argues "(t)he relationship between infrastructure, environment, and modernity has preoccupied anthropology since the beginning of the discipline." (p. 7) This focus has included several considerations of energy and culture dating back to the 1940s (Strauss, 2013) and examinations of interrelationships between labor, cultural practices, the environment, and technical systems including energy and irrigation. This observation can be used to reformulate the question: How does the program of research on anthropology, infrastructure, and electricity draw from anthropological scholarship and develop it further? As it turns out, the two books have distinct if related answers to this question.

Structures and contributions

In addition to an introduction, *The Promise of Infrastructure*, edited by Anand and colleagues, spans nine chapters. These are then divided into three parts focusing on Time, Politics, and Promises. The chapters on time range from half-built infrastructure projects in Equatorial Guinea and Bangalore to roads in Peru and electrification in Vietnam. Politics is explored through investigations of public

and hydraulic infrastructures in chapters on South Africa and India. The final part concerning promises is markedly more theoretical and conceptual, with chapters relating infrastructures to political aesthetics, interdisciplinarity, and sustainability transformation in energy systems.

Electrifying Anthropology, edited by Abram and colleagues, has eleven chapters. Following an introduction, their topics range from metaphors and language of electricity to ethnographies that link these conceptual considerations with a variety of fields and infrastructural issues. These include the politics of electrification in rural India, riding an electric bike in the south of France, electricity billing in Japan, computer models of the Mekong River, state power in electricity grids in Mozambique, electricity grid development in the United States, and public promotion of nuclear power stations in guided tours in Northern England. The volume ends with an afterword by Sarah Pink that draws these disparate research projects together and proposes ways to build them into a research program.

Both books begin with a fundamental issue: defining what this anthropological research field examines and situating it among other academic disciplines that study similar topics – in this case energy and infrastructures. On this point, the two books start on similar grounds but diverge quickly. For Anand et al., their research object is infrastructures in the wide meaning. This includes "roads and water pipes, electricity lines and ports, oil pipelines and sewage systems" (p. 3) among other large structures. This definition includes what are typically understood as material infrastructures – such as electricity distribution. However, it also encompasses what Geoffrey Bowker in his chapter calls "knowledge infrastructures," e.g. large-scale networked computing or scholarly communication platforms. The research in the volume is not only attempting to contextualize these infrastructures socially or explain them by something more-than-technical. Rather, the point is that infrastructures are already "dense social, material, aesthetic, and political formations" (p. 3) and inseparable from sociality, everyday life, and future expectations. As the editors summarize, infrastructures are "critical locations through which sociality, governance and politics, accumulation and dispossession, and institutions and aspirations are formed, reformed, and performed." (p. 3)

In principle, Abram et al. approach the difference between "social" and "technical" dimensions of electricity in a similar fashion. As they note, especially in regards to empirical research, "the 'social' and 'technical' elements of electricity are inter-defined, imbricated, and distinguished." (p. 6) Furthermore, the editors want to avoid a distinction between "a 'real,' scientific version of electricity" and "a socially and culturally constructed version." (p. 7) The volume's contribution is in presenting work that tries to cross this disciplinary and professional divide. But in focusing on this research interest, the differences between the two books emerge.

For Anand et al., infrastructures are the focus of the research; for Abram et al. it is electricity. It is telling that, while *Promise* begins with several empirical chapters that study how infrastructures are envisioned, built, and used – from commercial and industrial buildings to roads and electricity grids – *Electrifying* starts with several chapters that focus on the language and metaphors of the term electricity. Anand et al. look at the wide underpinnings of different kinds of infrastructures – including their relations to governmentality, citizenship, temporality, promises, and political and economic transformations. While many of these issues are also of interest to Abram et al., they pay closer attention to the particularities of electricity and anthropological problematization of what electricity is in itself. For example, this focus implies distinguishing electricity as an object of inquiry from infrastructure and further distinguishing electricity from energy: electricity clearly is part of current energy research, but we should aim at more precise interrogation "of qualities and affordances of one thing (electricity -AS) that is in energy research bundled under a wide category" (p. 202) as Pink notes in her concluding chapter.

Conceptual and methodological approaches

This different research focus means that the two books draw on different, though related, intellectual resources. *Promise* has a detailed review of earlier studies ranging from urban geography to STS, infrastructure studies, histories of technology, and beyond, while also including earlier anthropological research. *Electrifying* also reviews some of these earlier works, but an extensive literature review is not included. As a result, *Promise* is more conventionally structured. It draws from the stock of earlier academic knowledge and presents thick ethnographies where anthropologists engage with informants – in this case, designers and builders of infrastructures as well as their users – in different field sites throughout the world.

According to *Electrifying*, however, it is not apparent that only designers, scientists, builders, engineers, and related actors possess expertise on electricity that can be uncovered by ethnographers. When they describe the chapter "Electricity is not a Noun" by Gretchen Bakke, the editors state that expertise on electricity is problematic: "We barely know what electricity is … even if we are increasingly familiar with its effects (largely true for scientists as well as social scientists)." (p. 13) They continue: "When engineers talk about a flow of charge, … they knowingly adopt the methods of physics and its use of models and metaphors that serve explanatory purposes without being direct representations of material phenomena." Hence, both social scientists and engineers try to explain electricity in their studies, albeit doing so in very different terms. Both disciplines also remain at a distance from the material phenomena that they are trying to represent.

These observations correspond with different research styles in the

two volumes, depending on how they perceive the role and impact of anthropology and ethnography. *Electrifying* uses a wide-ranging mix of research approaches, in order to, as Pink characterizes the entire volume, "bring apart most of the concepts that might have been used to define electricity." (p. 202) These approaches and methods include autoethnography, tourism studies, analyses of energy models and markets, desk-based studies, as well as more traditional anthropological field studies. *Promise* adds historical overviews to ethnographic study, and several chapters develop nuanced theoretical accounts of infrastructure. Yet, except for the conceptual chapters that end the volume, the research builds on the classic field study method: an ethnographer unpacks the infrastructure by being situated in the field where they manifest, usually observing how they unfold over a long duration of time.

Research methods and approaches have become an important area of discussion in the STS of complex interconnected technologies such as infrastructures and electricity distribution (see Silvast & Virtanen, 2019). While infrastructures manifest to us at particular sites – such as households or workplaces – the systems themselves are interconnected, interactive, and multi-sited assemblages. In his chapter "Sustainable Knowledge Infrastructures", Bowker speaks of the layered character of infrastructure and recognizes the challenge of navigating between its various scales: including time and space, collectivities, and data. This layered character of infrastructures means that the single-sited field study and its focus on particular, localized, and situated dimensions of technologies offers a necessary but an incomplete account when inquiring into infrastructures.

Against this backdrop, it is important to stress that, while the two volumes draw on situated field work research and use it both systematically and creatively, they are not merely advocating a single-sited study ethnographically or by research design. This is apparent because of their structure as collected volumes, where each chapter represents a different possible field site of various infrastructures and electricity. But it is also apparent within many of the chapters themselves as they move between design, use, construction, state planning, inaugural ceremonies, and political discourse almost seamlessly to expose the different sites where infrastructures are continuously enacted.

Disciplinary difference or integration?

In this review, I have paid attention to the differences of the two volumes to stress a point on the varieties of anthropological perspectives on infrastructures. This is not meant to understate the many similarities between these volumes. Both volumes are advancing and drawing from the ethnographic method in its various guises. Both situate an interest in what is termed the Global South or non-Western countries, although the volumes, especially *Electrifying*, also consider Western countries. The two volumes advance anthropology both theoretically and in the applied sense. The underpinning of the research, which is explicitly addressed by Dominic Boyer in his chapter "Infrastructure, Potential Energy, Revolution" in *Promise*, seems also to be largely shared. Anthropology of infrastructure and electricity did not emerge just because of an ethnographic curiosity on the "hidden" structures of society, but because of our current ways of life and the need to reconceptualize time, politics, and promises in order to understand the role of infrastructures in these settings. The necessity of sustainability transition in infrastructure provision, especially to mitigate the impacts of climate change, makes this requirement urgent for academics working at the intersections of infrastructures, energy systems, anthropology, and STS.

As such, these two volumes call for even more consideration – more than what they contain – of what happens to the academic discipline of anthropology when it becomes part of research agendas on timely sustainability issues. It is true that several chapters outline a research program that reconstitutes the field, drawing from a general underpinning that is aptly summarized by Pink: anthropology is among many disciplines that "has begun to open up to and whose practitioners have begun to develop collaborations with design and engineering disciplines." (p. 206) She cites energy research particularly, and her diagnosis is doubtlessly appropriate in externally funded, collaborative research and development projects and explicit advocation of interdisciplinary research agendas, which often take shape in cross-cutting interdisciplinary institutes or as parts of research networks. But this collaborative agenda speaks less to the continued importance of conventional academic disciplines – in this case, anthropology – than to an increased level of interdisciplinarity that is assumed to be taking place.

Scholars developing a program on the anthropology of the contemporary (Rabinow et al., 2008) contemplated the state of their discipline a decade ago and explicitly called for establishing the disciplinary community in anthropology, its academic integration, standards, norms, and quality to address challenging contemporary research topics such as infrastructures. Academic disciplines are means for giving scholars the conditions for understanding quality, and they are always associated with specific gatekeepers, publication practices, and ways of recognizing academic reputation. Those embarking on interdisciplinary collaborations with anthropology should pay careful attention to this issue and recognize it when developing their research trajectories. The two volumes point towards a considerable amount of untapped potential in anthropological approaches to addressing complex energy issues all over the world. But, if one wishes to become an active participant in anthropology, more consideration needs to be given to its academic practices and norms and how various experts speaking on behalf of the discipline may recognize scholarly reputation and quality before this participation can be fully realized.

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