Data sprints as Critical Proximity

Issue-publics in a workshop format

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Abstract

Forskere har i stigende grad et ønske om at involvere sig i offentlige anliggender. Kendetegnende for dette ønske er, at de via deres intervention i højere grad vil assistere i de sager, der vedrører offentligheden. Dette gælder også forskere indenfor STS, som har en rig tradition for at beskrive sådanne offentlige kontroverser.

Blandt det brogede udsnit af felter, der beskriver STS, findes Digital Metoder. Digitale Metoder kan beskrives som en tilgang til at undersøge social videnskabelige problemstillinger ved at genbruge digitale data spor og digitale værktøjer.

Indenfor denne afart af STS har der været fokus på såkaldte sagsorienterede offentligheder. Sådanne offentligheder er en samling af aktører, som involverer sig i en sag, der ikke kan løses eller tilgås af eksisterende organisationer eller organiseringer af aktører. Således er sagsorienterede offentligheder specifikke fra sag til sag og er hverken konstant i deres sammensætning af aktører eller afgrænsninger af sagen.

For at involvere sig i disse sager har nogle forskere indenfor digitale metoder udviklet workshop formatet, data sprints. Data sprints er tidsafgrænsede begivenheder der samler forskere med ekspertise indenfor digitale metoder samt aktører, der er engageret i specifikke sager. Disse aktører kaldes også sags- eller domæne eksperter, da de siges at besidde indgående viden, som relaterer sig til den specifikke sag eller et domæne relateret hertil. Således arbejder deltagerne sammen om at bygge prototyper på Digitale Metoder projekter, som på forskellig vis kan svare på specifikke spørgsmål til det sociale i en bestemt sag.

I dette speciale undersøges en sådan data sprint. Denne data sprint, som gik under navnet SaveOurAir, havde til formål at undersøge, hvordan luftforurening kan tilgås som et emne fra en socialvidenskabelig tilgang. Således handlede den om at fortælle data drevne historier om sagen om luftforurening, for derved at involvere specifikke aktører og viden i udformningen af sagsorienterede offentligheder.

I samspil med Noortje Marres måde at forstå offentligheder som sagsorienterede offentligheder belyses, hvordan man kan se data sprint formatet som en måde at tilgå disse sagsorienterede offentligheder og i

visse tilfælde være med til at forme dem. For at gøre dette i et data sprint format låner jeg yderligere begrebet nær kritik (critical proximity) fra Bruno Latour for at undersøge, hvordan domæne eksperter kan bidrage til dette.

Ud fra etnografisk feltarbejde i form at deltagende observation foretaget i SaveOurAir sprinten, beskrives og analyseres de interaktioner, som foregik mellem deltagerne i sprinten, med særlig fokus på forholdet mellem domæne eksperter og øvrige deltagere. Analysen afslører, hvordan forskelle i tilgang til sagen mellem domæne eksperter og deltagere åbner op for flere mulige formuleringer af de sagsorienterede offentligheder. Ved at samarbejde om et fælles produkt, en Digitale Metoder prototype rettet mod den eller de sagsorienterede offentligheder, italesættes og forhandles de forskellige formuleringer og relevante fokuspunkter i sagen. Dette kommer blandt andet til udtryk i udformningen af prototypens visuelle præsentation af data, da nærheden til de sagsorienterede offentligheder er særligt vigtig her. Dette skyldes, at det er blandt disse offentligheder, at momentum omkring sagen skal skabes, altså skal prototypen designes til dem.

Disse interaktioner mellem domæne eksperter og deltagere understreger funktionen af data sprints som værende en måde at engagere forskellige aktører med formålet om at bygge bro mellem såkaldte eksperter og offentligheden.

Med denne analyse besvares spørgsmålet hvordan kan data sprints involvere sagsorienterede offentligheder gennem nær kritik. En del af dette svar er at domæne eksperter er en måde hvorpå denne nære kritik kan opnås. En kritisk behandling af måden hvorpå titlen 'ekspert' bruges og tildeles leder til erkendelsen af, at ekspertviden i data sprints, ligesom i alle andre formater, altid vil situeret. Dermed vil udformningen af domæne ekspertise i data sprinten hænge sammen med hvorledes deltagerne interagerer. Enten ved at bruge denne ekspertise til at tilgå sagsorienterede offentligheder eller ved at omformulere denne ekspertise til deltagelse i udformningen af sagen i en specifik offentlighed.

Introduction

How can researchers participate in the issues of public interest? This is a question that Science and Technology Studies, abbreviated STS, has asked itself for some years (Latour 2004b). The specific interest is how can researchers intervene in issues, with their methods and academic inquiry? And how should this intervention be done in practice?

Within the part of STS that goes under the umbrella term of Digital Methods, ways of engaging with the public have also been under academic scrutiny for some time (Marres, 2015). Digital Methods is described as ways of re-purposing the traces of digital data that people for instance leave online, for use in social research. Part of the research of engaging the public has been conducted through the data sprint format. A data sprint is an event that gathers several different actors over a period of time, some from within the field of Digital Methods and some with specific knowledge about a specific issue, all with the goal of visualizing this issue through digital data (Munk, Venturini & Meunier, 2018).
This workshop format has at its methodological core the focus of intervening with specific issues (Munk, Venturini & Meunier, 2018). Studies within the data sprint literature have thus far taken this methodological approach in providing ways of engaging with issues through digitized formats.

My field of investigation is how data sprints engage with so called issue-publics, an assembly of several different actors intervening in a specific issue (Marres, 2005), partly by way of their use of issue experts. The reason for engaging with issue-publics is that if we are to deal with issues such as air pollution, that are not handled adequately by a single expertise or societal domain, then we must engage these issue-publics because they transcend these classic divisions.

The focus of this thesis is the data sprint format as an event in which the interaction between issue experts and sprint participants, also called sprinters, situate issue-publics, and how they assemble prototypes of digital methods for use by these issue-publics. The case used to illustrate these dynamics is that of the SaveOurAir data sprint. This sprint tool place in February 2018 and was facilitated by The Public Data Lab. Sprint participants were from Aalborg University in Copenhagen, Density Design in Milan, Science Po in Paris, The Institute for Complex Systems in Lyon, and the Institute for Policy Research at the University of Bath. The participants were divided into three groups called the MyAir Group, the Mobilizing Our Air Group and the Hot Potato Machine Group. My participation in the sprint was with the purpose of generating data for this thesis.

Problem field

In this thesis, I investigate the interaction between participants and issue experts in the data sprint format. I use the concept of critical proximity, which is a way of providing critique that is close to the field investigate, to explore how these issue experts can provide situated knowledges as a part of assembling and engaging issue-publics.

By paying attention to the interactions between participants and issue experts in the data sprint, I show how such interactions come to define the issue of air pollution. Furthermore, I show how the definitions of and perspectives on air pollution is part of the construction of the prototypes built at the sprint.

As a way of guiding this thesis, I use the following problem statement:

How can data sprints engage issue-publics through critical proximity?

Unfolding this question, I begin by explaining the theoretical approach in which I write. This part unfolds the concepts of data sprints, digital methods and critical proximity to a greater extent than thus far. This is followed by a presentation of the SaveOurAir data sprint which I participated in and from which the data of this thesis was generated. In this part, the three projects along with the three issue experts central to my analysis will be defined and explained. In the analysis, I treat each of the three meetings between a project group and issue expert by analyzing their interactions and how this shape and inform prototypes of digital methods projects as well as the users of these prototypes, that is the issue-publics. The discussion to follow focuses on the critical questions of claims of expertise, and how the data sprint format, as any other critical format, to some extent accepts such claims considering the inherent demarcations of all knowledge. My conclusion will provide an unfolding of my argument, that issue-publics can be engaged through data sprints, by way of issue experts. I nuance this through a discussion on the concept of expertise, and provides a different way of explaining this, through issue participation.

Theory

In this section, I explain how the thesis is thought out. I will provide some context to the project and its relation to existing literature. I will also provide an ontological backdrop in relation to analyzing the empirical fieldwork.

I will first introduce the theoretical tradition in which I am writing and doing research, which is STS. I will then contextualize the specific research approach which I am engaged in, that is the field of Digital Methods. Finally, I will explain the analytical terms, critical proximity and issue-publics.

Science and Technology Studies

Describing Science and Technology Studies, henceforth written as STS, carries the risk of demarcating the field in an unnecessary way and leaves ample room for the critique of said demarcation. You can describe what might constitute the perfect demarcation, what the subject matter in fact is, or you can unravel these facts, in spite, in political agenda, as controversy devices or out of mere curiosity. Instead of unraveling these threads beyond compositional repair, I would rather much limit myself to the branch, if such exist, of STS that I situate myself in.

Within STS there are many different approaches that describe, from various ontological standpoints, the interplay between Science, Technology and Society (Jensen, Lauritsen & Olesen, 2007). Some of these approaches deal with the world in slightly different ways. In order to describe such particularities, I will now turn to these approaches, so as to describe these different approaches within the field of STS. This will hopefully give the reader an understanding of how STS as a field could have been said to come about.

SSK

One of the approaches related to STS is the Sociology of Scientific Knowledge, abbreviated SSK. This theory distanced itself from assumptions of scientific knowledge, that gave the knowledge of natural scientists privileged access to truths about nature and in extension about the world as an objective entity, in that it asserted that all knowledge, even the knowledge created by natural scientists in laboratories, were socially constructed. This provided a move away from the Mertonian school that

focused on scientists' careers, scientific institutions and the norms of science (Merton, 1973). Knowledge that turned out to be true, wasn't a question of representing nature '*out there*', but of an enculturation process that depended on the specific social circumstances for how truth was settled '*in there*', in relation to the field under scrutiny.

Within SSK two specific approaches can be pointed out as ways of carrying out this move. One was the STRONG programme, initially heralded by David Bloor in the book *Knowledge and Social Imagery* (1976). Of particular interest to this thesis is the concept of symmetry in providing uniform explanations for both true and false statements (Bloor, 1976). This means that the researcher cannot privilege any explanation due to its conception as being true in itself. So, the researcher must provide symmetrical explanations for statement regarded as true or false (Barnes & Bloor, 1982). The symmetry doctrine was a way of turning the explanation for how knowledge came to be, away from the individual scientist and towards the social circumstances for knowledge creation (Barnes, 1983).

Another approach that added to the field of SSK was the Empirical Program Of Relativism, or EPOR (Collins, 1992). This approach surmised that the social construction of truth was related to the social groups. The researchers' job is then to establish how our social interactions within the social groups of which we are part, are creating the facts that the social group rely on. As such the researcher takes a relativistic stance towards the creation of knowledge within different social groups (Collins, 1974).

SCOT

A way of understanding the innovation within technology and technology development is through the approach known as the Social Construction Of Technology, abbreviated SCOT. SCOT was thought out as a way to branch out the concepts within SSK to be included in studies of technology. (Pinch & Bijker, 1984) More precisely, it is the idea that technology is socially constructed (MacKenzie & Wajcman, 1985; Williams & Edge, 1996). It has been developed as a critique to the notion of technological determinism, that separates the explanation of technology from social forces. SCOT introduces the terms *relevant social group* as a way of explaining how artifacts are developed (Bijker, 1997). It is in these groups, that the explanation for how artifacts becomes successful or not is to be found. This way of explaining technological development sidesteps two assumptions about technology; that the development of technology is linear and that the explanation for successful and failed technologies are due to their traits located within a physical construction (Bijker, 1989). Instead SCOT proposes that artifacts are developed in a non-linear approach and that successes or failures of artifacts must be explained in symmetrical

terms, which is inspired from the same proposal put forward by researchers within SSK in regards to true and false statements (Pinch & Bijker, 1984; Collins, 1983). Furthermore, the relevant social groups also have what Pinch & Bijker refer to as *interpretive flexibility* in regards to specific artifacts, a term that also originated with SSK (Pinch & Bijker, 1984; Collins 1992). That is the different relevant social groups are socially constructing the same artifacts in radically different ways that affect how the artifact is constructed physically. Relying on discourse, the SCOT approach talks about the *stabilization* of artifacts in lieu of *closure mechanisms* (Pinch & Bijker, 1984). These closure mechanisms are ways of stabilizing an artifact in the sense that the relevant social groups no longer question the viability of the artifact, but merely uses it without any problem.

Laboratory studies

In 1979 Bruno Latour and Steve Woolgar wrote a book which has since been referenced as formative in the field known as laboratory studies. In the book *Laboratory Life: The Social Construction of Scientific Facts* (Latour & Woolgar, 1979) the researchers approach a laboratory setting with the same tools and methods that an anthropologist might use in studying the natives of a foreign nation. In doing so, they show how the construction of scientific facts is not due to a rigid process of finding the right facts, but more to a cultural appropriation of assembling the scientific facts in conjunction with the practice in the laboratory that also includes non-human actors. Thus, scientific facts are not separate from the world in which they are produced but are very much situated and contextual to the everyday practices of laboratory life (Latour, 1983).

This approach of also including non-human actors as having agency on the same terms as human actors was one of the key approaches in what would later be termed the constructivist approach.

The constructivist approach

The constructivist approach is a departure from privileging the social as a phenomenon in social constructivist approaches. In dealing with both human and non-human actors at the same level, Latour and Woolgar (1979) showed how the constructive work of facts were partly due to the interactions between scientists and partly due to interactions between materialities and scientists. The notion within SSK and SCOT that everything was constructed solely in the social was cast away to not privilege any type of explanation prior to empirically researching the subject or practices in the field. And it is an

empirical question that must be researched in order to know how these explanations matters in these specific contexts (Latour, 2005b).

This type of engaging in and understanding the world led to the formulation of actor-network theory.

ANT - Actor-Network Theory

Actor-Network theory, called ANT from here on out, is an approach developed in the 80's and 90's (1999, Law). Actor-Network theory is an approach used by researchers within STS and often associated with Bruno Latour, who is one of the central figures of doing science in a material-semiotic approach (2008, Law).

Actor-network theory treats the world as a relational practice. This means that actors and actants, that is non-human actors, which are treated symmetrically, exist through their relations to the actors that they have as part of their actor-network (Latour, 1988). Actor and network should in this regard not be seen as two different entities, but more like a hybrid of each other. That is, these act as extensions of each other. One can never trace where the actor ends, and the network begins or vice versa. Instead, one should 'follow the actor' (Latour, 2010) and try to map out the intricate relations in order to reconstruct the actor-network, and thus find out what specifically matters in situations. Latour underlines the importance of anthropological-style inquiry and fieldwork to stay close to the contextual knowledges of the field in play.

More recently, researchers have taken an interest in the digital domain. Specifically, they have wondered what might be said about everyday (offline) life when we study online practices. Media studies, platform studies, algorithmic studies are all parts of how researchers have inquired upon the digital as a form of social interaction (Birkbak & Munk, 2017).

This move has also happened within STS. The field of digital methods has been formulated in conjunction with STS scholars' move into the digital domain.

Digital Methods

Digital Methods is an approach to studying digital data and using digital-born tools. Even though digital methods scholars may use algorithmic applications, the interpretation and use of these are understood

in what Richard Rogers (2013) describes as re-appropriating the tools and logics of digital substance matter.

The reason for talking about digital methods is that the data sprint is informed by this approach. As such, some of the researchers participating in data sprints are usually informed by the digital methods approach of conceptualizing the digital (Munk, Venturini & Meunier, 2018).

As to the formation of the field, Digital Methods is an interdisciplinary approach that gathers a diverse range of academic professionals in this interest to (re-)appropriate the digital traces that people leave on-line (Marres & Gerlitz, 2016).
Whether it be for studies of platforms (Gerlitz & Helmond, 2013) insights into algorithmic consequences (Rieder, 2012) or a way of grounding online traces in offline settings (Munk et al., 2016), digital methods have the digital traces as its topic of academic inquiry.
In relation to researchers within the field of STS, attempts have been made to find the composition of the socio-technical materiality of the digital realm. Indeed, some thoughts from STS, and in particular, the work of Bruno Latour, has inspired the field of digital methods in understanding the world and the digital in a constructivist perspective (Birkbak & Munk, 2017).

In trying to understand the conception of the digital from a digital methods perspective I will provide an explanation for some of the most common terms within this methodology. It is by no means exhaustive, nor does it limit other possible ways of doing a digital methods approach, however it provides a look into the way in which the researchers conceptualize the digital as a way of telling something about the world and an object of study in and of itself.

One concept within Digital Methods is how much the researcher should let the medium decide the research design through its built-in logics and how much the researcher should resist these choices (Marres, 2015). And as a consequence, a researcher could instead use this opportunity to learn about the specific intricacies of the media through, for instance, *online grounding*, whereby the researcher uses other types of digital media to learn the ontologies of the medium under scrutiny (Rogers, 2013).

Data sprints

One way of doing data sprints is in the discipline of controversy mapping, in particular digital controversy mapping (Munk, Venturini & Meunier, 2018). This disciplinary branch can trace its roots back to Actor-Network Theory. Controversy mapping was particularly used as a didactic tool to teach

engineering students about Actor-network theory. This original usage was later broadened, particularly in line with the ever more permeating effects of digitalization. It is even possible to surmise that the invitation from the STS scholars, in regards to learning about ANT and the material-semiotic approach, to the engineering students has been reciprocated, for STS scholars to venture in to the field of what could be termed the digital, that is to learning about algorithms, search engines, and the like.

A data sprint is a workshop format where participants gather for 3-5 days in order to construct and tell data narratives (Munk, Venturini & Meunier, 2018). These data stories are informed by the contestants' repurposing (Rogers, 2013) of digital tools and digital traces in order to inquire upon a specific topic. The topics in data sprints have varied from obesogenic environments (Munk et al., 2016; Madsen, 2017), climate adaptation (Venturini, 2017) to envisioning the school of the future in a participatory democratic experiment (Madsen & Munk, 2015).

Sprinters working on their laptops on the 3rd day of the SaveOurAir data sprint in Copenhagen.

As to how data sprints are organized, they have been described as beginning with pitches by the invited issue experts that frame the work of the following days to come. The issue experts provide their issue specific knowledge within their respective domain and the sprinters ask questions and provide comments in order to elucidate the following days' work. (Venturini, Munk & Meunier, 2016)

The sprinters then attempt, both with and without the issue expert, to translate the research topic into a more specific digital methods project. By the use of computer programming code writing, they then try to build a mock-up of the project and, if needed, find data they do not already have at their disposal. Finally, the sprinters finish a working prototype of the data visualization or data story that is to be used or utilized by the issue expert in their work on the topic (Venturini, Munk & Meunier, 2016).

However simple it reads, the empirical reality of actually doing data sprints is far more messy than the polished description I have provided above. This should be no surprise as everyday life is usually not that organized as step-by-step representations. But the representation above hopefully serves as a foothold in getting to know what a data sprint might actually entail. The analysis in this thesis will draw out some moments that show how a data sprint can be made and also how they tend to deviate from the straight line of events

A recent conceptualization of the data sprint is that of the participatory data design. It draws on participatory approaches that seeks to engage the local actors in the production of data and ways of organizing and interpreting data (Jensen et al., 2017).

A way that the participatory data design approach facilitates the inclusion of local actors is in turning these actors into issue experts. These actors have the domain specific knowledge able to facilitate and translate the way in which a datafication of practices and projects are able to happen into local context (Jensen et al., 2017). In working with sprinters, they are able to situate the projects into practices having a close contextual knowledge as part of the field that is currently being sprinted. As such these issue experts are a way of engaging in what could be termed Critical Proximity (Latour, 2005a)

Critical Proximity

Bruno Latour has outlined a sharp contrast between how social scientists tend to take a critical stance (Latour, 2005a; Latour, 2004a). In particular, he has crystalized two standpoints in the discussion about how social scientists should engage with the world outside of academia. One is the stance of Critical Distance, which could be described as performing critique from a distance, that is researching a subject matter and then critiquing it. The other, Critical Proximity, could be described as actually engaging with the actors within an issue in order to know the critique currently in play, modifying it, and ultimately changing the scene of the critical landscape from the inside-out with all the caveats accepted in joining the field under scrutiny.

In a sense, critical distance allows for a critique *of* a field while critical proximity allows for a critique *in* a field (Birkbak, Petersen & Jensen, 2015). This is important because the critique of a field takes a distant position that places the researcher outside the context of which they are critiquing, while the proximal position places the researcher inside the context they are critiquing. As a consequence, the researcher taking the proximal position will know of the critique already within the field, while the researcher in the distant position will critique the field, from their own field.

The question of how social scientists could make a difference is left open by Latour in his paper *Critical Proximity or Critical Distance* (Latour, 2005a). Indeed, interpreting from the ending of this article outlining the two standpoints, where a discussion on what critical stance to take is interrupted by the phrase *"Sorry, I have a plane to catch" (Latour, 2005a:8)* leaves us with the distinct impression that Latour, although probably in favor of the critical proximity approach, sees a possibility for how both views could produce significant critique that might intervene in the world (Latour, 2004a).

When trying to change the world, a critique of the critical proximity standpoint from the critical distance standpoint would posit that you end up not changing the things that actually matter in that you lose sight of what type of powers are exerted upon you in becoming a 'complicit' in what happens in the field.

A rebuttal from the critical proximity standpoint is that the researchers critique end up not mattering for the field, because there is already a critique at play.

I would argue that a way of engaging in critical proximity is through the use of issue experts in data sprint.

So why do people in data sprints engage with issue experts? One answer is that this engagement gives the opportunity to change the practical landscape of a field by actively engaging with it.

Then there is also the interest in showing what the STS approach can do, through showing the ways in which this conceptualization of the world might offer some ways of engaging with people. As such, a component of data sprints is also the desire to make things public. That is to practically engage in these experiments through specific issues where the tools and methods for understanding these issues are created together with the issues. In short it is a way of situating the issues in the practice of everyday life.

There has already been a treatment of the critical proximity approach within STS and specifically

Techno-anthropological research (Birkbak, Petersen & Jensen, 2015). The addition that I would like to propose is that critical proximity as an approach could be conceptually thought together with the data sprint approach. And that a way of describing these different ways of being critical in the proximal sense is through the interaction with different issue experts and the simultaneous process of issue-public formulation.

The next questions that are to be touched upon is the way that issues and publics are thought out in relation to research within digital methods. In this I will turn to the contributions of Noortje Marres in the formulation of how the issue-public could be formalized in a data sprint approach.

The Issue-Public

Noortje Marres has defined a re-reading of the debate between Dewey and Lippmann in: *Issues spark a public into being: A key but often forgotten point of the Lippmann-Dewey debate* (Marres, 2005). In it, she posits that issues are best taken care of by democratic publics, because these publics are best suited to treat the issues as they are complex, and information is lacking. Issues is in Marres definition problems that cannot be solved by existing institutions, in that they expand across several domains and several practices. Therefore, existing institutions are not able to take care of these problems as they are not manageable. She describes the public as a sort of opportunistic public that takes care of problems that are lost by existing communities and institutions. Dewey and Lippmann argued that the public was something that rose from occasions, even that media enabled constitutions of publics (Dewey, 1927; Lippmann, 1922; Lippmann, 1927).

Marres describes the public as various different actors from different communities that are summoned because of issues that can no longer be handled by traditional institutions. When governments, NGOs or other types of communities fail, it is the public that handles these affairs. It is the public that assembles these actors in order to deal with the issues. The reason for this is that the issues are felt by actors who are not in control of acting upon the issue in the settled institutions. Because the repercussions of the issues is felt by these actors and because they have no way of handling the issues through the traditional institutions, a public is sparked as a result in order to handle these issues (Marres, 2005).

This public span across existing social communities and organizations because these organizations are not dealing properly with the problem at hand. The public is not a constant size, but it is defined through

issues, such as new techno-scientific inventions. As a result, the public is indirectly affected by the consequences of the issue (Dewey, 1927).

Marres departs from Dewey in that she argues that the public as a uniform entity is not really possible. As far as she is concerned it cannot be assumed that actors engaged in techno-scientific controversies such as GM foods could be assumed to being equally interested in building the common good world. As such she instead provides a controversy viewpoint for how actors engage in the formulation of publics concerned with issues. She also points out that some actors in controversies are not interested in making issues (Marres, 2005).

Marres thus posits that the public is not as unified as Dewey would argue, but instead provides a controversy view upon the way in which publics treat issues. In this sense it is the politics of whether something should be made an issue and how the public sets about defining issues (Marres, 2005).

In *The Issues Deserve More Credit: Pragmatist Contributions to the Study of Public Involvement in Controversy* (2007) Marres further elaborates how the contributions from the Lippmann-Dewey debate might help bolster democratic engagements in controversies to STS. She begins this by first outlining the current engagements made by STS:

> *"Latour outlines a democratic procedure for 'ecological politics', in which a range of competences – the sciences, ethics, politics, law and economics – contribute to the articulation of risky objects. And the principal aim of this process is the eventual accommodation of such objects within society." (Marres 2007:5)*

Marres asserts that researchers within STS has shown that these *political objects* are parts of what enables public participation in controversies of techno-scientific phenomena. Where she disagrees with Latour is in the procedural explanation of the treatment of objects in composing the common world (Latour, 2004b). As a consequence, she argues that:

> *"...STS perspectives on democracy all too readily adopt models of public participation developed in political science. This criticism also applies to the models of public involvement in politics proposed by Latour and Callon, insofar as they are procedural models." (Marres 2007:6)*

She argues that STS research itself has shown that these prescriptive ways of formulating democratic engagements are unable to adhere to a messy and practically oriented world. Instead she argues that democratic engagements within STS must accept an issue-oriented approach that attempts to make

things public. Not as in the procedural way of democratic engagements, but instead as various different events that may or may not form concerned issue-publics.

As to the formation of the publics that Marres describe, I will use the terms that I believe best capture the vein of the constructivist approach. Thus, publics arise, insofar as the consequences of actions or displacement of actor-networks, are felt in the actor's everyday practices. This also means that innovation in practices are a part of these publics. It is what 'spark them into being' (Marres, 2005).

The vein of Marres' writing is a contribution to the understanding of how STS might engage with and understand the public and its issues. I however depart here from the writings of Marres and walk down our own path. Where Marres discussed the role of democracy in politics within STS, the turn in this project is at a slight angle. Having the work of Marres as a backdrop, I instead inquire upon the situation of forming publics and their issues (Birkbak, Petersen & Jørgensen, 2018). I will argue that in order to understand a public, we must situate the public in the actors which engage with the issue of the public. And in order to understand the issue, we must understand the public. The importance of situating our public is that it is just that, at least if we are to follow a constructivist approach. In order to unfold the public, to understand how the public is thought of as being made into a public, we must understand the empirical interactions of the actors involved.

The public as something that can change affect issues, an assembly with political force, should be empirically founded, and situated in how that public is negotiated. How did this public 'come into being'? How did the public get exposed? Who claims authority on these claims? What kind of issues is the public oriented towards? Who claims public speakership? If we need to know how publics settle controversies, or could settle controversies, we should first know what made this public 'come into being'. And the answer cannot be relegated to an issue but should instead be treated as an empirical moment. A situation, in which the scholar, like a stubborn anthropologist, follows the actors, describing in detail their interactions with other actors. But instead of relaying the explanations of the actors, those same explanations should be scrutinized, along with the researcher's own explanations. This means that a claim to expertise on an issue should be an inquiry into how this expertise is constructed and accepted or refused by the public. And the explanations that the researcher provides should themselves be made from the bottom up, that is to "*follow the actors themselves*" in an effort to "*catch up with their often wild innovations in order to learn from them what the collective existence has become in their hands, which methods they have elaborated to make it fit together, which accounts could best define the new associations that they have been forced to establish"* (Latour, 2005b:12). And these explanations, should

endure the explanations of generalized symmetry (Callon, 1986). In order for critical inquiry to become potent, the researcher should be a complicit in the research. And this complicity, this, as Latour calls it, critical proximity (Latour, 2005a), should also be able to lay under the symmetrical, empirical study that the research framework calls for.

These ways of thinking about the 'public' involvement in 'issues' will hopefully engender that which is called for by scholars within the field of STS, which is a democratic engagement with scientific issues that assemble, creating arenas for the actors in which to gather.

In this project, I define the attempts at assembling an issue-public, the issue of air pollution, through a data sprint held respectively by The Public Data Lab in Copenhagen. This data sprint was an intense research workshop where participants, or sprinters, worked on the collective issue of air pollution for 5 days. The sprinters at the sprint in Copenhagen had visitors from outside of academia convening with the groups, utilizing these external people as issue experts.

The way that I operationalize or situate an issue-public is through a data sprint format. That however raises a question in and of itself. For how is the public thought of in the sprint by the facilitators of the workshops. And how does the issue enter into the fray?

Reorienting some of Marres work, I will personally advertise for what I term empirical publics. The first thing to remember is that it is still an issue-public in the sense, that it is a heterogenous group of actors concerned with a specific topic, such as air quality or air pollution.

In this way there is no considerable deviation from the work of Marres. Where the road starts to fork is how Marres solidifies this public. She rightly recognizes that publics and their issues might change over time. It is however the process of raising a public that I find might bolster the issue-public as a productive concept. In order to know how researchers within STS must engage with these publics, we must first turn this exact move, this intervention of sorts, into an empirical question. The reason for this is to escape the 'phantom publics' that Marres describes in her treatment of the Lippmann-Dewey debate (Marres, 2005). This is at least if we practice scientific inquiry in a constructivist approach.

The potent promise of using STS as a way to change the course of issues are indeed alluring and should for obvious reasons not be abandoned. However, the turn to issue-publics should also be a turn to critical proximity, insofar as the productive spirit of constructivism is to continue. And the reason for this is very obvious. Actors are already busy (Birkbak, Petersen & Jørgensen, 2018). One way or another,

there is already critique at play in the field, among the diaspora of various actors. So, the issue-publics, however their appearance, should be treated in an empirical way in the sense that the researchers should be curious how they can engage with their everyday practices. In this engagement, the possibility of displacing the critique and of situating the collective concerns of the actors is of great value as it will allow for the possibility to retain the sensitivity to the field and keep the focus on the research topic. As a methodological move, the researcher should attempt to situate the issue in the contextual everyday practice in the field among issue-publics. Through the analysis of my empirical fieldwork, it is my hope to show the value of engaging with potential publics and the reconfiguring of their issues in this way.

Methodology

The following section will lay clear how the empirical work was undertaken and also answer the why of that question. I will focus on the methodological implications of choosing one research design over another and what the abilities of the specific methods may afford.

Participant observation

Both of the data sprints were captured by fieldnotes. Constructing the field notes, I used the principles from Emerson, Fretz & Shaw (1995).

In particular, participant observation is about deploying the field to actively engaging with it.

As part of the participant observation, I also took part in the interviews that the groups had with the issue experts. I was allowed to share notes and recordings of interviews in which I participated. For instance, one of the sprinters recorded an interview with an issue expert, and in conversation with him, he agreed to share the recording with me under the circumstances that I anonymized the issue expert. This is also a somewhat peculiarity of the research design. A sort of design-in-situ. I had a preset idea on what was important in the field, and wanted to inquire upon these things myself, in what actually mattered in a data sprint. On the role of the issue expert, on the perspectives they had on sprinters, on sprinters perspectives on the issue expert and how it made a difference, before and after a data sprint. But instead of imposing this theme upon the data sprint, I situated my research question in the

deployment of the issue made by the sprinters and the issue expert. So the empirical reality of the field, already in play, made me go along on that play, for the sprint being. A reflection after this, is that in writing this thesis, the co-production ends. This obviously has its effects. This product is not co-written, however that also means that it can actually adhere to an academic standard as an academic product. The same with how the different sprinters have since used the synthesis of the data sprint afterward in their respective fields. For instance, the members of the Public Data Lab (Public Data Lab, 2018) have since used the process and products to garner more research funding. In actually proving the success of the data sprint, they can now do additional research within the field of Digital Methods.

When doing ethnography in the data sprint, I wrote field notes. This was a deliberate decision taken before the sprint. This was in order to get as close to the interactions between the sprint participants and to find out how they reasoned. Understanding when the facilitators plans of how one ought to do a sprint project met the participants of the sprints whom were not part of the planning process in the same fashion as the facilitators, and in extension what happened. In a same fashion, what the issue experts who, in lieu of their role and expertise, didn't have the same approach to the projects thought about the issue-topic and the process. How they interacted and acted with the sprint participants.

This meant paying close attention to what happened in the sprint. And because of the material-semiotic ANT way of approaching the field, and my research question, there was a need to not only pay close attention to what was said, but also the interactions between data objects. In short, the analytical focus of trying to know what got rejected and what didn't was facilitated through the ethnographic methods of following the actors around, letting them deploy the field, and inquiring them about why decisions were made in a particular fashion, or what mattered in specific situations.

Following actors gives the possibility of knowing what plays out as important, here in particular in a data sprint (Latour, 1987) . Having only focused on the digital footprints of the data sprint, might have led to an emphasis on the digital in a data sprint. Having only focused on the interplay between human actors in the data sprints might have led to an emphasis on the social in the data sprint. Which, I would argue for, is limiting regarding how workshops, in particular workshops with a digital angle, play out in the complex of processes. I would have perpetrated an unnecessary demarcation of what matters in the field, such as the social interplay between human actors, or an emphasis on the non-human actors, such as the digital work done in the shared folders and files in the digital domain. And a data sprint, a situation that is construed of working with digital data, has to have some special sensitivity in understanding the site of the field. A rule of thumb would be to go where the interactions are.

In finding out what mattered most, I paid *"...close attention to evaluations and distinctions made by members in the course of their daily activities."*, as Emerson, Fretz and Shaw (1995) put it. This could for instance mean the various distinctions the groups made in terms of how data should be presented. In the MyAir group, a discussion of how the issue should be unfolded, touched on the subjects of whether or not modelled data is any 'good' for representing the amount of pollution that citizens are exposed to, as a contrast to their real-time data.

Hammersley & Atkinson (1995) describe that the field worker can take various stances and produce various roles in the time of their research. For instance, they describe how one can go from *complete participant to complete observer*, borrowed from Gold (1958). Even though they question the value of what such distinctions might offer, they would still surmise that the type of engagement and veracity of engagement with the field matters, insomuch as it produces different roles and types of data for the field worker. This is indeed also the value upon, at least talking about such distinctions, that I might use these types of categories, although in the loosest sense. Thus, my field role would lean more towards the field worker as observer, since my engagement in the data sprint didn't surmount to what the other sprinters did. Although I shortly used my expertise from having participated in previous sprints, I mostly retracted from actually performing data sprint work, not only as it would have distracted me from writing notes, but also because I wanted to focus my effort on estranging the practice, that I myself have done so many times. In retrospect, I would also assume that my previous contributory expertise (Collins & Evans, 2002) allowed me such access to the data sprint and to largely formulate my own role. I would ascertain that this is because I know the field, and thus the other participant whom I have sprinted with earlier knows that I could take good care of it. This is also described by Hammersley & Atkinson (1995) as "*the construction of a working identity may be facilitated in some circumstances if the ethnographer can exploit relevant skills or knowledge he or she already possesses."* (Hammersley & Atkinson, 1995:87). I would indeed argue that my previous involvement with data sprints and knowledge of these provided me with a privileged access to this sprint. Following this line of argumentation also leads to some reflections on how the data should be interpreted afterwards.

With those reflections in mind, my academic goal, to know how publics are rendered in a data sprint by sprinters and issue experts, would thus seem in danger, if I allowed any privileged position of the actors involved. I would doubt that this is a 'problem' to be solved, but instead that it is a consideration that needs to be gauged. I would even consider my previous participation in data sprints a boon, since a data sprint consists of five days of convening and that there is only so much one can learn in such a short

time span.

Field Notes

The actual writing of field notes was done in a field notebook. This was also a very deliberate decision in regards to the ethical implications of doing fieldwork. When you are out in the field, you record situations and, hopefully, thick (Geertz, 1972) descriptions of praxis in play. This can bring the ethnographer in some delicate positions as being able to translate things that were otherwise temporally limited. In short, things that were said in a specific situation, to a limited audience, could be spread to a wider audience, which they were not meant for. As an ethnographer it is therefore important to know what kind of situations should be written down. Even though this issue is never solved, ethnographers have traditionally agreed upon some kind of transparency in what type of knowledge is written down. The ethnographers notebook, (in my case it was a nondescript black notebook of A5 size) has been a way of 'telling' the field 'in situ' when notes, and thus situations, are being recorded or not. And instead of interrupting the field, breaching the routines or doings, by verbally stating 'this is being noted', the notebook as an actor constitutes a way of saying just that in a different way. This of course has the prerequisite that the ethnographer has stated that the notebook is being used for writing notes of situations, which I did, and that the participants in some way grasps the role of the ethnographer. In praxis, the role of the notebook spurred some sort of interest in the research topic from the sprint participants. For instance, one of the sprint participants asked, "What are you writing?" when I scribbled some fieldnotes of her interacting with another sprint participant and her own laptop computer. I was able to explain that I was interested in the data sprint as a sort of intervention, my main interest at the time, and thus was writing what was being said and done in the sprint as a goal towards that, in relation to the issue of the sprint, namely air pollution. Obviously, there is always a chance that the agreed upon equilibrium can break between researchers and informants, which should be taken seriously, but this is a common issue in most research dealing with any kind of informant, whether human or non-human.

This is partly why I chose to use a notebook as a device for writing fieldnotes. Not only does a pen and paper allow me to participate in a different way than a computer for instance does. It also allowed me to 'tell' my informants that I was in fact engaging in ethnographic field work. And also, to remind them of this very fact. Had I chosen to use a computer, I might have had an easier time blending in, but I

indeed wanted to put the ethical question to the fore, in order to present myself to the informants.

Data

These following sections contain some contextualizing of the empirical fieldwork. It explains the concrete topics of where the fieldwork was done and what data was produced in that period.

The SaveOurAir data-sprint

The SaveOurAir data sprint was held in February from the 19th to the 23rd at Aalborg University in Copenhagen. The theme of the sprint was reframing air pollution as an issue. Before the sprint held in Copenhagen, another sprint was held in London which was a user sprint, where groups were formed in relation to which projects were pursued. At the London sprint all participants sat around a table and then issue experts came in one by one and talked about the issue. One sprinter notes that the questions for the issue experts were more reminiscent of an interview. Both sprints were hosted by the Public Data Lab (https://publicdatalab.org/) and funded by OrganiCity (https://organicity.eu/) which is a EU funded project collaboration among so called 'smart cities' in Europe to use citizen engagement, digital technologies and data in creating more sustainable cities (https://www.smartaarhus.dk/projekter/organicity). This project does not seek to understand the concepts employed in the OrganiCity project, but accepts that there is a possibility to ethnographically explore how these concepts are employed and in what contextual circumstances they are deployed.

Among the sprinters present at the SaveOurAir data sprint in Copenhagen were researchers from; DensityDesign at the Polytechnic University of Milan[1], the Media lab at the Paris Institute of Political Studies[2], the Techno-Anthropological Laboratory at Aalborg University in Copenhagen[3], the Institute of Complex Systems at the University of Lyon[4], the Institute for Policy Research at the University of Bath[5].

[1] https://densitydesign.org/
[2] https://medialab.sciencespo.fr/
[3] https://www.tantlab.aau.dk/
[4] http://www.ixxi.fr/
[5] https://www.bath.ac.uk/collections/institute-for-policy-research/

Among the sprinters disciplinary competencies were designers, data scientists, social scientists, cultural studies scientists, all engaged in the field of STS.

My role in this sprint played out as that of an observer of the interactions between the actors in the sprint. I am well versed within the field of Digital Methods and in advance knew some of the people at the sprint. Thus, in order to inquire, or learn, about the data sprint in a new way, I chose a deliberate strategy of avoiding participating with a formalized role. I was not assigned to any groups, which is usually how a data sprint plays out (Venturini, Munk & Meunier, 2017). And I only used my computer to write down my field notes from my notebook. Since data sprints are usually focused on digital data as a means of telling data stories, this was also a trick to distance myself from the other participants. To perform the role of a sort of outsider or stranger in the data sprint, still part of the sprint but not in the role of the active project participant.

Three projects, three groups

Prior to the data sprint held in Copenhagen, there had been a previous sprint in London that had been conceptualized as an idea sprint where sprinters partook in formulating projects that had something to do with the issue of air pollution. Each project has a respective approach to how air pollution could be made into a digital methods project.

The MyAir project[6]

The MyAir project is thought out as a way to situate air pollution in journeys that the users take as part of their everyday life. In particular, the project was related to teaching about air pollution in a Danish elementary school context. The sprinters were able to borrow air pollution monitors from Copenhagen Air Lab[7]. These monitors were used in conjunction with GPS data in order to geographically locate where and when pollution happened. They used this data in companionship with a prototype of a portal they developed for uploading data and thus allowing the user to navigate in their own journeys.

The Mobilizing Our Air project[8]

The Mobilizing Our Air project is conceptualized as a platform that gathers a diverse cast of actors in relation to air pollution. Specifically, the thought behind it is to mobilize actors already engaged in

[6] http://saveourair.publicdatalab.org/my-air/
[7] http://airlabs.com/
[8] http://saveourair.publicdatalab.org/mobilizing-our-air/

similar kinds of issues. This means that bike commuters, urban gardeners and other types of communities are to be gathered on the platform and thus provide a way for these actors to be visualized in air pollution as an issue, by redefining the issue as these activities. In this sense, air pollution is made into an issue about urban gardening and bike commuters, along with several other ways.

The Hot Potato Machine[9]

The Hot Potato Machine is a prototype that treats the issue of air pollution as the popular idiom of 'the hot potato' (Collins English Dictionary, 2018). It is an attempt to render visible the practice of assigning responsibility and blame towards other actors regarding the issue of air pollution.

My participation in the groups

In my fieldwork at the data sprint I prioritized observing the groups. As a consequence, I have done most of my research with the MyAir group. This has allowed me to gain an intimate knowledge of this specific project and its development. Due to the temporal restraints of the data sprint format, I was not possible to gain an ethnographic knowledge of all three projects. I do however consider my previous participation in data sprints to have provided me with the specific knowledge for understanding the format and as a result know how these other projects have played out in regards to the ideal format.

The issue experts

In order to get a sense of who the different issue expert are I have provided a list of three of the issue experts that interacted with the sprinters at the data sprint in Copenhagen. I have anonymized their names, but kept their intended roles as issue experts intact, so as to know how they were thought to contribute to the sprint.

Mr. Teacher

Mr. Teacher is a tenth-grade teacher at a school in the municipality of Gentofte. He teaches natural science classes for his pupils, among other subjects. He was mobilized through the network of one of the facilitators, who has gone to the same elementary school as him, when they were younger. He was invited to the sprint, because the MyAir group wanted to enroll him as he had access to a classroom and pupils, where they could test their prototype. He was furthermore invited because he would be part of the users of this prototype, as it is envisioned that teachers would be able to borrow it and used it in

[9] http://saveourair.publicdatalab.org/hot-potato-machine/

their teaching practices.

Mr. Pedagogy

Mr. Pedagogy is a university professor doing research within pedagogics. In particular, he has dealt with IT in teaching mathematics and STEM as a pedagogical process. The reason why Mr. Pedagogy was invited in as an issue expert was twofold.
The first reason was the sprinters in the MyAir groups interest in building a prototype that would be situated in a teaching scenario. As such the issue expert would act as someone with knowledge on the field of these pedagogical and didactic processes.
The other reason was that the issue expert was easy to mobilize. This is because the researcher is already a part of the organization that the facilitators in the sprint work at.

Mr. Smart City

Mr. Smart City is a public servant that works with innovation. He specifically works with how cities can act as smart cities and how models and data can help in this process. He refers to his workplace as a ‘smart city incubator’. The reason for why he was invited to participate in the sprint as an issue expert is that he and his workplace is currently working with the municipality of Copenhagen and Google in order to increase the knowledge about air pollution. At the moment he is involved in a project about data driven traffic control.

Analysis

In this part, I will describe how the issues of air pollution and the publics that should deal with them are assembled through interactions between sprinters and issue experts. I will also explore the roles of the issue experts by way of their domain specific knowledge in taking on a critical proximity approach. Furthermore, I investigate how these roles are constantly being negotiated and how this affects the prototypes, which the sprinters are trying to assemble in order to, in this case render air pollution as an issue with a specific public.

I will start out with a quote from the Public Data Lab that captures the way in which the sprint is conceptualized by this researcher community:

"*Neither the methods nor their results are the specific object of our research. Instead, what we hope to hatch through our interventions are new "data publics": publics that are not just the passive object of commercial and institutional monitoring, but who produce their own data actively and "by design".*" - *From www.saveourair.publicdatalab.org/about*

As in the above quote, the inspiration from STS literature is visibly at play in the conceptualization of the SaveOurAir data sprint. An attempt to hatch new 'data publics' is inspired by the notion of issue-publics, and the data sprint format is a way to engender these to become datafied publics. This approach is also inspired from attempts to design publics; to envigor new publics that are active producers of data, with fitted style of data production, tailored to their specific situations (DiSalvo, 2009).

This thesis aims at a different site in regards to the question of issues, publics and data sprints. Firstly, it asserts that issues as well as publics are not only already busy in the interactions of everyday life (Birkbak, Petersen & Jørgensen, 2018), but also very much doing work in relation to their specific domains. Secondly, it asserts that this domain-specific knowledge is re-configured as part of assembling the issue-publics. And that the data sprint as a format could be seen as an attempt at this process, using issue experts to re-configure the issue-public.

The following part will treat multiple specific empirical situations in the data sprint as formative of the prototypes, which the sprinters conceptualize issue-publics using. In this regard, I consider the sprinters' interactions with issue experts as a way of engaging in critical proximity. These engagements not only form the prototypes, but also the issue-publics and in some cases the issue experts' role.

The pedagogical expert

For the second day of the data sprint, the MyAir group invited Mr. Pedagogy in as an issue expert to evaluate the group's current mockup. Mr. Pedagogy is someone who is already part of the organization, Aalborg University, and was as such easy to mobilize to participate in the data sprint. He already had somewhat knowledge of the sprinters facilitating the data sprint. However, he had never actually participated in a data sprint before. In choosing issue experts, these kinds of considerations also play into the practice of practical research projects and research processes. This is not to discredit the issue expert, but more to point out that these possibilities form the issues of the sprint topic and situate these issues in very specific ways. As such, I will show that issue experts not only form, but also are formed by the interactions in the sprint, actively engaging in the performative work of assembling issue-publics.

In the meeting with Mr. Pedagogy on day two of the sprint, the group members provide some contextual information as to what the project had reached so far, and what lays ahead of them. The issue expert then asks what the "use-case" is for the project.

"*He further adds that they need a school that will be willing to participate in the project. Anders responds that they are in contact with something called Masseeksperimentet, which is a natural science education course, that will be executed in 2019 across 8.th and 9.th grade classes in Denmark.*" - Field Notes

What is interesting here, is how the sprint participants are trying to contextualize or situate their project in a specific setting, the elementary school natural science education.

One way of doing this is through the use of Mr. Pedagogy, who have pedagogy as his specialty in his research at the University of Aalborg. His relevance as an issue expert is translated from his experience in pedagogy, towards the group's future project, Masseeksperimentet, and in particular, elementary school science education. At this point, the sprinters try to translate the concerns of the issue expert into a formalized way of making and prototyping the public. As a way of using an already existing event, Masseeksperimentet, they try to situate their concerns about air pollution as an issue and how one can teach about air pollution. The sprinters' way of dealing with this in a critical proximal sense is that they will engage pupils in this Masseeksperiment but provide their own novel ontological luggage through their conceptualization of air pollution as journeys. Instead of criticizing the practice of teaching air pollution in natural science classes from a distance, they instead try to engage in the event. And in this,

Mr. Pedagogy is poised as being a help in understanding how the practice of pedagogics within natural science schooling is currently working.

As a contrasting backdrop to the approach chosen by the sprinters in the MyAir group, there could be other ways of situating the project. Experts in modelling air pollution, citizen engagement, or global policy could have been actively engaged in representing a critical stance. The group's choice however produces one novel way of situating air pollution and thus the critique and possible ways to and venues of critique in the project. And I would argue that the choice of issue expert in this case is more aligned with the group's intention of producing a prototype for Masseeksperimentet.

While the presence of the issue expert is important, only some of the statements, or feedback as the group says, made by the issue expert are thought into the project. For instance, the excerpt below, which was a point brought up several times from the issue expert, is not thought into the further process of the project.

"*Mr. Pedagogy reckons that a way to simplify the project is to make some aggregated data on fixed points. So instead of looking at the journey of air pollution, then leave the sensor to measure some place in, for instance, 5 days*". - Field Notes

This raises an interesting analytical point, which is of what and how much an issue expert can be an 'expert'?
In this example, the issue expert's expertise is not utilized in the data-model debate, which the group started the previous day and will continue to have the following days. It is the issue expert's articulation, that the visualization of the data is easier to interpret for the pupils in a bar chart form rather than the journey in the form of maps and graphs, which the sprinters currently work with. Even though such a simplification of the visualization would be possible for the sprinters to do, the sprinters are insistent on using the concept of the air journey as a way to situate air pollution. So even though the issue expert has an expertise regarding pedagogy, some parts of the expertise are not incorporated in the prototype. As such, the issue of air pollution remains to be situated through the pupils' journey with the monitor. The assembly of the public that the sprinters envision has to do with this interaction between monitors and pupils, because it situates the issue of air pollution in the pupil's everyday life.

Mr. Pedagogy then touches on the subject of using models as opposed to sensor data. He thinks that the group should formulate a teaching scenario around a sensor lying still and then use the aggregated data from several days as a contrast to the modeled data. As he puts it: *"It's a classic in science education.*

Show that the model is wrong. That you might use sensor data." - Mr. Pedagogy

Mr. Pedagogy argues for a different kind of involvement in issues than the one the sprinters seems committed to. He imagines that the political involvement of the sprinters is to show that the official models might be wrong. However, the sprinters are more keen on telling the local data story of an air pollution journey. This misalignment could also be treated as a way to crystalize what is at stake. On one hand, we have the possibility that air pollution does not get treated as an issue, and that it would be too advanced to adopt the prototype that the group is building. On the other hand, the issue of air pollution might be something completely different from problems with modeled data. In order to spark an issue-public into being, I would argue that we must know what type of critique, if any, is already out there, where we imagine the prototype to be situated. If we look at it like this, the issue expert provides critical distance in regards to teaching pupils at elementary school level. Underpinning this argument further he states that "...*in order to make political change the teachers need a scientific model" - Mr. Pedagogy*

The issue expert's concerns thus also have to do with the issue expert's expertise. That is the way in which the issue expert's statements matter or not. Whether or not they are thought into the project or dismissed. Ignored or focused upon.

As Mr. Pedagogy leaves the premise, the sprinters in the MyAir group talk about how the meeting went, and how they think the prototype should look. The sprinters all agree that the journey is still pivotal in capturing the pupils and making them interested in the issue of air pollution. As one sprinter puts it in relation to the graph visualization of the pollution figures, the pupils: "*...should fall in love with their curve" - Anonymous sprinter*

The concept of Issue Experts

The meeting described above between an issue expert and sprinters during the Copenhagen data sprint furthermore gives us the possibility of reflecting on the role of the issue expert in a data sprint. Venturini, Munk & Meunier (2017) have the following to say of the role of the issue expert:

"1) Posing research questions. Research questions are posed on the first day of the sprint by the invited issue experts. Besides suggesting a number of research questions, issue experts are also invited to help the 3 other participants (most of whom have little previous knowledge of the issue at stake) to get grips

with the topic of the meeting. This can be done through Q&A sessions or panel discussions, but it also (and often more fruitfully) through informal consultations as part of the running feedback on data visualizations." (Venturini, Munk & Meunier, 2017:2-3)

However, as shown earlier, the construction of an issue is not without its own political implications. Indeed, when choosing the issue expert, the participants themselves are complicit in constructing the issue of air pollution in a pedagogical framing. As a consequence, I would point out that the choices, or construction of what is deemed a worthy issue expert, is also the construction of the issue in and of itself. It would be practically impossible to invite every single person with a stake in the issue of air pollution. Even the choice of demarcating who constitutes an issue-stakeholder is a political exercise. When sprinters choose issue experts, they are not only engaged in representations of issues or representation of different publics, such as elementary school pupils, but also of the construction of issue expertise. So, the choice is not only what issue experts to choose from, but how to situate their respective expertise in an air pollution context. This means that the construction of the expertise is not of pedagogy in air pollution, but more closely resembles a pedagogy-air pollution hybrid.

The governmental expert

Later on the same day, the sprinters in the Mobilize Our Air group meet with Mr. Smart City. As said earlier, Mr. Smart City was invited because he works with air pollution as an issue in regards to measuring pollution figures for the municipality of Copenhagen.

The sprinters hope to find out if he knows any activists around air pollution and find out what a professional working with air pollution thinks of the public involvement in the issue. He says:

"No, and I think it's because of the Danish locality. We can contrast this to China, and Paris where a few years back they had such a heavy smog that you couldn't see the Eiffel tower. So they made it such that even number license plates were allowed to drive one day and uneven number license plates were allowed to drive other days. London has also had problems with air pollution." - Mr. Smart City

The above quote is Mr. Smart City's answer to the question of whether air pollution is an issue in the public purview in any sense. Here, air pollution as an issue is a geographical problem in a governmental sense. Air pollution is a governmental issue conceptualized as a state affair. He argues that air pollution

is not an issue in a Danish context, because we have not felt the physical events of the pollution:

"In Denmark, and Copenhagen, we have so much luxury, that we don't take it into account. We don't have problems like these other places have with bad air quality. We also have some of the cleanest water in the world, so we don't discuss on how to sustain it." - Mr. Smart City

Nonetheless, Mr. Smart City tries to turn air pollution into an issue in a Danish context, together with his company, by focusing on the pollution done by cars. He reckons that everybody knows that cars pollute and as such, modelling this pollution and measuring the data around traffic might turn air pollution into an issue. He even explains how some Danish roads are *"Exceeding EU limits for pollution" - Mr. Smart City*.

As far as the Mobilize Our Air group goes, they treat the issue of air pollution through what they call micro-activists. They explain it as actors who are engaged in making an issue a public topic, through activism. However, the issue expert instead tries to make the issue of air pollution about the topic of thresholds in pollution figures and models on air pollution in traffic. So, on one hand, we have the sprinters who want to make the issue of air pollution visible by making the activists around air pollution visible, and on the other hand, we have the issue expert that wants to make air pollution visible by way of models and measurements and official threshold limits. Even though the sprinters ask the issue expert about the viability of their platform that could gather various actors in the air pollution issue, his reflections turn to questions about modelling and sampling.

In this sense, the issue expert makes the issue of air pollution a governmental issue, as it is a judicial way of interpreting the issue of air pollution.

The difference between the issue expert's and the sprinters' situation of the issue of air pollution is also a question of which public should engage with the issue. In the prototype envisioned by the Mobilize Our Air group, the relevant public is thought out as one that makes the issue of air pollution part of other issues, by mobilizing the various actors in the neighborhood of air pollution.

The Mobilize Our Air group focuses on redirecting attention from existing issues in which actors engage. As such, air pollution is very much about the everyday interactions of specific activist groups. Relating air pollution to urban gardening, joggers or commuting through a gathering of these actors on a platform is how the sprinters try to situate the issue.

In how the public should interact with the issue of air pollution as thought out by the issue expert, the

prototype should instead be about showing the particle data to provide some political leverage. Here, it is politicians as actors who should pass legislation in order to bring down the particles, specifically around roads. The issue is in this regard rendered as a problem about polluting cars and that if the public knows this, they can act to apply political pressure on their elected officials.

The schooling expert

In this section, I focus on the MyAir group's meeting with Mr. Teacher on the third day of the sprint, who was invited as an issue expert in regards to getting the group's prototype tested in a teaching scenario. My analytical focus is thus what this meeting does in regards to shifting, aligning or otherwise disrupting the different actors whom attend it. What do the interactions at the meeting do in regards to prototypes, issue experts, sprinters and publics?

The section will begin with an extract from this meeting where the presenter, Anders, also a sprinter, is talking about the portal which the pupils will interact with in a teaching scenario.

"So basically, it is interactive in the sense that the student sits with it and you can click and ask why was there such a high exposure here? And you click, and then you are zoomed in and you figure out that it is because your neighbor is burning wood. Or you click and you figure out it is your father smoking. Or you click and figure it is the big road or something. ....That is the visual image they are presented with and then the teaching scenario is that each student sits with this and they write down...what they are presented with. So they click on a high thing and then they try to write down where did this happen, why do I think it happened." - Presenter

Even though almost the whole group is present in the room, counting 10 people including Mr. Teacher and myself, one person takes the lead on actually presenting the project. In the quote above, the sprinters present the prototype to Mr. Teacher who agreed to act as an issue expert probing for the viability of actually using this in a teaching scenario, as the MyAir group expresses it.

The presenter explains how the platform might be used in a teaching scenario. Specifically, the presenter talks about how pupils may use their data and the presentation of it as a way of asking questions about their 'exposure' throughout the day. While doing this, a translation happens. Let's slowly retrace how that is, taking note of the reconstruction of these translations.

Re-constructing the scene

Starting from the monitor. The monitor will transform air, that is some matter, into readings or data points. The monitor and the pupil will together begin the journey of air pollution; the pupil by walking around with the monitor 'being exposed'. The monitor and the platform that serves up the data will then transform this matter that was first particles in the air, then became numbers in the monitor's SD card, and now is being transformed again into a data view or datascape. The sprinters have now constructed a teaching scenario 'out there' with specific users; a scenario that affects them very much 'in here' at the sprint. This scenario is very much a careful construct, one that needs tendering if it is to practiced 'out there', that is in the classroom of Mr. Teacher.

As the presentation of the MyAir project progresses, Mr. Teacher listens to what the presenter has to say and intermittently nods his head and says 'of course', when the presenter is not talking. The presenter then talks about how the portal is to be accessed and what the imagined use might be.

"So that is the first simple exercise, we imagine that when the student logs into this portal they get access to their own data, but when you log in as a teacher you get access to all of them." - Presenter

The above quote from the meeting with Mr. Teacher also shows some of the considerations that the sprinters have put into the portal. They not only construct the students and teachers as users in the sense that they have to log in and use it. They also 'prioritize' the access to the platform. In conversation with the sprinters afterwards, I learned that these considerations were built in as privacy means to avoid 'exposure' of the students' physical locations. Since the captured data could geo-locate where you live, the sprinters thought it prudent to limit the access on the students' entry into the portal. In this, there is an interesting tension between the concept of privacy and the need to openly inform the pupils of the perils of air pollution.

Though the sprinters, for pragmatic reasons, have to shut down this tension, this thesis can leave it open for consideration how the classroom and the roles found in it are entangled with a platform teaching the pupils about air pollution in a novel way. That this platform follows the distinction between pupil and teacher in an elementary school classroom setting does not affect this particular scenario, however such aspects could be matters of concern in other projects.

Comparing journeys

The second part of the teaching scenario and platform is the comparison part, as the presenter describes it:

"Then you ask, who think they are very low on exposure and who think they are high and you pick two of the names and you drag them in to compare their journeys, maybe you figure out that, where I live in Valby, people living south of the school would be more exposed than people living north of the school because they go through Folehaven..." - Presenter

Here, the datascapes presented before become ground for a comparison between student's journeys. The presenter focuses on the comparison as a way of teaching the pupils about air pollution. They envision that everyday life might be rendered as an air pollution path in that the student and air monitor together make this air journey. This air journey is then rendered in the portal as graphs and a map that shows where the pupils have been.

Mr. Teacher is presented to the intended role of the pupils, but he is also presented to how his role should play out. Not only as an issue expert, but also as a future issue participant, someone who participates in the issue in a specific way and configures the issue in a distinct approach. How should air pollution be datafied and visualized? That is the issue expert, soon to be issue participants' role in negotiating this in companionship with the pupils. Together, their role is to situate the issue in elementary school teaching by way of performing the roles of teacher and pupils. In this part of the project, what the sprinters hope to add is a distinct angle on the issue of air pollution. As the presenter puts it:

"...so it could start a discussion about sociology, like where do you live and how do you get exposed." - Presenter

In this sense, air pollution is not only about particles in the wind, but also where you live. It is the vision of the sprinters that the discussion not only turns into a discussion about how these particles can be removed by way of turning them into an issue, but expanding the issue into the construction of our cities and a problematization of city planning.

Enter the model

After this, the presenter comes to the part of the presentation of the mockup of the portal which they

have designed. In this part of the session, the students are supposed to compare their journeys to the official modeled data.[10] The presenter is unsure of whether the students will be able to do that, as he sees it as a difficult abstraction. However, he focuses on the way in which the official modeled data could provide a comparison to the data that the pupil could generated with the monitors:

"So you do not have measurements for each house in Copenhagen, but you have a modeled measurement of it. And that model is based on car traffic and so on. So you actually have this map called 'luften på din vej', which tries to assess for each house in Denmark how polluted is this house. And the interesting thing with this is that this is also granular, it's on street level in the same way as your students measurements are." - Presenter

Here the issuefication is in regards to the modeled data, because both types of data is granular. This so called granularity allows the pupils to compare their journey with the official modeled data. Here the air journey becomes a way to bring models into the issue. Specifically, it is to question the models of the official data and the visibility that the pupils have in the official data. The pupils go from a public that dealt with the issue of air pollution taking into consideration their personal journey and configured by the issue of where they live as a comparison to their pupil peers, into a public that questions the modelling of air quality data by the government. In this, the pupils are concerned citizens in the sense that the issue of air quality also is an issue of how government and other official instances turn citizens into a modeled public. In this part of the presentation and in this part of the portal, it is the goal of the sprinters to problematize this practice of modeling air pollution.

As the presenter puts it, this ideally leads to a further step in the way in which the pupils are constructed:

"That's why we want them to ask these questions: do the official statistics actually know my problem as I see them through my monitor. That's a more high level thing, because then they start to ask questions about how do you even measure and model air pollution" - Presenter

The above quote shows how the pupils should engage with the portal. The pupils, after having questioned the way in which the official model doesn't resemble what they see on their monitor, should begin to ask about the ontological underpinnings of modelling and measuring air pollution. This is part of what one might term the Digital Methods approach. That data acts, not as a question in and of itself,

[10] The official data that the sprinters compare to can be found here: http://lpdv.spatialsuite.dk/spatialmap

but as a mode of asking new questions and learning about the medium through which these outcomes are produced. And it goes very well with ANT insofar that it renders visible how the world comes to be and how different actor-network assemblages make data, official statistics and provide models for how to render these on a web platform. This may not be an outspoken concern, but in the interactions between sprinters, data mockups and teaching curricula, it could be interpreted as something very important.

The sprinters in the MyAir group want to engage in the field, they want to engage the issue public, or even spark it into being, by way of engaging someone, an actor, already present in the field in scope. Mr. Teacher, that is the issue expert, is negotiated with in order for him to become an issue participant, one who becomes engaged with the issue. The sprinters do this by way of attempting to situate the issue in the practice of elementary school teaching. They place the monitor in the class, not only physically at a later intervention, but also in the presentation as a construction or reconstruction of the classroom happens with the issue expert present, so as to act as a messenger or an interpreter of the field with the knowledge of a native.

Making experiments

The sprinters have an additional consideration in the way of actually engaging the classrooms of elementary school teaching and in particular, physics and chemistry classes:

"We thought that, because we want to be in science classes these measures are just: I go around and measure, but is that really valid. I just do my own measurements, so we thought about how can we turn this into exercises in making experiments. We tried to imagine that out of all these comparisons, what will emerge from them is different types of hypotheses." - Presenter

The sprinter then continues to explain how wind might affect the measurements of the pupils and that these considerations should be built into an experimental setup. The issue of air pollution is also an issue of experimentation. The sprinters try to extend the criticism of models into the proximity of doing natural science experiments. This way, they want to problematize the replicability of experimental methods. That it is hard to do repeated experimental setups and that the students themselves should try to do this to learn the difficulty of this procedure. In writing this, there is one particular insight usually contained within STS, that I would actually have expected in this moment from the sprinters. An STS point that could perhaps have been extended to the teaching curriculum and the teacher present,

who were very much captivated by the presentation at hand.

The STS point is one that I alluded to further up in this thesis; the difficulty of doing experimental setups. The point is from SSK, but it extends well beyond into the work of Laboratory Studies and ANT. It is the concept of replicability. Of constructing durable actor-networks so as to make experiments replicable, not only by dialing the right dials, but in negotiation with every single actor at hand in the laboratory to make one's facts durable. And after this, to carefully tend to this fact and reinforce its durability. To transform this practice to elsewhere in the careful translation of different situated actor-networks.

Wind in air pollution

Getting back to the meeting, the sprinters explain how they imagine this natural science experiment may play out:

"The question is, you have a hypothesis in the class about wind now. How would a scientist turn that into an experimental setting with a control group and a test group? And it could either be a test; you stand on each side of the street and you know the wind comes from south and you test if this side is more exposed than the other side, because that would be confirming the hypothesis..." - Presenter

As the above quote from the meeting indicates, the sprinters imagine an experimental setting. A natural science experimental setting to teach the pupils about the effects of wind in regards to air pollution. However, this way, the pupils are not merely taught about the wind as an issue in air pollution, but is also being taught that of experimental setups. In an ANT approach, this could be an ideal moment to explore the way in which experimental setups come to make sense, not as a means of inquiring upon the world, but as a way of constructing the common world. That could have been part of this presentation. The group hints at it by leaving open the questions posed, for instance, does wind matter in regards to air pollution, and also accepts a multiplicity of ways in which the issue of air pollution is constructed by also including the natural science aspect of said issue. Constructing issue-publics is in this sense also about multiplying the issue into specific situated instances of practice. As such, the presenter imagines that this:

"At least would raise some discussions about what the difference is between doing experiments and just going around measuring. So that's the fourth exercise that we have been thinking up." - Presenter

As the above quote indicates, the sprinters' goal is a reflection on action, the pupils should reflect on the

measurements they produce and how they might use these measurements as a way to turn data points into experimental setups for inquiring upon the world. This sort of inquiry is informed by natural science physics classes taught in elementary school, at least to how it is conceptualized. However, it not only uses these concepts as a backdrop, it also constructs these concepts, adding to their durability as fact finding assemblies. So when you go into the physics class and perform an experiment, you know it is to find the hard natural facts of science, constructing assemblages of actor-networks, or maybe merely reinforcing those constructs. Insofar as the goal of the sprinters is not necessarily to de-construct the natural science teaching, but instead 'add' to this by way of their critical approach to data as a way of producing questions, they avoid an unnecessary bifurcation of the issue and instead focus on the critical proximal approach. With this, the sprinters attempt to engage a field already at work and already busy and in some ways add to that field partly with the physical monitor, the portal for data, but also engagements with pupils in the field, as will be explained further down. A critical distant approach might have been fine critiquing the way that natural science is taught at elementary level in municipal schools, but the critical proximity approach gives an opportunity to try and construct associations between this field, these assemblages of actor-networks, and their own ontological commitments as STS-inspired Digital Methods researchers. It gives the sprinters a possibility of cherishing the local schooling situation.

The presentation continues:

"So these are four teaching scenarios going from first very simple, just looking at your own data and trying to make sense of it and then going to discussions about modelling and experimentation." - *Presenter*

The above quote shows what the sprinters expect when they invite the issue expert to the sprint. It is the sprinters interest to get the knowledge of a potential user for the prototype that they are assembling. I would say that the sprinters would like to use the teacher as a way knowing elementary school teaching on the tenth-grade level through critical proximity. The first attempt at this, as the above quote exemplifies, is for the teacher to engage in the role of issue expert, having domain specific knowledge on the topic of teaching students. Practicing this everyday as his profession, the sprinters assume that this knowledge will help in the constructive work, first of building a robust app that may be contextualized in these specific situations of elementary school teaching, but also of the issue topic of air pollution, though that constructive work is further fleshed out later in this thesis.

The setting of the presentation

In conjunction with the above considerations going into the meeting, I also direct the analysis to the meeting itself. How does this play out?

First of all, the sprinters in the MyAir group convene in a room adjacent to the room where sprinters from the other groups are present. Their project is presented on a screen in a slideshow presentation. Before the meeting the sprinters have worked collaboratively in a Google Drive folder, producing the design mockups, writing the teaching curriculum, and preparing the specific slideshow. There is also a whiteboard which is used to write down the considerations of the group.

As a workshop format, the data sprint is conceptually thought out as a number of consecutive days of work. Specific for the participatory data design approach is that the issue experts engage with the actual design work of the prototypes of the sprint. Not in the sense that they sit down and learn to write code or design webpages, but in the sense that they have their matter of concerns embedded into the specific data prototypes. The deviation occurs in the role of the sprinters, who likely are not omnipotent designers, but curious pragmatists that seek to engage in a field already at play. And they do this through specific issue-publics that allow the sprinters to gain this critical proximity to the situated issue-publics. Obviously, they don't act as passive observers of this public, but intervene in various ways that are specific not only to each sprint, but sometimes also in regards to the specific data projects.

Getting feedback

Up until now, the presentation has mostly been a one-way presentation, as the sprinters have lead the session and showed the teacher their mockup of the prototype without any crucial intervention from the teacher. But now the presenter turns to the teacher and says: *"So it would be cool to get your feedback on what is even possible with a tenth-grade class." - Presenter*

The teacher answers the request sitting quietly, looking up at the slideshow, then up in the air, then back at the slideshow, as if choosing his words carefully:

"You have built it up pretty well as I said, as really basic in the beginning. I also think it would be fun to see their own journey and see how exposed they are, and it is not just some random data." - Mr. Teacher

Mr. Teacher accepts the value of the approach of situating one's air journey through a production of the pupil's own data.

Mr. Teacher does not engage from a critical proximal stance, if we would define this as providing

'feedback' to the sprinters with procedural knowledge as to how their issue might be situated in the field. In a sprint format, issue experts are thought of as providing domain specific knowledge to the sprinters so that they might better grasp the issue. However, if taking a constructivist stance on this, combined with a more diverse appreciation of critical proximity, then the issue itself is something to be situated. To think that you can find an issue out there is to assume that you know where to look. In other words, that you know where the issue plays out. However, in regards to the issue of air pollution directing the sprinters attention to one way of the issue would escape other ways of the issue. At least if the sprinters attempt to assemble a prototype that can engage a public. So sprinters themselves situate their issues in specific ways. This is why the critical proximity stance is helpful in understanding what matters in the field in which sprinters attempt to situate their issue. Here it is an attempt to situate air pollution in distinct approaches in elementary school teaching.

Pupils as issue-publics

As the probing continues, the conversation falls on whether the students smoke and how you could use this as a device for learning about air pollution. The presenter then asks whether the children are allowed to move out of the premise of the school. Mr. Teacher affirms and even provides a scenario for how he imagines the pupils to experiment:

"Go out for an hour. And there could be a question saying: try to find where you would be most exposed. That could be some kind of reflected question for them." - Mr. Teacher

In the above quote, Mr. Teacher actively uses his issue expertise to provide some critical proximity to the sprinters who are unaware of the practicalities of the school setting. Mr. Teacher has this knowledge because he actively engages with the pupils, this new emergent issue-public, every single day in a professional setting. Thus, he knows how the field is is in a practical sense and what is allowed in the field. Even though this might seem like a rather small and perhaps trivial insight, it allows us to gaze at the practices in play. And even though this construction of the field is one done out of the field, the issue expert can recollect parts of the field and reconstruct it for the sprinters. The caveat is that the performance of everyday life does not play out as neatly as one may put into words and that the issue expert may have a hard time expressing 'learned' embodied practices in discursive terms. So it could be argued that there is a classroom at the sprint in the meeting with Mr. Teacher and a classroom at the school in Gentofte were Mr. Teacher works. And that these two fields are not the same, but that they might resemble each other, because of the presence of an issue expert.

One of the sprinters then asks whether the pupils are allowed to leave the premise from the seventh grade, as the group is still open about testing their prototype in various settings to which the teacher, with his issue expertise answers: "*Yes in most schools they are allowed to go out from the seventh grade." - Mr. Teacher*

Teaching curricula and expertise

The sprinters have so far mainly explored the configuration of the pupils. That is, how can the sprinters engage the pupils with the issue topic of air pollution through their prototype. Now, the sprinters turn to the teaching curriculum and the construction of teachers as well as the teachers' role in the formation and caring of issue publics. They do this through two distinct ways in which the teaching material can be formulated. The first way in which the sprinters imagine the teaching material being formulated is through a worksheet with preformulated questions. The considerations in arranging the teaching material as such is that the teachers with relative ease can activate the pupils in the class. What is specifically drawn out from the conversation between the sprinters and the teacher is that preparation time is a concern. The teacher remarks that:

"It should be really easy for the teacher to say, here is a worksheet that you can give the kids with some questions and guidelines for how to do it." - Mr. Teacher

The sprinters are not only using the teacher as an issue expert, they are also configuring the teaching material prototype. And in such an assembly, they chose to compound the teaching material and the role of the teacher to one that relies on what the presenter refers to as: "*a narrated script"* for the teaching material. They did however open the possibility for a second way of formulating the teaching materials so as to imagine another type of user of the prototype.

"If we are really trying to make this, do you prefer as a teacher that we wrote down those questions, or would you prefer that we made some kind of abstract description of; this is where we want to go with this part, for instance the comparison part, now write your own questions." - Presenter

The above quote illustrates the sprinters' envisioning of the two roles that they see through the teaching curriculum. The first was the narrated version, however, they also consider what they refer to as an abstract description of the teaching curriculum. In this sense, the teacher should be seen as not following a script, but producing questions about the issue of air pollution himself, which may fit the teachers particular teaching practice.

The question that I would like to raise in lieu of this is, what is good issue participation? Good in the sense that the issue of air pollution will actually be practiced in the local setting of the classroom. And in this endeavor, the sprinters need some actors to actively use their prototype and take that prototype into the field and do experiments.

In one sense, there is an issue participant who is engaged with the issue topic as assembling the teaching curricula to the public, bringing the sprinters concerns about both their conception of the field and the STS concerns regarding the treatment of data to the classroom.

And in another sense, there is an issue expert who have to rely more on a different sort of technique in situating the issue topic of air pollution. As such, Mr. Teachers expertise in regards to schooling practices is to an extent what could drive engagement in the assembly of issue-publics. The teaching material as part of the issue of air pollution relies more distinctly on the local practices on the teacher.

These two methods for teaching should not be seen as exclusive, but indicative of how the sprinters imagine an their users of the teaching curriculum and how Mr. Teacher as an issue expert or issue participant could engage with the prototype and in the assembly of an air pollution issue-public.

Put simply through how the sprinters imagine the teaching material, there might be two different issue expertise's for how to deal with the teaching material as teachers, when they use this to participate and situate the topic of air pollution.

Mr. Teacher ascertains that the convenience of preformulated questions trumps the open nature of an abstract assignment description. He specifically values:

"...some really concrete material that you can give them. Of course you can say you are welcome to do other things." - Mr. Teacher

Leaving room for teachers to choose their own way in which they might use the material, the teacher prefers the narrated structure of teaching resources.

In the sprint, the MyAir group thought about whether they should do both teaching scenarios, that is the concrete one and the more abstract version. However, through the presence of the issue expert who acts in place of a multitude of teachers' opinions and practices, he chooses for them. It is obviously not without merit that he is able to choose for them, it is merely to describe the situation and context in the sprint.

The teaching portal

Another part of the prototype that the sprinters want the teacher to give feedback on is how to present the portal, where the students upload their monitor data, inside of the teaching material so that the teacher knows how it looks and can use this as reference in order to teach the pupils what to do. The presenter explains:

"So we will make some software, but we also want to make this instruction for the teachers. Would it make sense that you get some screen dumps of what the students will see and you get some kind of suggestions of what to ask? ...Because we could also do it in a video. Showing how to use the interface." *- Presenter*

The above quote yet again tells us something about the sprinters' thoughts on making some teaching material for their project. In particular, they wish to know what the teachers will use in their practice in preparation for teaching about air pollution. But it also pertains to the role of the teacher.

Questions about how teachers interact with materials, using specific mediums whether it be screen dumps in an otherwise narrated curriculum or if they prefer a video tutorial of someone explaining how they should teach this material, is also a question of practice. How does a teacher incorporate specific mediums into their teaching? And a question arising before this, how does a teacher prepare to teach a class on a specific subject or issue?

These are questions that could be answered by empirically driven inquiry into the everyday lives of teachers at elementary schools. The concept behind a data sprint however is the way in which prototypes can be quickly iterated upon in participation with the potential users of said prototype.

Instead of having a long empirical process of describing a field in ethnographic candor and detail and then pass on these findings to someone else to develop an app on the knowledge of these findings, the data sprint offers a shortening of this period, due to, among other things, the presence of issue experts, the willingness to engage in a critical proximal stance with the specific issue topic and the issue driven nature of the format that attempts to re-situate expertise, insofar as these expertise's span several different disciplines, providing a more solid construct to the projects undertaken.

The field

For the most part of the meeting, the active participants, those that have taken a lead in filling the void

of silence with conversation and discussions, have been the presenter and Mr. Teacher. However, one of the sprinters, who have been sitting patiently listening, now turn to voice his concerns. He straightens his back and intervenes in a break in the conversation:

"If you had to be really critical and point out the problems of realizing this in a Danish classroom, what do you think that would be? Because it is still in a prototype phase, so it is just an idea. But if we actually have to make this, what needs to be done?" - Sprinter

As indicated from the above quote, the sprinter voices his concerns in regards to the viability of the project. Specifically, he wants to know what it takes to teach pupils about this issue.

The question not only includes this, but it also questions the possibility of situating the project. What the sprinter asks for in particular is an operationalization of the project. So far, the teacher has been nodding in approval and asking specific questions, but the sprinter attempts to get Mr. Teacher to engage the project with him as a main interlocutor, trying to spur his concerns about the ability to use the prototype in a teaching scenario. The sprinter wants the issue expertise in the form of knowledge of the field which they would like to bring their prototype into. And this knowledge specifically pertains to an operationalization by having knowledge of what the prototype does and the specific problems that may arise in the field in regards to this operationalization. This is another way of performing the role of issue expert. A puzzle solver, a problem smasher, that can materialize the teachers' knowledge in words. And so, the issue expert, Mr. Teacher, answers:

"I think that for some students it will be difficult to just understand these kind of graphics... For many of them, even in the tenth grade it is difficult to understand, air is not just air, there's different particles, so of course there should be a lot of work with the terms. What is it that surrounds us?" - Mr. Teacher

Now, the knowledge of the field is presented by Mr. Teacher. Beforehand, the issue expert was inquired upon the envisioned prototype of the sprinters, but now the sprinters ask, what about the field? Insofar, the field is something that the sprinters have imagined working through the prototype and drawing on their own knowledge. And in this, they have sifted through what they think would matter in the context of making an issue of air pollution in elementary school teaching. The sprinter asking the question however, would like for Mr. Teacher to open up the prototype and pick it apart with his domain-specific knowledge of teaching. And so the teacher begins with gauging how he should be as an issue expert. Observing him, I could tell that he chose his words carefully, looking upwards, slightly squinting his eyes, ever so delicately moving his lips so as to formulate the sentence that could provide critical feedback to

the sprinters. He gestures towards the slideshow presentation and explains how the graphics could be difficult to understand for students. From that, he turns to the natural science part about the knowledge of different types of particles. Behind this statement lies an expectation that in order to know something about air pollution, one must have a physics or chemistry knowledge about the composition of particles. That is indeed an interesting thought, considering the credo in this particular data sprint, which is to use the issue of air pollution as a way of broadening the understanding of valid data in such a topic. As such, some of the producers of data in regards to the issue of air pollution are not necessarily natural scientists, nor are they producers of measurements of particle counts in the air. Instead the pupils are composers of journeys that situate the issue of air pollution in their everyday life. Particles and ways of representing data is still important in this regard as part of assembling the prototype, but what the sprinters would like the teacher and pupils to engage with is the question of how air pollution might be constructed and inquired upon through the journeys that the pupils take.

Particles in air pollution

The presenter then asks Mr. Teacher another question which relates to the conversation:

"There are these different types of particles. So one suggestion is just to collapse them all into one aggregated line and then don't deal with that complexity. Another route is to actually teach them the complexity between 2.5 and 10." - Presenter

What the presenter refers to here is the size of the particles that the monitoring device detects. The monitoring device is capable of measuring particles in sizes 2.5 pm and 10 pm[11].

This conversation about particles and different graphics is a different way of formulating and engaging an issue-public. Some pages ago, I described how the pupils should act as an issue-public, insofar as they could translate their everyday life into an issue about air pollution. Now, the pupils have to practice the issue of air pollution in everyday life and engage in natural science teaching about the complexities of different particles and different particle measurements. At a glance, this seems contingent. Learning about air pollution also means learning about particles. If I am to take my constructivist approach seriously, I would very much argue that indeed thát contingency is a construct in and of itself. That natural science education must be included, one way or another is not an answer, but a question.

[11] PM is an acronym for Particulate Matter. 2.5 and 10 refer to the size of the particles measured.

Put another way, in making the issue also about the complexities of particles reinforces the construct of natural science as part of this specific issue. This may indeed make sense, but the role of the constructivist is more to understand how things came to make sense and show that the world could have been otherwise.

Graphs in the prototype

Turning attention back to the prototype, the presenter asks what the teacher thinks about the visualization of the graph. Specifically, he states:

"Right now, we only have one timeline. We can think of that as an aggregate between all the particles. But it could also be two timelines and actually the monitor also measures humidity, temperature and air pressure. So the question is the level of complexity introduced." - Presenter

Since the sprinters use the issue expert as an actor with domain specific knowledge, they dive further into the dynamics of the visualization of the particles' timeline. Specifically, they open up the question of how this data should be shown and how much of the data should be shown.

The sprinters accept a critical proximal stance, in that they cannot change the circumstances for elementary school teaching, so they have to engage with it in the way that they can.

A critical distant critique might then just refute the way in which the subject is taught, or that air pollution as an issue has an overemphasis on the teaching of natural science that either does not engage the students or does not take into considerations the circumstances for air pollution.

However, in a critical proximal stance, the sprinters try to find out how this visualization may come to make sense in a teaching scenario within natural science education at elementary school level. Getting to this point, and having the pupils discuss their air pollution journey, encompasses a lot of different elements and different actors that have to be aligned in order for the prototype to be embedded in this everyday practice of teaching. Therefore the sprinters try to open up the knowledge of the field through the issue expert. By engaging with a 'native' in the setting of where they would prefer to situate their prototype, they may gain an ally in this endeavor and an initial test of the expectations that they have regarding the prototype. To underline the first point, the meeting with the teacher is not only about getting feedback for the prototype, but also about enrolling him as an issue participant in their actor-network. The idea is that the constructive work done in the project is strengthened through the

expansion of the disciplinary scope.

As such, with Mr. Teacher, the sprinters will be able to make a better prototype, because it is made more durable. This durability has to do with the extent of the actor-network, that is in what different disciplines, at what places, and in what practices, the prototype might be a part of.

And if the prototype is to be successful in a wider context of the issue of air pollution, then this durability certainly helps in the assembly of the actor-network. The alignment of the STS researchers and of Mr. Teacher is thus productive in that it might situate the prototype, along with some analytical points from the sprinters, in the practices of teaching elementary school natural science classes. This should obviously be studied empirically, so that when the prototype is to be launched in natural science education, we will know for certain whether the constructive work of the sprinters, Mr. Teacher, the visualizations, the monitors, the pupils, and the other actors as a whole will be able to situate the issue of air pollution within a classroom practice.

As to the choice of what graphs to display in the prototype, the teacher reckons that separating the particles may fit well in an educational setting.

The presenter then try to expand upon the topic since another actor, the monitor, is able to gather several other data points. He explains the teacher the specifics of the abilities of the air monitor and then questions him about this in an educational setting:

“Air pressure is another data point we have. So would you think it would be cool to have those in? Would that be easier? Would you prefer to have humidity for instance in the graph so you could see that as well?” - Presenter

In regards to the quote above, another important analytical point comes to mind. As stated above, in order for Mr. Teacher to be mobilized in relation to the issue of air pollution there needs to be an ability to connect the different actor-networks between the practice of teaching elementary school pupils and the issue of air pollution. So we should also address another actor that has an influence on the meeting currently partaken. The mockup with its graphs visualizations. The graphs themselves are like several of the other actors present in that it can be mobilized in various specific ways, in various specific approaches. That is what the presenter touches upon when he puts to words the way in which the graphs can be shown. In this sense, the graph is multiple in as far as it is both a way of rending particle counts on the student's journey, and a way of configuring Mr. Teacher in being an issue expert.

Mr. Teacher decides that "*Maybe it is going to be too difficult with a lot of new words for them to learn and get their head about." - Mr. Teacher*

The sprinters then agree that only the pm 2.5 and pm 10 measurements stay in the graph.

Teaching pupils

As they have decided on the layout of the graphic interface, the presenter turns the participants focus to the concrete exercise that is to be performed in the classroom. The presenter says:

"If we were to make an exercise where they were tagging this timeline, where they cannot tag it in the interface, so they either have to print it and write on it...or they have to tag it in Adobe. What would be the best teaching scenario do you think?" - Presenter

The above snippet of empirical data shows how the field is attempting to be inquired and configured at the sprint. As far as practical teaching tools goes, what do the teachers do? Do they prefer to use the materialities of paper and pen in order to write on a printed piece of paper? Or do they utilize digital technologies in order to engage in this process?

This also deals with how the sprinters are trying to render the field at the sprint, closer to the field out there, that is in the concrete situation of the actual classroom. As of now, there are two classrooms. The one that is at the sprint and the one that is temporally and spatially somewhere else. One may be inclined to think that these classrooms are one and the same, but the difference is how they are constructed. It is not the same classroom we are talking about, because we are not able to gather the same actors around the specific classroom. The idea that we would be able to replicate the classroom doesn't take into account the situatedness of the actors present both here, at the sprint, and there, in the classroom. This situatedness is what the world is constructed of. This is why we can't have 'a view from nowhere' because this 'gods eye-trick' ignores the empirical reality that we are always 'somewhere' (Haraway, 1988). Always situated and entangled in the practices of everyday life.

The presenter then continues to ask: "*Do you even have printers at school anymore?" - Presenter*

This is an interesting observation. Instead of assuming the composition of the field, the presenter asks the issue expert how the field is constructed. In this way, the issue experts both act as a knowledge repository on what the practices of the field are, and that of eyes in the field.

The answer was yes, and Mr. Teacher thinks: "*It would be best just to print it." - Mr. Teacher*

What happens as part of the above conversation is that the presenter remarks on the printed timelines that the pupils could *"...put it along a wall, go around and talk about each other's journeys…" - Presenter*

The presenter reveals a teaching scenario in which the pupils are actively engaged in making sense of their own and each other's journeys. What should be talked about, the presenter leaves open. However, it is a way of making an issue. In this sense, the pupils are actively engaged in formulating the way in which the interpretations of the gathered data are made. They are able to situate their own journeys in a teaching scenario. That is, the way that the issue is taught. There are different ways that teaching can happen, and several different practices which teaching can be thought out as. One way is the collaborative format mentioned above. The way that students can go around and inquire upon each other's journeys, making the inquiry of the journeys the main topic. Another teaching scenario is engaging with other types of actors as ways of learning about a specific issue. The way in which the learning situation is configured has its consequences. Not only is it what the pupils learn in the situation, but it also means constructing the issue in a different way. Choosing to use a natural science book with preformulated exercises that are meant to be worked on individually, or choosing to make the students gather their own data and work on that collaboratively are two very different, yet possible ways of engaging an issue that co-constructs different issue-publics.

This means that the choices made in regards to what the teaching scenario should look like, not only deals with the practicalities in the field for the teacher, but also has a concrete effect on the specific way in which issues and publics are assembled. This is why I would argue that the way in which we engage our issue experts has profound effect on what issue-publics we are able to engage as a result. And that these issue-publics might be very dissimilar from the way in which the publics are made in the sprint.

Teaching portals

The presenter returns to his concerns regarding "*stuffing things down the teacher's throat"* in as how 'open' the teaching material should be formulated. In relation to this, Mr. Teacher points towards a portal with teaching material called Clio[12]. He remarks that he does not like the way the teaching material on this platform have guidelines, having to go through 30 consecutive steps for one lesson. So, there is a fine line between the sprinters approach of offering a narration of how the teaching

[12] https://www.clioonline.dk/

material should be used and the step-by-step process offered by the teaching portal already available in the field. Mr. Teacher is however fine with the way in which the teaching material is narrated by the sprinters, such as asking the pupils questions in regards to their journeys and air pollution.

This is indeed also interesting in regards to what the sprinters might learn from a potential user of the portal and teaching material. Mr. Teacher, who already have experience with specific teaching material and portals, knows what makes for a good teaching scenario, that is, what makes sense to actually deploy for him as a practitioner. In a sense, he is not only an issue expert having extensive contextual domain specific knowledge of the field, but also a lead user, since the teaching material can be formulated and negotiated in interaction and association with him present. One would be able to argue that it is also a form of user involvement. Insofar as the literature for data sprints covers this topic, the term of participatory data design is the one that most closely resembles how we could explain this phenomenon.

Mr. Teacher also ascertains that it would make more sense for him to print it if he were to do the exercises. This tells us something about how the pupils are presented by him and whether or not they might be mobilized in the issue of air pollution. It also tells us something about how Mr. Teacher imagines them mobilized in the issue, what competencies the pupils have, and how this might actually contribute to them being active participants in the issue-publics. This way, the pupils are both pupils, that is, they tend to their school, but they are also an issue-public, formulating ways of rendering the issue visible through the participation to assembling the issue as part of their air pollution journeys. They render the issue visible by both showing the pollution in the air through graphs, but also by performing it as part of their educational practice. And by doing this issue through their journeys outside the school, even having the monitor on them in their spare time, they associate the issue with other things than the topic of particles. In this way, air pollution is not only about particles in the air that can be observed as a natural phenomenon, but also about how the pupils transport themselves, what they do as part of their spare time activities and where they live. These are obviously only instances of how the sprinters imagine the issue of air pollution may be situated as a part of the everyday life of the pupils, but it multiplies the issue of air pollution by showing that it not only has to deal with particles in the air, but also practices of teaching and the practice of everyday life.

Issue participation

In relation to talking about embedding the issue in the practices of school teaching, and in particular

walking around with the monitoring device, the presenter tries to think of ways that this can be done. He then begins talking about what he calls a gamification story:

"Would a gamification story be interesting?...Now everyone in the class has an hour to get the most exposure possible. So come back in an hour upload your data and we see who wins and who loses, who succeeds in getting most exposure." - Presenter

The presenter asks Mr. Teacher whether one way of engaging the students could be a gamification scenario. There are several interesting things to explore here. First of all, there is the question of the pupils as producers of data. Beforehand, the way in which they were supposed to gather data was through a scope of natural science teaching experiments, being what the sprinters referred to as "*small scientists".* The pupils' role was that of seeking out ways in which to render differences between different phenomena in regards to air pollution, such as wind or location. Now however, the presenter imagines a different scenario that involves the focus on what pollutes the most or the least. So instead of going out with the goal of comparing phenomena, the pupils go out to find the phenomena they think pollutes the most or least. In a way the pupils are still considered *"small scientists",* but in a sense, their reason for going out and monitoring the air has changed. Now they don't have to see what possibly changes the states of air pollution, the graphs inside the portal. Now they actively have to imagine raising a graph that renders the issue of air pollution most or least visible. It could be, that the difference between being exploratory and being comparative is the same. In one way, the pupils are supposed to be exploratory in finding the places or phenomena for raising the number of air particles measured by the monitor. In another way, they have to compare different places' number of measured particles and different phenomena' states rendered as a difference on the graph.

This has an effect on what the issue-public is able to handle and how a proper public is assembled. It is the difference between having a public that renders comparison between the same phenomenon and showing what phenomenon is the most polluting. It is an issue-public that is equipped for both practices, but focused on rendering, or sparking the issue, in one way or another.

Mr. Teacher nods and then agrees on the way the teaching could be practiced. He expands on how he would formulate some questions:

"...what did you talk about, where did you plan to go and why did you plan to go there, why did you think you would be more exposed there?" - Mr. Teacher

Mr. Teacher is becoming a complicit in situating the issue both at the local places of the teaching practice, but also in the teaching practice itself. The issue expert resembles an issue participant by making the pupils participate in the issuefication of air pollution. This is important for the sprinters. Not only because they will be able to mobilize him in the issue of air pollution, but also because they will mobilize his disciplinary knowledge. So the value of him as an actor is not only in the value of the expansion of the actor-network that this actor poses, but also of the actor-network that follows, which in this case, is the disciplinary knowledge of the teacher. Put in another way, it is not only important to expand one's actor-network, but also important that this constructive work is durable and rigid. Having durable associations and relations with the actor-network of Mr. Teacher is equally important as being able to mobilize him in the data sprint. This way of making him a participant in the issue, thus also entails a more durable prototype, insofar as it becomes a part of the extended actor-network and is durable enough to be re-situated in the actual context of elementary school teaching.

The presenter affirms with Mr. Teacher that the scenario could be about:

"*...the discussion when they come back. That one of them actually failed to get a lot of exposure and then you bring that map up and start asking, why is that the case?" - Presenter*

Mobilize resources

One of the sprinters then reiterates on the original plan of the project as the sprinters thought it out yesterday. To summarize, the plan is that the teacher will be able to rent the teaching material from a central depot. One of the sprinters then asks the teacher: "*How often do you use that? Do you use it often or have you ever used it?" - Sprinter*

Mr. Teacher answers that he "*...never borrowed something from the outside" - Mr. Teacher*

At first, this might seem gloomy for the project. That he simply do not engage in renting materials from these central depots. There are however several ways of analyzing this that gives several different ways of doing something about it.

One way of analyzing this is that there is a better need for communication. However, this model of communication deficit does not take into account the role of the constructivist approach. Information is not something that is transferred, as an object outside of the context in which it is used. Thus, the information deficit is not a viable explanation in telling how practices are formed.

We also cannot explain the way in which the central depot has never been used by referring to the practice itself. That is, we cannot use it as an analytical category if we are serious about deploying actor-networks empirically.

What this shows, is that the sprinters do not necessarily have aligned ontological agendas. Or at least that what matters in this situation is not some concept about participatory procedures, but instead of how to actually spread the prototype. There is both the possibility that the prototype does not get situated, but also that it does not move outside of the room. Whether choosing a route of trying to 'inform' teachers about the prototype, or to get them to prototype it as a means of situating it, it is the constructive work of the actors that will help define how rigid that practice will turn out. Mr. Teacher even offers some actors in alliance of the first possible way of engaging this problem: "...*there's a lot of magazines handed out to the teachers, you can put an article about it in there." - Mr. Teacher*

So a mobilization of magazines in teachers' conference rooms as a way of making the prototype more durable, could be a way of getting the prototype to be rented and used by teachers. To become part of a practice of teaching in natural science education.

The presenter then redirects the attention to how the prototype may be thought out as part of a different learning situation:

"Do you also have these theme weeks where you could work a week with a theme across different disciplines?" - Presenter

Mr. Teacher works only with tenth graders and they do not have this work format, but he knows that other schools have these sort of theme weeks. The reason for why the presenter might think it relevant is revealed afterwards:

"And do you ever mix with social sciences, because there is also a lot of social science questions here. You compare timelines and you figure out that it is the pupils coming from the rich part of the town that are less exposed..." - Presenter

As from the above quote, the presenter is interested in speaking to the interdisciplinary nature of knowledge production. As part of the way in which the prototype may be used in the classrooms, there is an expansion of the focus that has so far been the natural science education. Beforehand the sprinters proposed that one could viably add social sciences into the natural science education by asking students to talk about their 'journeys'. Now they consider the possibility of making it a core component of the

way the issue of air pollution is taught. In this way, the presenter is trying to align practices that he already knows of, which is the interdisciplinary approach of STS research, with the practices of the field, which is the way in which teaching is structured in a disciplinary sense.

Mr. Teacher and the Common Objectives

Mr. Teacher is however interested in how this may benefit his teaching. In particular, he is focused on the Common Objectives, in Danish called Fælles Mål. These are requisites, or goals, that the teachers have to teach the pupils during their lessons and then the teacher has to show how he or she have met those goals.

"...the Common Objectives are also talking about trying to be scientific and it is really difficult as a science teacher to make some experiments where the pupils can be scientific." - Mr. Teacher

Mr. Teacher draws attention to the ability to *be scientific* and to live up to these Common Objectives as a teacher. He also talks about how part of these goals is fulfilling work methods in regards to teaching. Mr. Teacher is not only part of the sprint by way of his issue expertise, but also that he can translate this prototype into something of value for him in his field. This is interesting, not only because he can translate the prototype into concrete practice, but also because he himself starts configuring the prototype. In bringing in the Common Objectives, he mobilizes an actor that the sprinters might not have known about had they built the prototype themselves without him present. So, getting Mr. Teacher to participate in the data sprint, acting, not only as an issue expert, but also an issue participant, has been productive in the sense that the Common Objectives, something that all teachers have to consider in their daily teaching practice, is now being mobilized in order for the prototype to become more rigid. Mr. Teacher ascertains that the formulations presented in the teaching material produced by the sprinters fits the Common Objective very well. He also says that the specific part of these Common Objectives which the prototype may address are *"the most difficult part of trying to live up to these goals." - Mr. Teacher*

He furthermore adds that the pupils now have to attend a natural science test to graduate 9th grade, and that this is a test where the students are supposed to mix geography, biology and physics. And that he sees that this prototype could fit very well in preparing for that test. So, he is in a sense configuring the field, trying to translate the prototype into his own practices of teaching and that of his fellow colleagues within elementary school teaching.

The presenter readily takes this as a cue to try and formulate the teaching material around those Common Objectives. As he says: "*So maybe it would be a good idea to read those goals and try to create the narrative around that if they fit these goals." - Presenter*

So not only is the prototype formed by Mr. Teacher as an actor, but also by the Common Objectives as an actor. Their agency directly translates into teaching material that is being situated around their formulation. And this is not only the goals. The goals are formulated by the Ministry of Education, so by extension of the actor-network of these Common Objectives, it is an alignment in conjunction with said ministry. Even though the ministry does not have any direct influence on the teachers' everyday practice of teaching, nor on the data sprint and the practice of data sprinting, they are still being mobilized in the sprint as an actor that plays a role in the MyAir group and influences the assembly of the prototype and the issue of air pollution as a situated subject.

Mobilize Mr. Teacher

The sprinters and Mr. Teacher having assembled and configured the prototype in various ways at the meeting and thus having contributed in formulating issues and publics, agree to let the sprinters come and test the prototype in his class.

The sprinters then show Mr. Teacher the monitoring device that measures the particles, along with other data:

"So it has an external battery, but it will probably be internal, it records it on this one (points to hole in sensor ed.), then you have the temperature, the humidity, and the pressure and then you have two different particle numbers. So three is really clean, but outside it is usually around 20-30 (particles ed.). You can see here, I think this is Mads, when he is smoking, or in a smoking area, he goes up to 250. So that is the kind of data you can see" - Sprinter

This is the first time that Mr. Teacher sees the monitoring device and gets to know how it works. Beforehand, the sprinters have instead talked about how the teaching scenario as a whole could be configured and how air pollution could be made as an issue through aforementioned teaching scenario. Mr. Teacher listens to what the sprinter has to say and look over the monitoring device in his hands.

One last note on this is the placing on the issues in the meeting with the teacher. That is where the issues are supposed to be performed. First of all, we have the placing of the issues in the journeys of the

students. Either from school to their home, or as some sprinters imagined after this meeting had happened, on their way to soccer practice. This is one place in which the issues are performed and localized. Another place is the vicinity of the school. Using it as a proximal place to create data. And then there is also the classroom. Both the physics classroom where the students will perform the issue as a way of doing natural science and in their own classroom in discussion about their own timelines, the comparison between their timelines and the way that the previous place, that is their journeys, is visualized compared to the modelled data.

Having concluded the meeting, the sprinters stay in the room to talk about how the considerations from Mr. Teacher might be included in the prototype. Now we can turn our attention to some other sprinters that also have a role in the data sprint; the designers.

The Italian job

In a data sprint, the work of narrating data, creating data stories that situate some kind of issue, whether it be in an online or offline setting, involves the work of sprinters with practices in data visualization. In the SaveOurAir data sprint as well as other sprints, the role of data visualizers has been practiced by researchers at DensityDesign from the Polytechnical University in Milan. At DensityDesign, they work with visualizing complexities or as they put it themselves: "*we can develop a diagrammatic visualization—a sort of graphic shortcut—to describe and unveil the hidden connections of complex systems.*" - *www.densitydesign.org/about*

In succession to this presentation, the next question that could be raised in how this all translates to practical work within a data sprint. How does the designers perform the role of experts on data visualization. How do they engage with the specific issue-data and how do they translate this role or practice into this specific context, situating their ontological purview into engagements with the issue topic and issue public?

One way is how they might imagine the visualization happening as one designer puts it:

"I am trying to imagine something which is simple to realise. We can do something when you click on the name on the bar. Or we could move to another kind of comparison, maybe we can imagine more than one visualisation. The question is which other kinds of comparisons can we make? When I have the data

for all the monitors, the overall amount of pm 10 over the day, we can see how we could try to create this kind of gamification involvement with the students." - Designer

In the above example, we see how the designer is interacting with the data that the sprinters from the MyAir group has gathered. In particular, he is trying to configure ways of presenting the data in a visualization so that it may be used in a teaching scenario. In this particular instance, the way in which the issue topic is being practiced is through the design of the prototype. So the designer uses the measurements from the monitor, the number of particles in the air measured as the data point 'pm 10' to imagine what would be interesting about the way in which this might be part of a teaching scenario. The designer and the other sprinters imagine that the teaching scenario involves group work, a particular way of imagining the users of the prototype. Following this line of inquiry weaves together a teaching scenario where the users of the prototype 'compare' their data gathered through the air monitors and then visualized in the platform.

As such the designer is constructing for a specific practice of how teaching should be done. In other words, it situates the prototype within the practices outlined by Mr. Teacher. However, the situating techniques are not without their choices and specificities.

Indeed, one could easily imagine a scenario where the teaching was done in a self-help ontology of pedagogics. This could have led to a different prototype with a datascape centered on the personality side. The reason for bringing this up is showing, by way of describing the constructive work of the sprinters, how things could have been different. In choosing a comparative model for visualizing data and choosing a teaching scenario where the work is being made in groups configures the potential users towards this way of teaching the pupils. This could be both productive and hindering. Productive in the sense that the situating of the prototype in critical proximity to the practices at play in the field allows for a tighter anchoring in said practices. It has the potential to be re-constructed in the actor-networks of the school system that it is imagined to engaged with. The question of how much of the ontological luggage from the sprinters that can be situated is interesting. In this specific situation it is how pupils compare air pollution journeys in a participatory way. It is the sprinters intention to use this as a way of raising questions instead of receiving answers This is also where the possibility of an Achilles heel lies in that it may not sufficiently change the way in which the field treats data. In this sense, it might not 'activate' the 'data-publics' envisioned by the Public Data Lab. There is a possibility that the issue-public, one that ferments the issue of air pollution in an elementary school context, will resist to settle the ontological luggage that the prototype is envisioned as bringing.

Interdisciplinary approach

Another part of data sprints is the intermingling of different disciplines. In a constructivist sense, because the constructive work of these prototypes is done in an interdisciplinary approach, their prototypes are particularly durable.

In interaction with the other sprinters in the MyAir group, the designers configure the way in which the data should be presented. In particular, the sprinters talk about how they might incorporate an average measure of particles into the data visualization:

"I think the average is nice when you talk about what the EU have of thresholds and what the UN has made of goals. Then it will be 50 (particles ed.) for 24 hours and it will be 25 (particles ed.) for a whole year average. Let us say if in one day, you are at 60, then you need to do something, because you can not do that everyday and that is where the gamification comes in, where they can try to do something about their exposure levels." - Sprinter

Here the sprinter uses the data visualization as a way of presenting to the pupils the official threshold values of the European Union. This is one way of presenting the issue of air pollution. In this way the EU is brought into the classroom by way of thresholds for what the particle count should be over an average of a day or a year. In this way the issue is made into something that the pupils should act upon. Here the pupils are constructed as an autonomous public, in the sense that they have the responsibility of acting upon the issue as something to be solved. If treated this way, the issue surmounts to a problem-solving state in which the autonomous individuals in the classrooms can treat the problems themselves. What is left out in this way of engaging the issue is the questioning of what counts as data to be shown. In specifically choosing the EU recommendations of thresholds the sprinters risk missing what matters in the context of the teaching scenario. Obviously, this prototype has to be done prior to entering the field, in order to test it, but the consideration of what data to render in the data visualization is a political move. The questions of what data, which experts, what models, would in an STS perspective be something that could be considered after the first prototyping of the portal.

Issue expertise or issue participation

The facilitation of the SaveOurAir data sprint included issue experts. The literature states that issue

experts are defined as having some sort of knowledge of the issue at hand. In this sense, expertise entails that they engage with the subject of the sprint which in the case of this sprint has to do with air pollution. The empirical choice of what issue experts to include is far more complex and fuzzy than what this presentation details. Should we take our constructivist approach seriously, we must first acknowledge that associations between actors are either durable or not. This means that the construction work in keeping the actor-networks somewhat solid and firm must be perpetually practiced. This is turn entails that the invitation to issue experts in participating in data sprints must be included or configured in a productive way. And this is where the facilitators, in the SaveOurAir sprint, chose an ontologically disturbing choice in issue expertise. Air quality and air pollution could be made as an issue in several different ways. And the issue-publics that are assembled in lieu of such an issue configuration could not be said to be a direct effect of the work of issue experts and sprinters in configuring the issue. If organizers of data sprints are to take serious an interventionist approach in participating in issue-publics, then the issue experts, or how I would rather moniker them given what the empirical fieldwork shows in regards to the sprint, issue participants should engage in critical proximity work. Currently there are two ways to do this work.

The first entails the issue participants as contributory in the issue that is currently being engaged. This should be taken in the most literal of senses. Prior to engaging with sprinters, the issue participants must have participated in the issue as either having contributed to producing data about the issue topic or having engaged with the publics that are being configured as a potential issue-public for the prototypes being worked on in the data sprint projects. This goes both ways. An issue participant may be able to reconfigure the projects of the sprinters, so that the issue definition of the issue participant is successfully integrated into the prototyping projects. This is not necessarily a benign thing. It could be argued that the ontological work of the issue participants might be incorporated into projects to produce innovation. It is when the configuration of existing actor-networks are destabilized that innovative and new hybrids of networks are built. The displacement of these constructs could be seen as fertile, in that they prototype potential configurations of issue-publics and their respective stability. And it is only through the vigorous work of sprinters and issue participants that these might stabilize into productive practices within specific issue-publics.

The other way of engaging in critical proximity work in a data sprint is of a more opportunistic approach. In this sense the sprinters try to situate the expertise of one of the issue experts in relation to the issue topic. This approach moves into the territory of using the sprinters as designers in trying to build

meaningful associations between issue-publics and issue expert. This is when issue experts would deserve their moniker as experts, not because they necessarily have intricate knowledge of the issue at hand, but because it is their expertise that actively, in the foreground, and constantly is being negotiated or configured by both the expert herself or by sprinters or by the data prototype or other actors actively engaged in the sprint project. Through this, the sprinters, along with the prototype and the issue expert, try to configure the way in which a practical approach to making an issue-public might crystalize. All the participants work with situating the actors at hand in relation to the issue topic out there. This work is constantly probing the question of how the public might also be situated in the topic. The balancing act is thus trying to assemble these heterogeneous actors, the situated issue, the public, the expertise, the data visualizations, in some sort of prototype that can be made durable. In this vein of critical proximity work, it then falls to the sprinters to take their prototype 'out there' and try to engage in the translational work of incorporating the assembly in a specific context. It is a sort of re-situating approach in that the assembly that had been durably constructed in the sprint now moves around more permeable and fragile. When it engages with already existing and durable actor-networks, the prototype must be malleable if it is to be made successful in engaging with existing practices. Putting things on reverse, the concerns of the field which the prototype meet must also be valued as important, for it is here where critical proximity must stand the test. In this sense, it is here that the critical engagement can happen when sprinters work with the concerns of the field. As a way of taking a critical proximal stance, the sprinters can co-create contextual concerns as a way of situating the issue in relation to the field site where the prototype is brought.

Summary

Throughout the analysis, I have shown how participants in a data sprint interact, specifically focusing on the interactions between issue experts and sprinters. This focus was out of interest of these interactions as the constructive work in making prototypes which potentially situate the issue of air pollution.

First, I focused on the interactions between the sprinters in the MyAir group and Mr. Pedagogy. The different ways of situating air pollution, the sprinters' 'journey' of air pollution, and Mr. Pedagogy's models of air pollution as a didactic objective changed the way in which the prototype and expected users might look. Taken further, this results in distinct approaches of engaging with issue-publics.

These distinct approaches can also be found in the meeting between Mr. Smart City and the Mobilize Our Air group. Here, the Mobilize Our Air Group focused on the platform that used data from blogs and other types of digital media presence as a way of situating air pollution while Mr. Smart City focused on various models and measurements for air pollution.

Second, from the interactions surrounding the prototype between the sprinters and yet another issue expert, Mr. Teacher, I argued that Mr. Teacher both acted as an issue expert providing domain specific knowledge of the field and as an issue participant in contributing to the issue-public. I showed that the process of designing the prototype was linked to the users, both pupils and teachers, in several ways. That is in the sense that the sprinters insisted on the journey format to make pupils question modeled data, and that the prototype was contextualized in existing types of natural science teaching. I argue, that this engagement with already existing practices of teaching natural science could be seen as a critical proximity approach. These exercises furthermore showed the situatedness of assembling the prototype in the field as well as at the sprint, which could be seen as a way of constructing the issue-publics insofar as the pupils would engage the issue by doing these exercises.

Finally, I discussed the crucial practice of visualizing data as part of constructing the prototype. This is also a part of the contextualization of the prototype itself, as can be seen in the example of visualizing journeys to the pupils, one of the issue-publics of air pollution.

Discussion

So far, I have provided a rather flat mapping of the data sprint and it's participants. The interactions between sprinters and issue experts have been treated empirically as they happened in the sprint.

However, in this empirical treatment, I have yet to discuss the subject of expertise. I deliberately chose not to unfold this subject until now, because the focus was on the interactions between sprinters and issue experts. But an inquiry into how expertise come to be expertise might be fruitfully discussed.

Notably, this thesis does not make a critical topic of expertise. That is, if someone is regarded as issue experts in the data sprint, then they get to be an issue expert. Though the thesis accepts that there are different kinds of expertise, the concept, the very notion that we are able to demarcate between experts and non-experts is a discussion worthy.

Within STS, there has been numerous discussions about how to treat expertise as a subject of investigation. Do researchers accept the demarcations of knowledge made in the field? Do researchers make the distinction themselves in regards to who are regarded as experts? As a researcher, there are many ways to treat expertise. And the next question that comes to mind is, who decides which experts to choose from? What are the merits of each expert and how do we deal with different ways of being an expert in a specific domain? It is not only a question of which expertise should be called to which issue, it is also a question of whether these experts are regarded as having the domain specific knowledge on the relevant topic. And even then, we cannot fully accept this claim to expertise, as there might be discussions on what the valid knowledge is within a specific community of researchers.

As for the treatment of expertise in this thesis, I would argue that parts of these discussions are fruitful, insofar as they unfold some of the tension that this treatment has brought. One example of such tension described earlier, is how the issue experts' knowledges indeed have been taken into account in constructing the sprinters' prototypes, yet their opinions have at times been questioned and even overruled by the sprinters' opinions and ideas, as for example the situation with Mr. Pedagogy and the visual presentations of the data. While we cannot fully find a solution for how issue experts should be treated in a data sprint, keeping the topic open for critical inquiry is important.

The first argument for unfolding issue expertise is that there is already critique present. A field such as pedagogy has numerous discussions about how research should be carried out. There are several

different ontological tools that researchers use, and several ways of conceptualizing the world. So, when I treat pedagogy as issue expertise in this thesis, I know that some parts of these discussions are left unopened. But there could be great value of inquiring upon this, as it would allow the intricacies and discussions of said field to unfold. It would show the tensions that arise when claims to expertise are made. Part of such tensions is that claims to expertise differ. In a data sprint, an issue expert might be an expert on pedagogy. But in his own field, that fidelity of information is not nearly enough to describe what he does in his research. The issue expert's peers could be able to change that description. Perhaps as a demarcating move that might question his authority on a subject, pose devastating critiques, offer alternative perspectives or, contrarily, strengthen his authority by supporting his claims of expertise.

We cannot assume that the entanglement of everyday life does not permeate all kinds of situations. As such, maybe we could show how issue expertise is made. But practically, that does not help in our workshop format, the data sprint, as this procedural approach would weigh down too much on actual practice of data sprints. Convening for five days with actors from different parts of academia and outside of academia would have a difficult time containing this critical approach to expertise due to the amount of work to be conducted within these few days, including that of testing the prototypes.

Another way, that could provide a way through the subject of expertise in a data sprint, is to deliberately seek out confrontational issues. This would be issues that are so heated and perhaps in apparent deadlock, so as to relatively easily know which standpoints different actors take, and which types of expertise the actors rely on. In this case, the sprinters should worry about several ontological standpoints on an issue. This could provide a more robust prototype with several possible interpretations or several ways of being applied. However, this does not solve our problem, but merely relocates it.

First of all, the current assembly of already heated issues takes for granted several aspects. In the formation of such issues, actors have come and gone, and experts have been appointed and cast aside. This means that if simplicity appears, it is due to the vehement work of a multitude of actors, who successfully translated different aspects of their actor-networks, so as to unseemly incorporate these aspects in everyday practices. Some things cease to be questioned as relations between actors change. And this leads us to another problem with treating expertise this way.

How would we know that it is the right experts who speak on behalf of the actors involved? This is a question of marginalized groups as much as it is about a normative standpoint. It is also a question of

the relationship of power in the field. As a researcher, interaction is also intervention. There is no value neutral position from which to determine who the right experts are. In the case of the SaveOurAir data sprint, the issue experts may not be the right, or the only right experts to speak on behalf of the other actors involved. Maybe a wider array of issue experts, or a different teacher, pedagogy, or innovation expert than the ones present, could have provided better or different input, improving or changing the prototype and the issue itself. Making the choices of which issue experts to engage will always be determined by a mix of the perspectives taken on the issue by the sprinters inviting experts to engage, social and professional relations, and opportunity. If the 'ideal' expert cannot make it, who then to choose? Who do the sprinters know or know of? As such, the choice of issue expert is not necessarily made only based on their known or expected ability to speak for other actors involved, but also on other perhaps unrelated circumstances, stressing the indeed value loaded position as well as the power relations at play in the field.

Another way of dealing with the problem of choosing issue experts could thus be an interventionist approach that specifically attempt to seek out marginalized positions in issues and include these in the sprint. That could for instance be displaced people in issues of climate change. There should be a healthy skepticism as to who gets to claim expertise on behalf of such groups of actors. However, a choice must be made in who gets to claim expertise in regards to marginalized people. As such, there is a risk that the researcher could bring an issue expert to speak on an issue, that entirely reorganizes the issue and displaces several other actors.

There is no standard answer for how to treat the considerations around expertise in a data sprint. As in other endeavors within STS research, the act of knowing about the world is also an intervention in the world. And in regards to the assembling of issue-publics, it is also a matter of the way in which issue experts try to engage these issues.

One way I have dealt with the tension around expertise is by situating the expertise in how the issue experts try to shape the public and its issues. As a method, it has the distinct advantage that I as a researcher can take their expertise serious in a critical proximity approach, accepting that within their specific domain, critique already exists in practice. However, taking the considerations above seriously, there could indeed be a risk that these experts come to speak on behalf of several actors of whom they, in other situations, would not be able or suitable to speak on behalf. That is indeed a precarious situation, one that could be a subject of inquiry in and of itself.

Conclusion

In conclusion, I have shown some of the ways in which issue expertise, data sprints and critical proximity are related.

The issue experts' roles in data sprints are not only configured by themselves with their domain specific knowledge, but also by other actors present in the data sprint. This means that data sprints as issue driven events are very much configured by the interactions between sprinters and issue experts and how these actors negotiate roles for each other. This not only has the consequence that the issues are shaped by the issue experts' expertise, but also that the issue experts through their domain specific knowledge try to re-align the issue. In the specific sprint of SaveOurAir, this means that air pollution is not only a phenomenon being studied and defined by researchers within the natural sciences, but also by other types of expertise. That is, by other types of expertise within academia, such as pedagogy, and by other actors engaged outside of academia, as in this specific situation, a teacher with domain specific knowledge in elementary school teaching and an expert on city modelling.

By exploring the making of the projects, or rather prototypes, of the data sprint through the interactions of sprinters and issue experts, I showed that such prototypes can be configured in close alignment with the field in which they are to be tested. To account for this, I borrowed the term critical proximity from Latour and used it not only to provide an explanation for how sprinters in data sprints can engage in productive critiques of a field, but also for that critical proximity can play out in many different ways. This was exemplified through the interactions with issue experts, who provided their expertise as a way of bringing the field into proximity of the sprint and also re-configured the way in which their expertise were to be deployed. Thus, critical proximity show how issue experts also could act as issue participants, not necessarily providing their expertise, so much as providing their field and willingness to engage in constructing and caring for a potential issue-public.

In addition, I have shown how issue-publics get situated in and through the data sprint. This is an important part of how data sprints could be conceptualized as engaging in critical proximity work. The construction of working data prototypes not only pertains to working on the material side of these prototypes, but the prototypes could be a way of understanding the interactions between issue experts and sprinters in how they assemble issue-publics in data sprints. As such, paying attention to how issue expertise is formulated also means paying attention to the way in which the public and its related issue

is defined. As a contribution, I would argue that there are at least two ways of doing this. One is the way in which sprinters can situate an issue by acceptance of certain ways of formulating the issue already existing in the field. In this way, the sprinters act as a sort of Anthropologists, reconstructing the issue in a novel way.
The other way is by creating more distinct novel approaches of actually making an issue and a related public. In this sense, the issue is made specifically in regards to a practice that does not yet engage with this issue. The sprinters try to situate the issue of air pollution in everyday practices of actors by engaging issue experts through critical proximity in the SaveOurAir sprint.

Though I treat these two approaches as distinct ways of situating publics, they are not entirely purified from each other. There is no 'neutral' ground for mapping out actors' positions and there is no 'creation' of issues not already, at least tangentially, known to specific actors. However, I would argue that data sprints could function as ways of engaging issue-publics in a productive critical proximity format, a format that makes possible mobilization of various actors relevant to the issue.

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