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Speculative Data Work & Dashboards

Designing Alternative Data Visions

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ABSTRACT

This paper studies data work in an organizational context, and suggests *speculative data work* as a useful concept and the *speculative dashboard* as a design concept, to better understand and support cooperative work. Drawing on fieldwork in a Danish public sector organisation, the paper identifies and conceptualizes the speculative data work performed around processes of digitalization and the push to become data-driven. The speculative dashboard is proposed as a design concept and opportunity for design, using practices from speculative design and research to facilitate speculation about data–its sources, visualizations, practices and infrastructures. It does so by hacking the 'genre' of the business intelligence data dashboard, and using it as a framework for the juxtaposition of different kinds of data, facilitating and encouraging speculation on alternative visions for data types and use. The paper contributes an empirical study of organizational use of and attitudes towards data, informing a novel design method and concept for co-speculating on alternative visions of and for organizational data.

CCS CONCEPTS

• **Human-centered computing~HCI theory, concepts and models** • Human-centered computing~Empirical studies in HCI • Applied computing~E-government • Social and professional topics~Socio-technical systems

KEYWORDS

Speculative Design, Business Intelligence, Data Visualization, Ethnography, Data work

INTRODUCTION

"The only limits imposed are those of the imagination," was how a presenter described the Microsoft software "Power BI", at a workshop in the Municipality of Copenhagen, Denmark. Such imaginaries [76], mythologies [92] and speculation on the power of big data and analytics are rife within modern organizations. Dashboards are one ubiquitous aspect and paradigmatic example of such dreams; a board of instruments which promises the translation of data warehouses and lakes into an accessible overview of visually appealing graphical representations of the organization – its current state and goals – at a glance.

This paper provides two contributions to CSCW. It first provides an empirical analysis of a particular kind of data work we term *speculative data work* and examines how dashboards arise as a site of such work within a public sector organization. It then describes the design concept of a *speculative dashboard* based on the empirical analysis and early prototyping work, aimed to account for, interrogate and support the aspects of anticipation, imagination and speculation present in organizational data work.

Based on fieldwork in the case organization – a public sector organization in a Danish municipality – we analyze a number of tensions and stresses caused by the centralized push to become a more digital and "data-driven" organization. Our analysis finds that data work is bound up with speculative activity, in that it involves both visionary speculation on the possibilities of new technology and more pessimistic speculation associated with cutbacks and changing work descriptions. We suggest the concept of speculative data work to denote how speculation shapes the validity, affect and valences of data work before identifying how this work is connected to existing data infrastructures, especially the dashboard.

Informed by these speculative dimensions of data work and the role of dashboards in the organization, we draw on research on speculation from HCI, CSCW and STS to propose the speculative dashboard, a technique

and potential design artefact for provoking different and more cooperative speculations about alternative visions of data. We describe early prototype work on the speculative dashboard developed together with IT professionals, discuss how speculative design might inform and facilitate such alternative data visions inside of organizations and consider the broader implications for design within the economy of speculation prevailing in current techno-capitalism.

Our contributions attempt to explore the following questions: How should we understand the role played by anticipation, imagination and speculation in data work? How might (speculative) design projects help listen to the concerns of public sector employees in the midst of digital transformation? How might existing infrastructures such as the business intelligence software Power BI be repurposed to support different kinds of speculative data work? What would an infrastructure/interface look like that would facilitate open "co-speculation" on what it means for a public sector organisation to be data-driven?

The paper proceeds by first reviewing the literature on data dashboards and infrastructures and how these relate to CSCW concerns. It then provides a review of literatures on speculation and speculative design from CSCW, HCI and STS. Having described the relevant literatures, the paper then describes the empirical case and the methods used to study it. The paper then conceptualizes speculative data work, sets out the analysis of the empirical material and then details and reflects on the speculative dashboard. Finally, the paper ends with a discussion of the relations between data infrastructures and speculation and a conclusion describing potential future directions for this research.

Dashboards, Organizational Data and Cooperative Work

Power BI, along with similar software such as Tableau, is a business intelligence (BI) software which is designed to be a comprehensive tool for the warehousing, cleaning, analysis, visualization and presentation of quantitative data [95]. BI is a tool bound up with the current mythology of big data, promoting the notion that quantitative and big data will provide organizations with objective and valuable insights that cannot be achieved through qualitative or interpretive work [92]. In practical use, BI software is typically a desktop or browser-run program, which enables the user to access data files from single files or from a data warehouse (if connected), and which can generate data visualizations and analysis either through drag-and-drop experimentation or through formula. Such data visualizations are typically a standard variety, such as pie charts, bar charts, scatterplots and geographical mappings of data. They can be combined within the business intelligence software to form reports, presentations, or, make up what is called "dashboards".

Dashboards are an increasingly ubiquitous form of data visualization and interface [28], used in private companies and also within public sector organisations in both western countries [8] and in South Asia [60,85]. Dashboard displays have a long history within cybernetic projects of information visualization and control [35], and remain a central aspect of modern smart city projects [58] and so-called "urban intelligence" management [55,56]. The term 'dashboard' supposedly originates from the car dashboard, understood as a board of instruments showing the key information needed to operate a car.

Dashboards are defined in the influential work on the topic by Stephen Few as: "A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance" [28:26]. As the definition suggests, dashboards are first and foremost a visual medium and so are related to the general rise and developments of data visualization.

Data visualization by some assessments is a primordial human occupation [31], although it is arguably the tight coupling of information with control and visuality as developed in cybernetics that has brought data visualization to its current ubiquity [35]. Data visualization has become commonplace in popular culture through the work of figures such as David McCandless [59], and within visual design and statistics Edward Tufte [91] in particular has defined the principles by which "good" and "bad" visualizations are judged. While the scope of describing the trajectory and norms of data visualization is far beyond the scope of this paper, these figures represent the overall tendencies towards data or information visualization as aesthetically pleasing, minimalist and tied to statistical displays of data.

The kind of dashboards assessed in this paper particularly represent the merging of software tools from business information modelling [52,74] with these trends within data visualization. Dashboards are thus increasingly presented as a solution for organizations, both corporate and public [8], faced with either rising amounts of data or with the narrative that becoming more data-driven is the only way to remain competitive. They offer to transform data into objective, truthful and accessible graphs and indexes [9]. At the same time, the development of dashboards themselves demand more data, in order to increase the potential inputs. That is, in wanting to become data-driven like other organizations that have dashboards, the dashboard enters into organizational thinking before there is data. In this way the dashboard is an artifact both supporting cooperative work with data as well as one that prefigures and articulates the need for certain kinds of data, as we will discuss.

The ability of dashboards to organize and make visible an overview of data and metrics position them as artifacts sitting at a unique crossroads of themes relevant to CSCW. A dashboard can be said to both help coordinate work [17,81], improve awareness [33], and to a lesser extent, facilitate knowledge management [1]. Attention to dashboards within CSCW has fallen along these lines, seeing researchers study and develop dashboards to support team activity awareness [11,45,90], facilitate idea management processes [5], explore and improve shared cognition and performance in teams [2,34] and coordinate work in design studios [64]. The focus within CSCW research has been to understand how dashboards support particular goals, such as productivity or awareness in programming, or explore more diverse topics, such as "workplace learning processes" [75] or college student mental health [98]. This focus has thus been somewhat instrumental–what are missing are more holistic studies of what the introduction of dashboards might mean for other work practices, social cohesion and employee wellbeing.

Many others in CSCW and HCI, while not examining the "data dashboard" genre specifically, have considered the role of data, its representation in organizations, and how this is changing as data-driven approaches have come into vogue [15,51]. This literature covers a wide range of organizations and technologies, from nonprofits [94], architecture firms [61], and healthcare [70] to civic data infrastructures [12,21] and municipal digital platforms [53]. In particular recent work by Bopp et al. explores how design aspects of information infrastructures such as the requirements of "primary keys" can be "coercive" for work practices, with significant effects for the work carried out in organizations [14]. Peer and DiSalvo's work on literacy and design with regards to data dashboards and infrastructures is also particularly relevant to the present paper, as it also seeks to interrogate how design can intervene into these topics [67,68]. These contributions are inspirations for the present work, with Bopp et al. pointing to the need to intervene through design in the make-up of data infrastructures themselves and with Peer and DiSalvo exploring how practices around dashboards and infrastructures such as workshops can help change practices of use. With regards to the specific Danish context, research has examined a diverse range of topics, ranging from the IT workflows and knowledge management practices of frontline welfare workers [16,63] to data work in healthcare settings [13]. All of this work considers the role of "data infrastructures as complex sociotechnical entities" [71] in reconfiguring classifications and categories, introducing new types of job titles or strategies, and importing conflicting logics into organizational work. We wish to contribute to this research by investigating BI dashboards as similarly "complex sociotechnical entities", and furthermore suggest that the design and effects of IT systems such as dashboards are heavily dependent not just on their technical specifications, but also on the kind of imaginaries and speculations they are involved in.

CSCW has a strong commitment to the empirical study of work, and the design of systems based on close observation of actual, situated practices and the enactment of technologies-in-practice [66,80,88]. We argue that with the increasing pivot to data-driven work within organizations, empirical attention should be given not just to work practices, but also to the various rife practices of anticipation, imagination and speculation which data work both occasions and is often grounded in. Such speculative data work is an important but underexamined CSCW concern, as imaginaries of and speculation in novel yet unproven technologies, systems and organizational forms increasingly plays a role in managerial decisions and workplace changes [10,49,57,76]. We aim to demonstrate how speculative methods might aid in understanding, intervening in and designing for organizational work practices in such contexts. To do so we engage critically with dashboards as a genre and artifact for supporting cooperative work. The following section draws out and synthesizes feminist and critical strands within STS, CSCW and HCI dealing with speculation in a variety of ways, in order to explore how

dashboards can be designed in a more pluralist and participatory manner [7] and thus better support cooperative work.

Speculation in Research & Design

Speculative design is a form of critical design [54] which refers to a type of design activity not specifically aimed at producing objects for the marketplace or according to criteria of efficiency or optimisation, but instead seek to create dialogue about the role of technology or more broadly, 'open up all sorts of possibilities that can be discussed, debated, and used to collectively define a preferable future for a given group of people" [24]. Dunne and Raby engage broadly with this notion of the 'speculative' in relation to both design objects, fictions and installations and focus on the notion of speculative design as a technique to opening up collective deliberation about 'preferable futures'. James Auger [3], on the other hand, differentiates speculative design from other similar design practices such as design fiction, design probes or discourse design by focusing specifically on design intended to engage popular discourse about technological trends and developments. Auger's approach is thus to encourage precisely speculation by drawing attention to the future possibilities or the paths not taken by existing technologies. Pierce and DiSalvo use speculative design to designate a process of design wherein they speculate on and explore potential design ideas on the basis of a wide range of tactics, theories and concepts in an attempt to address anxieties about networked technologies [69]. Desjardins has suggested focusing not on particular artefacts, but instead looks to "co-speculation" as a way of not just producing a different artefact but also to transmit knowledge "between researchers and the field" [20]. While speculative design methods have been applied broadly to design processes, few have specifically focused on the role that speculative methods might play in emerging forms of data work. Elsden et al. use an approach of "speculative enactment" to imagine what "datagraphy" might be and add to a wedding service, offering a useful example by speculating on how data from a wedding might be turned into meaningful visualizations [25].

While both Auger and Dunne and Raby position speculative design as different from commercially oriented design, and others have questioned to which extent speculative and critical design in fact is critical [65], Wong and Khovanskaya [97] point out that the practices employed by speculative design projects actually align with and are present within the history of commercial and industrial design research within HCI. They mention the example of Xerox PARC researchers, who drew on practices similar to those of speculative design, within the context of their commercial research. For Wong and Khovanskaya, this suggests that the criticality of speculative design has less to do with the specific methods employed, and more with the space they open for reflexivity and normative orientations amongst researchers. They encourage researchers to be strategic in using the ambiguity in speculative design projects as a means to not just critique, but to present critical projects as actual workable alternatives.

Speculative research [96] is a broad interdisciplinary project which also recognizes the ties between the speculative and the commercial and industrial. It ranges wider yet, pointing out how speculation is particularly associated with "negative" phenomenon such as financial speculation, and related attempts to predict and control the future through techniques of a probabilistic or statistical character. Orit Halpern has demonstrated exactly this issue, showing how contemporary projects of global resource extraction and instrumentation [36] have roots running deep into cybernetic ideas of information, control and a certain aesthetics of vision [35], all of which not only involve but rely on speculation both for prediction and profit. Thus for Halpern, "change itself is a medium for speculation" [37] and a necessary companion of the many transformations society is subject to. Wilkie et al. however wish to reclaim speculation from this connotation, or at least propose that it not be the exclusive provenance of the negative, and suggest that researchers must risk more speculative kinds of research, and thus perhaps create situations wherein those practitioners they research may themselves be interpellated by the lure of alternative, speculative futures. Part of this notion of speculative research is an explicit shift away from an understanding of the future and time as determined mechanistically, towards a focus on the kind of changes that lie outside of this conception, overturn expectations, and represent something truly new.

Speculation is also a central concept for Donna Haraway, who provides perhaps one of the best examples of research which risks and creates much through her engagements with the speculative. In *SF – Speculative Fabulations and String Figures* Haraway generatively speculates on the string figure, science fiction and engages in what she calls speculative fabulation, using string figures and mathematical equations to discuss practices of worlding, "opening up what is yet-to-come in protean times' past, present and futures" [42]. Haraway speculates

by drawing up figures such as the cyborg [38], monsters [39] and companion species [40,41] and thinking through and with them, staying with the trouble that this may bring because trouble is not something that can be warded against, but must be learned to live with in the present rather than probabilistically predicted away through the future [43].

A strand of STS research also related to the theme of speculation is that of sociotechnical imaginaries, developed by Sheila Jasanoff and Sang-Hyun Kim [46,47]. Developing classic research on the role of the imagination in constituting the notion of society and the nation-state [18,89], Jasanoff and Kim have drawn attention to how sociotechnical phenomena such as nuclear energy also can be understood as constituting particular imaginaries. Their work has inspired studies of a wide range of topics, from GMOs [83] to smart cities [77]. Sociotechnical imaginaries are defined as "collectively held, institutionally stabilized and publicly performed visions of desirable futures" [47:4], which foregrounds a conception of imaginaries as stable, public and collective. Speculation can be both public and collective but is rarely stable. We draw on Jasanoff and Kim's work in the following to suggest that speculative data work as we define it, may (re-)produce certain sociotechnical imaginaries.

Within CSCW, there is relatively little work on speculation or speculative design. Steinhardt and Jackson [87], however, have advanced the notion of 'anticipation work' to denote the different kinds of work done by actors in relation to the future. They highlight the importance of paying attention to this type of speculation about the future, noting that, "Anticipation work makes visible the actors within our empirical cases as actively engaged in practices for managing the size of the project, both in the number of human and nonhuman resources as well as in their long term temporal scales." [87:450]. Vertesi and Dourish [93] highlight how understanding many facets of organizational data are important, if one wishes to design systems that effectively support cooperative work. By advancing the framework of a "data economy", they underline the importance of paying attention to how data is produced, as well as how it is circulated or used. We extend this argument, by looking not just at the systems of production and circulation which are actively in play, but how such systems are the result of an interplay of imagination, anticipation and speculation with the realities of organization, work practices and resources. Concretely this means attending to the speculative work which takes place before the establishment of new data infrastructures, systems or practices. This sort of speculation, as we will show, happens in relation to the realities which actors are faced with such as already existing systems, resource constraints, historical precedents or more. We argue that this speculative data work prefigures data, shaping data in myriad ways such as what is valid data, the meaning of data or the kind of affect it is associated with.

In this paper we build on and combine the previous work on dashboards, speculative design and various kinds of speculation. We follow Vertesi and Dourish and pay attention to the data economy of production, consumption and circulation of data as it relates to dashboards and the data-driven organization, and also highlight the various kinds of anticipation work taking place within our case organization, per Steinhardt and Jackson. We thereby highlight how data work is also speculative data work. Rather than simply critique this tendency, we build on the above insights into speculation and speculative design to suggest how such work may be productively met and shaped. The speculative dashboard emerges as one such productive engagement.

The moniker 'speculative' here refers to the above wide range of related theoretical commitments: Speculation in this sense means simultaneously following Elsden et al. in seeking designs which make data meaningful for their users, Desjardins in encouraging "co-speculation," and per Halpern, Wilkie and Haraway trading on and exploring the ambiguity of meanings associated with the speculative – its economies and both negative and positive connotations. We recognize that invoking speculation in such a broad sense risks imprecision. However, we believe it is necessary to run the risk and invoke a certain sense of ambiguity, as both Wilkie et al. and Wong and Khovanskaya argue, if we are to succeed in interpellating others by the lure of alternative, speculative futures. The speculative dashboard therefore refers to a design process and potential design artefact which can support cooperative work through multiple meanings of speculation – by engaging with speculative data work, making it meaningful, co-speculation and creating openings for alternatives.

Case & Methods

The following section will describe the case being studied and outline the methodological approach to data collection and analysis underlying the present paper.

Case

The present paper is primarily based on a workplace ethnography of a particular project within a department of a Danish Municipality, the Culture, Arts and Recreational Department (CARD)[1], but also draws on wider ethnographic work done in the dynamic "gyre" [99] of the Danish tech and public sectors (see Author 1, forthcoming). The purpose of this wider project is to explore the relations between data as a socio-material phenomenon, these sectors of Danish society and various speculative practices and imaginaries.

CARD is the organization responsible for citizen service centers and municipally run cultural offerings, including sports facilities and cultural institutions such as concert venues and libraries, and is organized into several local units and a central unit comprised of management, a secretariat and a number of offices (HR, Strategy, Finance). It is politically led by an elected executive official and an elected board. See Figure 1 below for details of the organization. The fieldwork centered on a project within CARD named "Organizational Innovation" (OI), the goal of which was two-fold. On the one-hand it was to explore what the profile and tasks of the "employee of the future" might be, and on the other hand it was to assist with digitalizing and making CARD more data-driven. The present paper focuses on the aspects of the project associated with the second goal, whilst future publications will analyze the material with regards to the first.

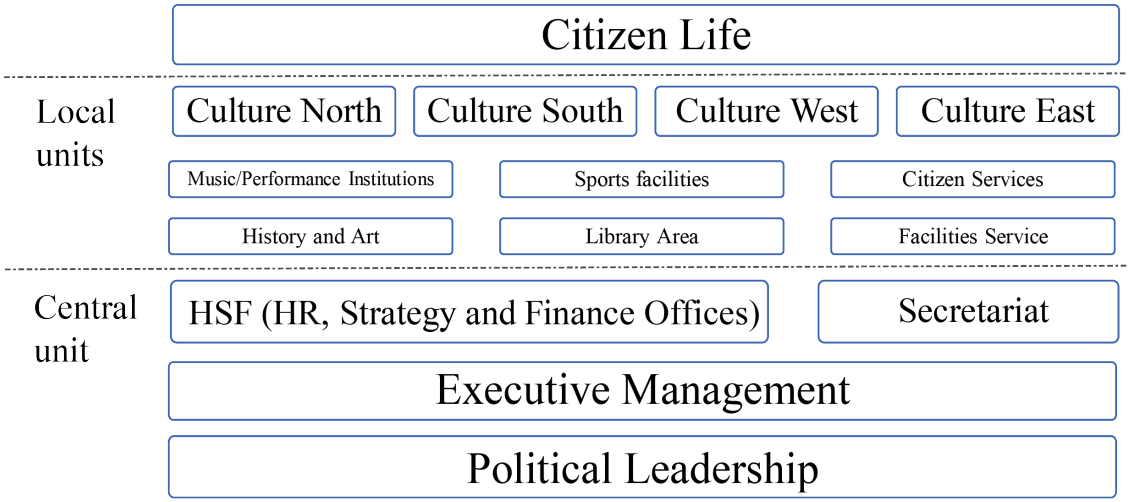

Fig. 1. An organizational chart of the Culture, Arts and Recreational Department. Fieldwork took place primarily within the offices of the central unit and administrative branches of the four main local units: Culture North, South, West and East.

The OI project consisted of creating up to 45 wage-subsidized positions in time-limited projects across the CARD organization and hiring graduates with humanities degrees to fill them. The motivation for the project was the relatively high unemployment rates of this kind of graduate, coupled with a supposition that their "humanistic competencies" could benefit the "work with digital and data-driven organisational development and ethics"[2]. These hires were initially called "digital humanists" by those managing the project.

Within the Danish public sector, organizations are generally required to host a number of wage-subsidy positions to contribute to upskilling unemployed persons and giving them a "foot in the door". These positions may not, however, entail doing labor that would otherwise need doing. This provision is meant to ensure that wage-subsidy positions do not become "free labor" which puts regular full-time jobs at risk. In order to create these wage-subsidized positions, numerous sub-projects within and across the various local units of CARD were therefore developed. The sub-project entitled the "Data Project" (DP) was chosen for in-depth study. The DP consisted of a cross-organizational mapping of existing data sources and practices in the different local cultural

[1] Name of the Department, units and projects are pseudonyms.
[2] Source: Project application. Authors' own translation.

units, in order to improve these practices and support other ongoing projects to make the organization more data-driven. Concretely this meant that the five employees were deployed across the units of CARD, with one based in the central unit and the remaining four distributed across Culture North, Culture South, Culture West and Culture East. Organizationally, the DP was coordinated by a project manager based in the strategy office, but the project was devised as a collaboration between the finance office and the four local units. It was thus a cross-organizational project.

During the four-month period of the DP, its project members developed an interview guide, conducted a series of interviews with CARD employees of the local and central units, analyzed their findings and created a report which was presented to key figures in the relevant units at the end of the project. Their mapping of data focused on its types, sources, practices and attitudes towards data, but also covered obstacles and organizational issues.

The OI project was but one of many projects in CARD focused on digitalization, each with separate emphasis om topics such as "digital leaderships" etc. The next section of the paper will analyze the intersection of these projects in greater detail.

The CARD organization, the OI project and Data Project sub-project were chosen to be a case study due to the combination of it being a public sector organization, having a focus on the use of data and the speculative and unusual nature[3] of the OI project. These features were important for the wider research agenda which this paper is a product of, for allowing for an empirical study of how speculative imaginaries of the future are enacted in actual practice within a Danish public sector organization. Additionally, and in line with the notion of a speculative ethnography (Author 1, forthcoming), the case offered the possibility of studying how such practices are co-produced with research and the expertise it is taken to represent.

Methods

The paper is based on a workplace ethnography of CARD. This ethnography took place over 18 months and entailed a written agreement which granted access to CARD's physical premises, access to the intranet, a (moving) desk and an institutional e-mail account. The ethnography mainly took place in the strategy office, but also involved visits to the local units where the DP took place. The fieldwork consisted of participant observation in meetings [78,82], workshops, daily lunches and social events, and material was gathered via jots and fieldnotes [27], casual discussions, formal interviews and collection of documents.

Access to CARD and the DP were negotiated through an informant working in the strategic unit of CARD, who would go on to be hired as project manager of the OI project. It was given in part out of goodwill as CARD is a public organization, and in part in exchange for 1st author hosting a two-day workshop on the topic of data, for the hires in the Data Project. This workshop was carried out during the fieldwork. The fieldwork consisted in following the development of the "Organizational Innovation" from its conception, to actually hiring employees and then following those associated with the "Data Project" and interviewing these employees about their work with mapping the various data sources and practices already existent in the organisation. The ethnographer (first author) was met with a mixture of curiosity, confusion, benign neglect or interest by informants. They understood the researcher's role as a combination of studying the OI project for purposes of publishable research (as part of dissertation work), as being an expert or resource with regards to digitalization (due to affiliation with a technical university) or were unsure of what the role was. Which part of this understanding was highlighted depended on the informants' role and position within CARD. Employees working in the central unit were more likely to view the researcher as a curious and interesting actor who could be enrolled into meetings on their projects and be solicited for expertise on what was trending in research of on digitalization. Members of the Data Project initially regarded the ethnographer as an expert due to the presentation conducted as part of the access agreement but came to see them as an independent researcher and confidant who could act as a release valve for articulating frustrations. Employees of local units generally regarded the researcher with benign neglect and some curiosity.

[3] Hiring 45 wage-subsidized employees who were initially referred to as "digital humanists". Even though the project was funded by the municipality's Innovation Fund, and thus did not rely on the department's internal budget, this represents a large investment in a unproven and untraditional category of employment.

Ten formal interviews were carried out during the fieldwork. All interviews except one were conducted using a semi-structured interview guide and were recorded digitally and transcribed verbatim. Of these nine interviews, six were conducted face to face and three were conducted over Skype due to distance constraints. A single interview was carried out by e-mail due to time and distance constraints.

Selection for these interviews were made based on positions in the projects being studied: the first project manager of the OI project, Rebecca, and her replacement, Emil, were each interviewed once. The five individuals hired for the Data Project were interviewed at the beginning and end of the project (only three of the five were available for the end-of-project interviews). All of the latter interviews were between 1.5 and 2 hours long each. A range of documents were also collected during the fieldwork, including e-mail correspondences, PowerPoint slides from meetings, meeting briefs, workshop evaluation results, promotional fliers. A number of photographs were also taken.

All material has been analyzed through a mixture of grounded theory and memo techniques, in which themes and concepts were distilled via engagement with the empirical material. Adele Clarke's interpretation of grounded theory as situational analysis [19] provided a general inspiration for the approach to analysis, in which material was iteratively interpreted and coded during the fieldwork according to a range of categories (organisational, non-human, symbolic, discursive, etc.) and plotted in messy maps.

Memoing was used to explore how these phenomena cut across the empirical material and develop insights into their importance. Based on this process of memoing about the coded material, and repeating this iteratively, themes of the analysis appeared which form the basis of the structure of analysis below. The analysis was conducted by posing questions to the material. Synthesizing the analytical insights thereby derived, namely the interrelation of various kinds of speculation with actual data work, materials and infrastructures, resulted in the concept of speculative data work. Tables 1, 2 and 3 below were developed as part of the analysis work, helping to systematize and structure the themes found in the material. In particular Tables 1 and 2 helped develop the central concept of speculative data work by providing a structure for analyzing the different ways in which data was speculated about in the organization. The following sections details the analysis enabled by the coding process, memoing and tables.

Having now introduced the case and the methods used to gather and analyze empirical material, the following sections will put forward the actual analysis and findings of the paper. Section 5 will introduce the concept of speculative data work, relating it to literature on data work and exemplifying how it took place within the case organization before diving more deeply into the different themes. Section 6 will then consider the role dashboards played in the CARD organization. The section will describe how this type of data infrastructure was central to speculative data work, and on this basis will outline the idea of speculative dashboards and prototyping efforts done so far.

Speculative Data Work

The following section shows how data within the CARD organization can be understood through the notion of speculative data work. This concept designates the particular ways in which speculation plays a central role in organizational data work. To show this we analyze certain themes of how data was enacted within CARD, in particular what was considered valid data, what affects it produced and the wider data valences forming the backdrop. We also relate the concept to existing literature on data work and the various kinds of work within CARD. Speculative data work is an attempt to capture the complex sense in which data is speculated on, in and about. Data produces affect, has certain valences attached to it, is circumscribed as being valid in a particular way and is the subject of a lot of work. Speculative data work captures how *speculation* is a central part of this.

This paper proposes the term speculative data work to conceptualize this particular type of data work we observed in which speculation with, on and about data took place within the CARD organization. The concept is distinct from existing CSCW research on data work [6,13,15,26,30,62] but takes inspiration from it, and synthesizes how data valences *[29],* the production of affect around data and the determination of what is valid data all represent and perform a particular kind of work within the organization. These themes were derived from coding and initial analyzes (in the form of memos) of the empirical material and informed by literature. Questions were then formed on the basis of these themes, which form the basis for the following analysis of how

speculation and data work are related. Table 1 below outlines these themes of and questions. At the end of the analysis we answer these questions via Table 2, an expanded version of Table 1.

Table 1. Data in CARD

Themes and Questions
Data work: what kinds of data work are performed and what tools are used?
Valid data: what is seen as valid and useful data?
Affects of data: how do groups relate to data on the level of affect and emotion?
Data valences: what are the main valences of data?
Data-driven imaginary[4]: What is understood by the notion of a data-driven organization?
Main speculation: What kind of speculation is stimulated by use and discussion of data?

Speculative data work refers to the work of speculating with, on and about data. This concept points to how speculations on data which appears to be contradictory (worrying and being passionate about it) or how imagining what futures it might bring (supporting cultural work differently or streamlining organisations more) all comprise different examples of the same kind of work, that configures data in particular ways. This work is not purely abstract as it stems from both material interactions with data (collection, sorting, analysing) and anticipatory or imaginative work (anticipating what data might be used for, drawing on existing imaginaries).

As Wong and Khovanskaya note, speculative design practitioners have traditionally traded on the rhetorical ambiguity of the term "speculative" with relation to its critical use or its more general future-orientation. We invoke speculation throughout this paper in a variety of ways: Speculation is both something our informants engage in, something we wish to encourage and the nature of our own project. We distinguish per Wilkie et al. [96] loosely between forms of "negative" speculation which are probabilistic, statistical or economic or just conventional worry about cutbacks, and forms which are more "positive" and "open." We do not believe that the latter can replace the former, and we therefore purposefully trade on the multiple meanings of speculation, in an effort to "stay with the trouble" as Haraway says. To decisively separate different kinds of speculation would be counterproductive to this effort, and we therefore encourage that "speculation" and "speculative" be read with these multiple valences simultaneously.

Data work is a growing theme of study within CSCW research. It has found to be relevant in many diverse contexts such as interdisciplinary collaboration in Ocean Science [6], sensemaking of personal data from the past [26], IoT implementation [30], hospitals [62] and the new reality of the push to be data-driven facing many organizations [15]. These studies emphasis data work in an equally diverse set of ways, with Baker at al. focusing on its relation to infrastructures and collaboration, Elsden et al. considering it a rhetorical kind of appropriation of own data, Fischer et al. describing it as a range of collaborative activities done between IoT advisors and clients, Møller et al. highlighting the importance of attention to clerical data work whilst Bopp et al. describe data work as an administrative burden related to other organizational dynamics, caused by the focus on becoming data-driven. We put forward speculative data work as a related but different type of data work, which focuses on the particular kind of speculative work within the CARD organization. The analysis that follows shows how data is a topic of both practical work, definitional work, affect, imagination and speculation. Speculative data work is a concept that draws attention to how these forms of actual work with data are intimately tied up with affects and wider imaginaries of what data is, could and should be.

[4] The following sections explore the notion of the data-driven as an empirical example of speculative data work producing a sociotechnical imaginary. The concept of speculative data work does not necessarily rely on this particular imaginary, and other contexts in which speculative data work takes place will likely produce or interact with other imaginaries. Within city planning speculative data work might for instance involve the imaginary surrounding Smart Cities. We include the imaginary in the table as it played an important role in the way speculative data work took place within the CARD organization.

Speculative Data Work in a Danish Public Sector Organization

In practical terms, data work within CARD ranged widely: from mundane and manual as in counting cultural event attendees and adding them to excel sheet, to extracting datasets from online portals on social media statistics or automated visitor counter sensors, to compiling reports, analyzes and data visualizations for management to the very symbolic work of producing strategies, power-points or conducting workshops on the meaning and importance of data. This work took place in differing parts of the organization, with most of the manual work concentrated in local units, and with the more abstract work such as analysis or strategy centered in the central units.

CARD thus contained data work which was sustained locally and practically [73], was plainly administrative or clerical [15,62], collaborative [6,30], involving the rhetorical reconstruction of data traces into narratives [26] and anticipatory of the future [87]. Our concept of speculative data work however focuses on how speculation was woven into all these varying forms of practical or symbolic data work. Two examples of speculative data work can make this clearer: One is the notion of the data-driven, which was developed, discussed and contested within the CARD organization and the other is the role of sensors in generating organizational data within CARD.

The data-driven is an empirical phenomenon in the form of a term used by actors in various projects. Concretely, the term was used for two separate projects, one entitled "Data-driven leadership & development" and another called "Data-driven CARD". However, the varying articulations of what was meant by the term both within and across these different projects demonstrate that it was a kind of sociotechnical imaginary [47] produced by speculative data work. For one of the projects data-driven meant an innovative and open approach to understanding data as both quantitative and qualitative, and that work practices within an organization focused on culture summarily must account for this broad definition of data. For the other project, data-driven meant an association with "big data" [57] and the development of sound data governance and infrastructures. Additionally, there was uncertainty even *within* the projects as what the term meant, as demonstrated by Figure 2 below, which depicts a slide from a presentation given on the notion of a "data-driven CARD".

The notion of the data-driven within CARD can therefore be understood as an example of speculative data work in process, showcasing speculation *in* particular ideas of data where it is simultaneously unclear what data precisely is or is meant to achieve, yet where it is coupled to wide-ranging imaginations and indeed constitute a kind of "desireable future" [47:4] for the organization. These organizational sociotechnical imaginaries are partially collective and performed through discourse and material artefacts such as power-points slides referenced. Speculative data work in this example refers to the work of imagining what data-driven means, anticipating the future needs of the organization, practically developing slides with these articulations and corralling other actors to adopt and use this terminology – and the speculation or investment all of this represents.

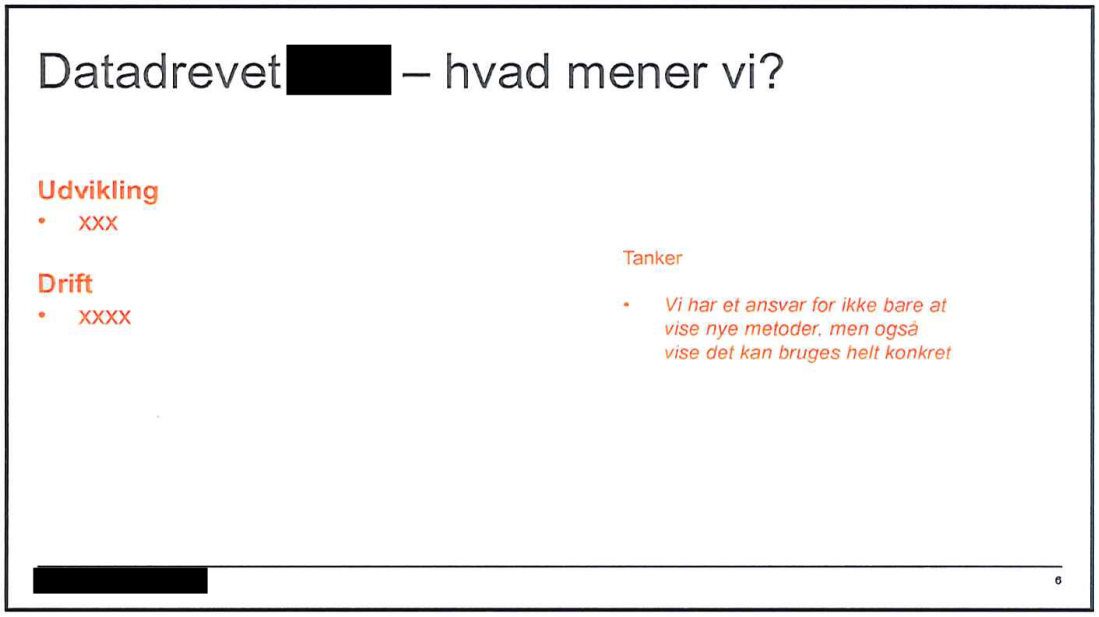

Fig. 2. A powerpoint slide produced in CARD. The slides says 'Datadriven [Name of Org.] – what do we mean?', under which both "Development" and "Operations" are filled with Xs and the only description is a point called "Thoughts" where it says "We have a responsibility to not just show new methods, but also show that it can be used concretely".

A very different example is the speculative data work produced by something mundane such as the visitor counting sensor depicted in Figure 3 below. This sensor was installed at an entrance to a cultural institution under the purview of CARD and counted the number of people entering the facilities. These numbers were stored in a database and were used in certain reports to estimate the number of users and as an overall metric of performance. However, employees working at the cultural institution actually did not know how it really worked, finding themselves stumped and puzzled by basic questions about how it for instance distinguished between visitors entering and leaving the building. At a meeting held between the Data Project members and key stakeholders from both the local and central users, disconcertment at sensors such as these was relayed from the DP members. They outlined how cultural workers felt uneasy at the quality of data produced by the sensors, citing its apparent inability to for instance count children visiting libraries, because they were too short to be registered based on how the sensor was installed. This was particularly disconcerting because employees felt that management decisions with regards to their institutions were being based on information such as visitor counts.

We suggest that these are empirical examples of speculative data work where the sensor is a socio-material technology which employees speculate on (performance importance, workings) and are affected in various ways (puzzlement, unease, disconcertment) by the technology and the data it produces. This is different from the example of the data-driven in being a much less discursive and symbolic kind of speculative data work, but similar in that it involves speculating on the role and relations of data within the organization.

Fig. 3. A sensor in "the field", at the entrance of a cultural institution in the municipality. Used for counting visitors, but the precise parameters for its data collection were unclear, making it a source of unease with regards to data quality.

In summary data work within CARD can be said to be very multifaceted, comprised both of mundane adding of numbers to excel documents, of developing dynamic dashboards featuring visualizations and KPIs for management purposes and of more qualitative, discursive or symbolic work. We have suggested speculative data work as a concept related to but distinct from existing research on data work within CSCW and argue that it denotes a particular complex of these various kinds of work with and the speculation in, on and about them. The following sections will explore aspects of speculative data work in greater detail, describing how this kind of work is related to the themes of validity of data, the affect produced by it and the dominant data valences within CARD.

Data validity

What was considered data was not itself immediately clear from the scope of the Data Project – there were multiple data practices in the various units of CARD, and the point of the project was to get a better understanding and map all the various sources and practices surrounding it. The members of the DP therefore took an open approach, interviewing employees in order to get a better handle on what data meant for them. Through this process they identified a large variety of data and practices, ranging from manually counting individual attendees at cultural events and adding them to an excel sheet to accessing and gathering data from Facebook on how well a certain post performed. "Data" thus came to be mapped as a very broad category yet referred primarily to any kind of documentation practice relying on numbers used locally or communicated to the central unit. At the same time, such data work was identified as being very irregular across the various units.

On a more conceptual level, however, perceptions of what constituted valid "data" differed substantially within the CARD organization. During a meeting prior to the start of the workplace ethnography, the first author discussed data with an internal CARD consultant, who asked for a research perspective on data and the data-driven. In this meeting, data was discussed as encompassing both qualitative and quantitative material, and that it might require interpretation and have to be fitted to local contexts of operation. This CARD consultant worked in the strategy office of the central unit, where this perspective of data was generally more accepted.

The finance office within the central unit had a very different view of data however, and was generally skeptical of anything that was not computational and quantitative data. The main focus of employees within this

unit was the development of sound and conform data practices, which could feed into CARD's database infrastructure and in turn form the basis for reports and dashboards.

In summary, what was considered valid data within the CARD organization was understood to be a range of different things, depending on the units in question. Validity is here understood not as a particular qualifier, but as a distinction between what is and is not considered data. It is an aspect of speculative data work in that it represents the boundaries of what is speculated on. While maintaining the boundaries of what is and is not data is always a part of data work, speculative data work refers to the work of actively challenging and speculating on what these boundaries are. When the CARD consultant was openly considering that data might mean something more than what it conventionally had, they were engaged in speculative data work.

Data affect

Data generated a lot of varied forms of affect within the CARD organization. In the course of the fieldwork, through our own ethnographic experience and by interviewing the DP members, it became clear that organizational data was a matter of some unease within the local units and perhaps even conflict with the central unit and management. In one conversation the interviewee was asked what her mapping of data practices had revealed about the understanding of data amongst local employees. She replied with little hesitation that it was "stress": "It's something which is really on everyone's mind, because when I mention 'data', then it's perceived as something decided from above. So generally, a kind of stress factor, and some nervousness in relation to resources and that one all of a sudden has to have a lot of focus on it." This understanding of data would turn out to be symptomatic for how many employees in the local units perceived data. Based on discussions during the fieldwork and various written materials produced by the "Data Project" employees, it became very clear that data was a both stressful and contentious topic.

Data was a stressor for local employees for multiple reasons: The above-mentioned collection and registration of data (such as number of visitors) was often manual, and thus an extra task competing with others. It was also unclear for many employees exactly what the purpose of the various data collections were, since they were most often not given any feedback on what they submitted, nor saw the results of the analyses compiled centrally. Employees also experienced that some of the automated processes of data-collection, such as sensors were unreliable, a feeling underscored by the difficulty in teasing out how they functioned and what they actually counted. Figure 3 above illustrates one such sensor, as discussed.

Data was also a stress on a more conceptual level, as the public sector within Denmark has been the subject of austerity and an annual budgetary reduction of 2% for many years, and new technology and data are often linked to cutbacks. Thus, for many of the employees at the local units, registration of data was equated with potential cutbacks and firings.

Within the central unit, the affect of data was far more one of curiosity, novelty and even passion. Employees from the finance office talked enthusiastically at workshops about Power BI, making jokes about being "data nerds" and loving the experience of "drilling down" into the data. Data for these employees was commonplace. Members of the strategy office also considered data as a novel trend to be mastered in the organization and discussed it with a mixture of mystery, interest and reserved distance. Unlike employees in the finance office, many in the strategy office did not consider themselves "data nerds" or "technical" enough to be experts in data, and so data produced an affect of mixed interest and disdain as it was seen to be important but also inscrutable.

Data valences

Fiore-Gartland and Neff's concept of data valences [29] was developed based on studies of discourses, practices and expectations around data within health and wellness communities, and offers up particular valences such as self-evidence or actionability. Following their suggestion, we utilize the concept here to make sense of the data valences within the CARD organization. In relation to the particular case described here these valences have been slightly re-interpreted and supplemented to fit the case. Data valence is defined by Fiore-Gartland and Neff as a multidimensional concept for describing both the discourse and material practices, including expectations and gaps in these, around data.

Due to the above-mentioned perceptions within local units of data work as being an extra task with dubious quality, much of the data collected was not perceived as central to or as getting to the heart of the kind of cultural work that individual employees were passionate about. They were interested in creating meaningful events or connections for the individuals for whom it might matter, more than they were concerned with increased visitor numbers which they viewed as arbitrary abstractions. "Data" was generally associated with technical IT-systems and was understood to be quantitative measurements such as visitor numbers, frequency, geographic distribution, etc. It was therefore difficult for employees of local units to make the connection between how this sort of data could support their ultimate goal of providing quality cultural services to citizens who need them. However, the employees did express wishes for data and technologies which did support this sort of goal.

Using Fiore-Gartland and Neff's examples of data valences within health care communities, the most appropriate valences are therefore those of actionability and discovery. Local unit employees wanted from data something which was actionable and could help them with what they saw as their core task. But they did not find that what was commonly understood as valid data within CARD would help them with this. Simultaneously, they also wanted data to help with discovery of what was needed to do.

Differing data valences of course existed between the strategy and finance offices within the central unit. The strategy office saw data as a topic of political importance which it was important for the organization to be competent within, and to a lesser extent, was willing to consider data a "site for conversation" [29:1475] about topics of organizational relevance. The finance office on the other hand generally considered data important for reasons of efficiency and economy and considered data itself as having a "truthiness" and "actionable" valence. Within Fiore-Gartland and Neff's interpretation, these latter terms represent an understanding of data as being objective and representative and as being centered on making decisions and actions possible based on correct knowledge. Furthermore, the finance office also favored the valence of transparency, albeit in a limited sense, in that they advocated the roll-out of more coherent data goverance and analytics software such as Power BI in order to make data more broadly accessible throughout the organization. However, as we shall see, access to data was not equal and the finance office was the arbiter of what levels of access were afforded other units and employees.

Data valences is a concept which connects multiple dimensions of data as it exists in practice, discourse and between institutions and communities. This is similar to speculative data work in its multidimensional nature. However, our purpose has been to refer to the particular work which takes place against the backdrop of valences, affects and validity and participates in producing these in turn. Data valences has thus been a helpful concept in precisely articulating this background but does not encompass what speculative data work itself is. The valences of data which we have described within the different CARD units show the range of opinion present in CARD, underscoring how data was a concept open to widely different interpretations.

Summary

Having outlined the notion of speculative data work and exemplified it through the imaginary of the data-driven, the visitor counter sensor and the themes of validity, affect and valence, the following table summarizes the analysis of the empirical work so far. The different themes and questions concerning data in relation to three different actors – the strategy office, the finance office and local units – are described in Table 2 below. The table illustrates how different actors engage with data differently not just on a conceptual level, but also very practically. Data is both affective and practical on some level for all of these groups, and they also have certain goals and normative notions of what "counts" as valid data and the valences of this data.

What can be seen is that all of these units engage in some form of speculative data work, but that the kinds of speculation are very different. The fieldwork thus outlined a situation where organizational data was the source of speculation in a myriad of ways: stress for some employees in local units, a contested topic between the strategy and the finance office, and a potential source of conflict between local employees and central management.

Table 2. Data in CARD: Themes and questions in relation to different groups of actors

Data themes and questions	Strategy Office	Local units	Finance Office
Data work: what kinds of data work are performed and what tools are used?	Analysis, strategy, symbolic	Manual collection, some report access	Power BI, analysis, visualization, formulas
Valid data: what is seen as valid and useful data?	Multiple kinds	Anecdotal, experiential	Quantitative data
Affects of data: how do groups relate to data on the level of affect and emotion?	Novel, new, important, visionary	Stress, burden	Investment, enjoyment, fun
Data valences: what are the main valences of data?	Political, competency connection	Cultural work	Actionability, truthiness, discovery economic, budgetary, efficiency
Data-driven: What is understood by the notion of a data-driven organization?	Competencies and thinking differently/innovatively on the basis of data	n/a (no articulation)	Infrastructure and tools
Main speculation: What kind of speculation is stimulated by use and discussion of data?	Hype and futures	Cutbacks	Accumulation, Control and Efficiency

Dashboards in the CARD organization

The use of Microsoft Power BI was a central way that employees at CARD engaged with organizational data. As part of the fieldwork a Power BI workshop was attended, where over 40 employees attended. These employees were taught the basics of how to use the software by an internal expert from the finance office, the unit with most expertise using the system. In this workshop employees were taught the basics of importing data, cleaning it and making basic analyses using the standard example dataset which Power BI loads with. This standard data set was fashioned as that of a generic store franchise operating in the US, including sales of different types of goods such as furniture in different store locations in the US. This is perhaps an innocent coincidence, but it showcases that this sort of software is built primarily for commercial use, intended for the tracking of sales figures across different segments and locations. However participants learned and trained in using the software through speculating with this commerical dataset about what kind of visualizations might be possible. While data was a locus of stress for many employees in local organisations, this did not necessarily translate to dashboards being a source of stress. Dashboards, as described earlier, were used in the organisation as analytical tools mostly intended to be used by management. Whilst there was a move to spread the use of dashboards wider in the organisation, this was a work in progress that had yet to be completed at the time of the fieldwork.

Microsoft Power BI was presented within CARD as a tool for generating “pretty visualizations”, creating an overview and working more in depth with data. It was presented as an amalgamation of Power Point and Excel, which would allow users to interactively work with and present data. Dashboards in particular were presented as “screens” which were central for the sharing of analysis work done in CARD. More specifically, it was articulated that the central unit would be making reports “for and with” the local units, why it was important that people there knew how “to do some of the stuff and understand some of it.” This underscores an

understanding of dashboards as a tool for making aesthetically pleasing representations of knowledge work done mainly within the central unit of CARD, which can then be interacted with to some extent by employees in other units. We suggest that dashboards are a centralized tool, and is an instrument of control insofar as it primarily allows the central unit to define the parameters of the various dashboards being created. This is the case because it was a small group of super-users within the central unit who were experts in the system, had an overview of the available data and guided others in its use. In this way, dashboards are also a site of speculative data work using quantitative measures as a means to make projections about the future. Another way of understanding this is through the lense of problematizations, a Foucauldian concept that points out that problems are not neutral phenomenon that exist free of political and sociotechnical interests and values, but rather are constructed and shape our way of thinking [4].

Through the fieldwork this acceptance of a certain set of problematizations became apparent when the "Data Project" prepared its final report, mapping the data practices of CARD. The report consisted of qualitative descriptions of the earlier mentioned issues with data in the organisation – i.e. that it was a stress-factor – and a set of data visualizations. Due to the affordances of the Power BI tool and the data available, the only data visualizations that were produced related to the number of visitors to the cultural facilitates operated by CARD. When asked why they had not tried to creatively visualize some of the issues with data quality or the requests for data more related to cultural work, the project members of the "Data Project" replied that they were told that since there was not any relevant data on those topics, they could not visualize it. As Peter, a member of the "Data Project" expressed it: "I think, Frank from analysis or the data department, he said: 'With the datasets we have, we only do descriptive reports.' So, in that way, with regards to [...] the needs that were there and all the qualitative data, we had all of that, we had generated far more things, which could have justified [making] far more nuanced reports. We just couldn't do that, because we didn't have data on it, and we couldn't feed statistics or graphs with no data." While this is of course straightforwardly true, it showcases how dashboards do not allow for the investigation or challenge of existing problematizations: one can only visualize based on data that has already been collected, based on what was considered relevant at the time.

Finally, dashboards are interfaces that are often focused on results rather than processual work. As Bartlett and Tkacz demonstrate in their report on dashboards in the UK government, dashboards are often home to Key Performance Indicators (KPIs) and similar target measures, that inform managers or employees how well one is performing in relation to a goal [8]. Similarly, in the fieldwork, dashboards were discussed as tools which might be used by management to make decisions about operations. This could for example be using data about visitor numbers to determine how many employees were needed to be available in the off-hours of a library. In this way, dashboards were seen as an interface to be used to make a singular decision as opposed to a processual tool. While the interactive aspects of using a dashboard, with the ability to drill down into underlying layers of the data, and the process of making the dashboard may be partially processual, the functions of dashboards were still mainly related to the ability to focus on making decisions. An alternative, more processual, use of dashboards might be to collaboratively explore a topic together as a unit over an extended period of time, rather than management making one-off decisions based on decoupled targets. Table 3. below summarizes how dashboards were used and presented in practice at CARD in a table of dashboard "traits".

Table 3. Different perceptions of dashboards amongst employees in the local unit

Dashboard traits	Description
Epistemological	Related to the production of knowledge through analysis
Representational / Aesthetic	Dashboards are thought to depict the organisation through and transmit knowledge through aesthetic representations.
Centralized	To be mainly developed by the central unit of the department, then potentially consumed by others
Result-oriented	Focused on decision-making and KPI-like metrics for determining operational aspects of the organization.

Dashboard traits	Description
Instrument of Control	By only allowing certain employees to work with data, dashboards become a potential instrument for control
Accepted problematizations	Work with dashboards is constrained by existing understandings on what issues and problems are worth working on, and what data is seen as relevant to this

While dashboards themselves were perceived and used in CARD according to the above table, they were not the main source of anxiety or locus of the speculative data work for employees – data itself was. It was the collection of data that caused unease and speculation amongst local employees about the quality, use and purpose of data collection. Dashboards, rather than allay this unease and speculation were instead used to facilitate a different kind of speculative data work amongst the members of the strategy and finance offices – towards their respective visions of the data-driven. The dashboard is therefore representative of a wider organizational difference with regards to data and the kind of speculative work about it one engages in.

The analysis described above highlights how dashboards are perceived and used as result-oriented artefacts that centralize control of data around accepted problematizations, thus failing to address central concerns around data by local employees but still being the site of uneven speculation around data and its futures. Taking up the question from Wilkie et al. on how we might speculate positively [96], but keeping in mind the concomitancy of change and speculation posited by Halpern [37], the following explores how insights from speculative research and design can inform a response to the situation in the CARD organization through a design proposal.

The fieldwork illustrates that a large group of employees were not well served by the existing practices, infrastructures and tools around data, and that the Power BI tool and particularly its data dashboards were a site where data "met" the organisation and thus already a site of some speculation. It showed that speculative data work of varied sorts was indeed already taking place, but was doing so in a siloed and differentiated manner.

As a response to the issues highlighted by the analysis of the empirical material, we propose the speculative dashboard as a different way of engaging with and perhaps infrastructuring [72,84] the speculative data work which is already taking place. The following sub-section develops this idea by detailing a pedagogical exercise in which the notion of a speculative dashboard was first prototyped and then put forward an exploratory proposal for using it as a design intervention in the field.

Prototyping speculation

The speculative dashboard is a very simple design idea; it consists in using or "hacking" the recognizable form or "genre" of the dashboard as it is known from BI software, and using some of the quadrants or space to introduce other kinds of data. The effect is to juxtaposition data types, typically quantitative, and its visualizations, with qualitative data which often is not considered legible, usable or interesting to most organizational data infrastructures. This is reminiscent of Peer and DiSalvo's "remix a visualization" approach, where they encourage community members to try to build different narratives about existing data [68]. It also represents the application of the sort of "questioning lens" to information visualization developed by Marian Dörk et al., which focuses on the principles of disclosure, plurality, contingency and empowerment [23]. We return to how these principles are related to the speculative dashboard below.

As part of the speculative ethnography that forms the context for this paper, we decided to work with IT professionals and conduct a pedagogical exercise to explore and engage with speculation. We did so in order to take seriously that pedagogical settings such as universities are a central site of dissemination for sociotechnical imaginaries and practices which inform speculative data work. By engaging with IT professionals and encouraging them to speculate with data and dashboards, we hoped to better understand the kind of imaginaries they had and actively involve them in pushing the boundaries of these through a speculative design

prototype. We acknowledge that it might have been more optimal to do this prototyping work in the actual organization in which the rest of the fieldwork was conducted. However, time and practical constraints precluded this as an option. While the classroom setting fails to mimic an eventual use-context in many important ways, we would like to emphasize that the participants in the prototyping exercises were IT professionals working in many parts of both the Danish public and private sectors, in positions ranging from Managing Director to Backend Developer. Thus, while the exercise lacks input from a direct context of use and actual co- or participatory design process, it benefitted from a diversity of perspectives from within the wider industry context that we believe the speculative dashboard would be relevant for. It also provided a valuable context for teasing out and challenging the kind of imaginaries around data held by such professionals.

The speculative dashboard was developed as a pedagogical exercise for a Masters course taught to IT professionals, as part of a Masters in IT-Management. This course explored the notion of the "data-driven organisation" and what "visionary leadership" meant in such a context. Drawing on literature from Information Systems, Infrastructure Studies and STS, the goal of the course was to explore the complex interrelations of data infrastructures, organisations and both qualitative and quantitative data. The course participants were introduced to a case, in the form of a cultural institution in Copenhagen, Denmark, and were tasked with exploring the themes of the course through the challenges faced by and data of this institution. They were given quantitative (visitor numbers, sales, audience geographical location, etc.) and qualitative data (interviews, photos, presentation by head of the institution) on the case, and explored the quantitative data through the BI software Tableau.

In practice the exercise consisted in the course participants being given the task of designing a quadratic space using either A3 paper or through a digital mock-up, and both some of the quantitative and qualitative data provided, according to a thematic challenge outlined by the case institution such as "increased diversity" or "volunteer engagement". They were also tasked with developing a fictitious use scenario which would include as many relevant stakeholders as possible.

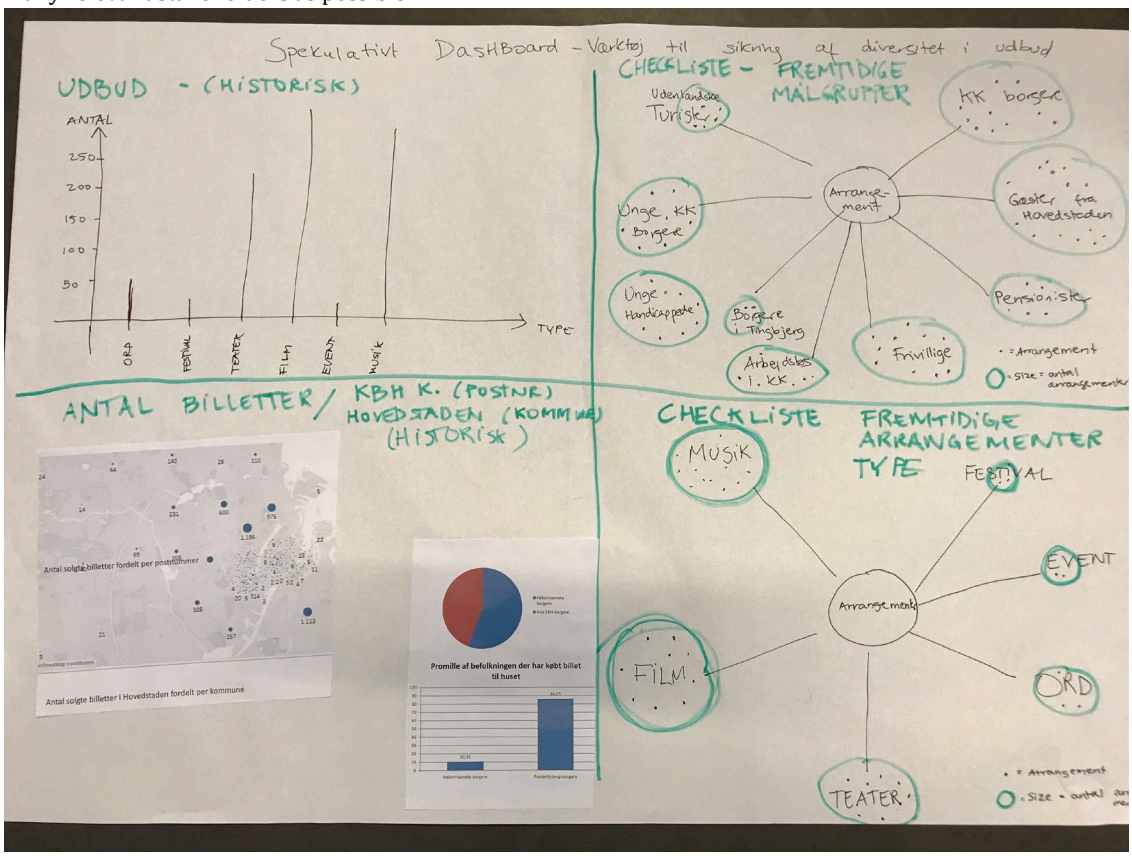

Fig. 4. An example of a participant produced speculative dashboard, focused on 'ensuring diversity in event types' by using a mix of hand-drawn diagrams.

The pedagogical exercise with the speculative dashboard generated some insights into how data workers might engage and speculate with multiple data sets. In particular, the course participants' prototypes show that there is a tendency to reproduce existing technical and quantitative approaches, which rely on the existing imaginaries of data-based technologies. For example, in the speculative dashboard in Figure 5, the course participants suggested gauging how an evening in a cultural institution with multiple concert venues had gone by combining ticket sales data with the venue's social media feed, a "heat map" showing where people had been and a network graph over visitors' music type interest. In contrast to the other visualizations, the course participants did not have access to data that would be able to produce the aforementioned "heat map", nor did the institution have the requisite infrastructure to generate that sort of data. Thus, the participants had themselves assessed that a heat map – showing visitor density but in principle providing anonymity – would be a valuable "alternative" kind of data. Rather than use qualitative data from interviews or photos, one could argue that they used the speculative dashboard to speculate on data infrastructures and visualizations that are more technical, imply more surveillance and move further away from qualitative data. In this way the speculative dashboard, as a somewhat blank canvas, risks encouraging more speculation about data that is based in considerations of technocracy and economics than less. We can conjecture that this is partially because people simply draw from the already existing kinds of sociotechnical imaginaries that exist around digital technologies [47,79].

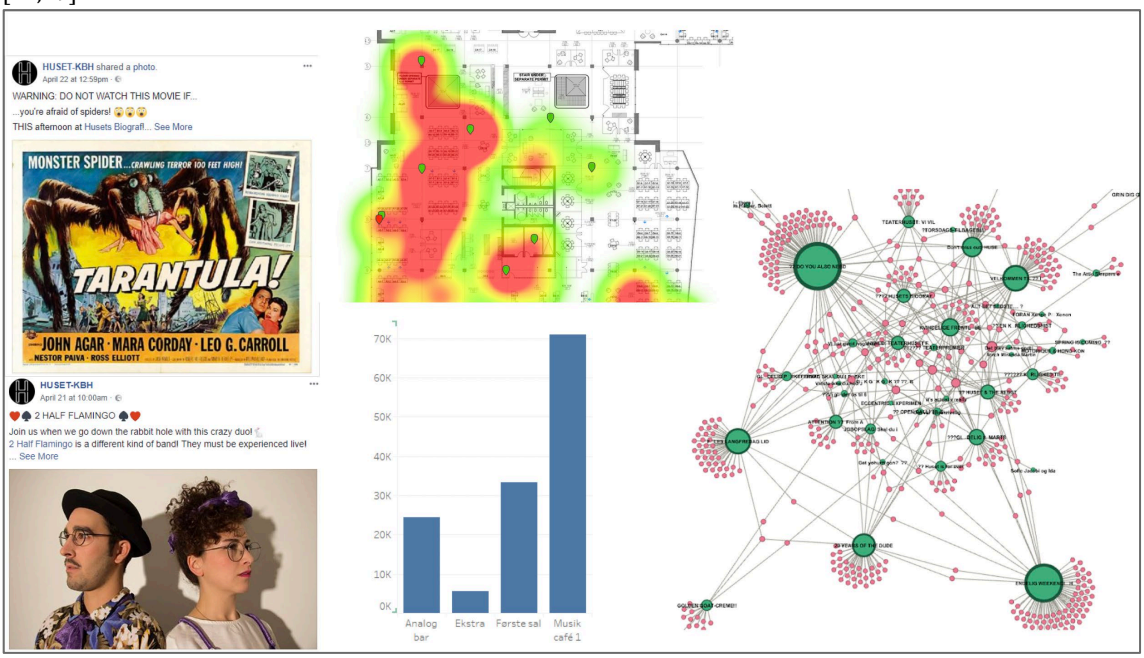

Fig. 5. A speculative dashboard designed by course participants, showing a social media feed, a heat map of visitor concentration, a bar chart over tickets to different venues and a bipartite network graph of visitors and different concerts, showing clusters of genres.

Despite the issues of reproducing technical tropes, the speculative dashboard did lead to discussion amongst course participants of the sources of the data, the infrastructure it was collected through and the kind of social contexts surrounding its production and use. Done in dialogue with the teachers of the course, this process is reminiscent of what Desjardins calls "co-speculation" [20]. In addition to this, the aforementioned dashboard with the heatmap also included a kind of "qualitative" data in the form of a social media feed from the institution, and the use scenario suggested was one in which weekly meetings would be held around the dashboard between cultural institution employees and volunteers, who could try to discuss and gauge how well the previous night or weekend's concerts had gone based on the data. Thus, whilst the experiment indicated that speculative dashboards in many ways rely on and further existing sociotechnical imaginaries, it also indicates

that they can occasion discussions of these imaginaries and existing technologies, and prompt use scenarios that are substantially more inclusive and open to different speculation than standard BI systems.

This initial experiment raises some questions for future work. What would the speculative dashboard look like and how would it function in practice? The following considers some basic implications for how one might be designed for the public sector organisation where the fieldwork was done, but which could potentially be used in other organizational contexts. The device is intended to address some of the concerns raised by public sector employees about the use of data within their organisation – namely that it is a source of stress, uncertainty and that they do not find it supports the central aspect of their work – and the siloed way in which data already is speculated upon and with, within the organization.

These concerns obviously reach beyond a single design artefact, and touch upon organizational structure and goals. To take in and address these issues is an ambitious goal, and there is no doubt that the speculative dashboard cannot change how data is understood on its own. However, it can be designed in such a way that it might create the possibility and encourage a different kind of relation and speculation with data.

For the above reasons, we imagine a speculative dashboard as an interface similar to existing dashboards, but with a number of changes intended to encourage speculation and address the issues identified through the fieldwork. The first change is that certain spaces are reserved for qualitative and "other" kinds of data, which can be uploaded from the units currently submitting quantitative data. This would allow for employees at decentralized units to upload images, videos, sound bites, or free-form text to the dashboard, effectively changing the nature of the dashboard from a one-way data output interface where local employees are unsure of what their data is used for and where it goes, into a channel for also communicating rich qualitative data which may add context or caveats to other sources. This would be a design feature aligned with both the empowerment and plurality principles discussed by Dörk et al., in that it would allow local employees to contribute more actively to dashboard creation and to do so with a greater plurality of perspectives, through different kinds of data.

Secondly, the speculative dashboard might also be designed as an object to be gathered around and discussed, much as a "matter of concern" [22,50], rather than displayed on the wall on the tablet device of a manager. This might be implemented by purposefully placing the speculative dashboard in a horizontal position, similar to a "smart table". This would make it possible for users to convene, discuss and speculate on the meaning of data, discussing the ontology of the different variables and categories and taking into account the qualitative dimensions of the data uploaded by others. This design affordance draws on the two other principles outlined by Dörk et al., disclosure and contingency. If the speculative dashboard were to be designed as an actual artefact that a team would gather around, it would provide more opportunities for the disclosure of how visualizations were constructed and a more contingent relation to these visualizations.

In these two ways, the speculative dashboard would be both a small and a large change in practice. Small in that the interface is left quite similar to its original shape and function, but large because it focuses on changing the overall practices surrounding the use of data, including adding new ones for the submission of qualitative data and thereby encouraging more collective speculation about organizational data and its infrastructures. As mentioned above, the exercise in which the speculative dashboard concept was prototyped is methodologically constrained by having taken place in a classroom setting. Despite having gotten input from professionals working in the IT industry, the concept needs further developing and actual prototyping within an organizational context before its value can be fully determined. Conversely our experience was also that the classroom setting can be a good opportunity to create dialogue, reflection and stimulate alternative speculation amongst IT professionals.

Discussion

We have explored the data work of public sector employees in the context of an organizational push to become more data-driven. Based on this we found that employees engaged in different kinds of *speculative data work*, relative to what part of the organization they worked in. In particular, we explored how speculation played a central role in determining the validity, affect and valence of data and data work. We identified how certain groups of employees had differing dominant or main speculations about data. These findings were

related to the specific data infrastructure of the data dashboard analytics tool, Microsoft Power BI, and we identified further how the interplay between data work and dashboards in particular did not serve a certain group of employees well.

We then described prototyping a speculative dashboard with a group of IT professionals. The prototyping exercise took place in a pedagogical setting, and explored how the dashboard genre can allow for speculating on data, its types, uses and role in the organization. We then imagined how this could be an actual speculative design project, in the shape of a dashboard that could encompass more varied types of data, listen to the concerns of unheard employees, and repurpose the existing infrastructure of dashboards to enable more open and collective speculative data work across an organization. The intuition behind the speculative dashboard is to acknowledge and embrace the existence of speculative data work, and try to develop a design concept that might "channel" such speculation rather than ignore it.

We now turn first to a discussion to elaborate the relationship between speculative data work and speculative dashboards, and how the latter can be considered either as an exercise to explore speculative data work or as an IT artefact to facilitate better cooperative work. Secondly, we raise this discussion of the role of speculation to the context of the wider digital economy, arguing for how the speculative dashboard might lure organizations and be implemented.

From speculative data work to speculative dashboards

Our ethnography of the CARD organization allowed us to identify how different employee groups engaged in speculative data work. Building on previous research on data work, validities, valences, affect and imaginaries of the "data-driven" we were able to describe how these groups related to data through speculation. We identified this as the "main" speculation of each group.

Speculative data work, we suggest, is an integral part of data work in organizations, referring to both the anticipation of and investment in what data can and will bring to the organization, through speculation. Speculation is involved in both mundane and symbolic data work, and data validity, affects and valences are involved in it. The example of the visitor counting sensor (Fig. 3) showcased, for instance, how data engenders speculation for employees in the local units through the feelings it provoked and the discussions of its validity. The local unit employees speculated on whether a greater focus on data would lead to cutbacks, and the sensor itself became a socio-material cipher for this speculation.

The speculative dashboard is a design concept which acknowledges this need for speculating about and with data, while also itself being an exercise in speculation. As we described, the concept of the speculative dashboard has been explored together with IT professionals in a classroom setting. This exercise focused on speculating on the juxtaposition of different kinds of data and creating more accessible scenarios of use. We furthermore briefly reflected on how such a dashboard might be implemented. The speculative dashboard can therefore both be considered 1) an exercise to speculate on relevant kinds of organizational data to be included when developing/implementing IT infrastructures or 2) a concept for designing an IT system in the form of an infrastructure, which supports positive kinds of speculative data work.

Given the increasing use of data in organizations, the speculative dashboard as exercise would be helpful for designing better tools, that either allay negative speculations or channel positive speculation better. In the case of the CARD organization, doing a speculative dashboard exercise between employees from the local units and from the strategy office could draw attention to the differing understandings of relevant data, data validity and the ongoing speculation about data significance. This could even lead to the inclusion and use of different kinds of data in the organization, or for new work practices that ensure better cooperation around data.

The speculative dashboard as an exercise could be done in a number of ways, but we imagine the basic approach to be similar to our own pedagogical experiment. Here relevant employees are invited to create a physical mock-up of a dashboard on a given organizational topic. They could use a mixture of already existing sources of data and graphs, but then supplement or contrast visualizations of these with kinds of data that currently are not available or considered relevant. By doing this in groups and having a facilitated discussion

about it, the exercise could be helpful in mapping disconnects between employee groups, their understandings of data and lacunae in data sources. Such an exercise would represent a kind of "structured" speculative data work, channeling and surfacing existing speculations and concerns about data, including its validity, valences and affect.

The following section briefly discusses the speculative dashboard as an IT system, in the form of an infrastructure which through its explicit ontological nature might also channel speculative data work in positive ways.

Speculative dashboards as ontological infrastructures

Based on our empirical work, we also imagine that the speculative dashboard could be developed as an IT system that would have different properties than those of conventional BI Dashboards. Table 3. below illustrates the contrast between the BI dashboard and the speculative dashboard as a system for supporting more cooperative work. Where BI Dashboards are mostly considered epistemological artefacts, in the sense that they represent knowledge about an organization, we suggest that a speculative dashboard could be developed to be explicitly ontological in its nature, meaning that it would aid to construct the organization rather than represent it. We say "explicitly" because whilst BI Dashboards are often understood as epistemological artefacts, we know from STS research that calculative devices and infrastructures are *indeed* ontological [44,48]. By epistemological and ontological we here mean the broad senses of these terms, as developed within STS scholarship. BI Dashboards are in this sense epistemological because they are a tool through which actors *know* their organization, and speculative dashboards would be ontological because the ability to input alternative kinds of data into them would allow actors to trouble or redefine what *exists* within the social world it represents. By encouraging more juxtaposition of different kinds of data the speculative dashboard could help to denaturalize the given data categories existent in the system. In relation to the concept of speculative data work, this means that speculative dashboards to some extent would allow for troubling boundaries of data validity and valence, by introducing unconventional kinds of data to the dashboard environment.

Furthermore, we imagine the speculative dashboard as an IT system developed to be used by both managers and workers alike, in the local units and centrally. The speculative dashboard could, as described earlier, be a screen or interface to be gathered around in individual units or teams for depicting and exploring relevant organizational matters of concern [22,50]. By involving more kinds of employees from across the organization, engagement and speculation on data can perhaps be made into a more explorative, process-oriented and ultimately democratic practice. In short, we believe that the various kinds of speculative data work described in this paper can be harnessed towards more positive processes and outcomes for cooperative work with data, through the development of speculative dashboards as IT systems to channel this impulse.

BI Dashboards	Speculative Dashboards
Epistemological	Ontological
Representational / Aesthetic	Constructive
Centralized	Democratic
Result-oriented	Process-oriented
Instrument of Control	Tool for exploration
Accept problematizations	Open problematizations

Report Matters of Fact	Gather Matters of Concern

Table 3. Different perceptions of dashboards amongst employees in the local unit

We therefore imagine a concrete design of the speculative dashboard as a multifaceted tool for the upload, analysis and exploration of data. A speculative dashboard would be a system that utilized the conventions of BI Dashboards, such as the canvas in which different data visualizations can be juxtapositioned. However, it would also allow for the upload and collaborative annotation of types of data that are non-numerical. Rather than be a point for disseminating information, we imagine this system used for two- or multiple-way communication, and to be a gathering point for teams. We imagine it to be used by groups of managers and employees to discuss, collaborate and co-design visualizations that make sense of and speculate on the social worlds of the organization. In this way, speculative dashboards would support positive forms of speculative data work and perhaps limit the kind of negative affects it currently produces.

Implementing speculative dashboards

One cannot invoke the "speculative" without also invoking the political economy within which much digitalization takes place; the speculative investment in promising but unproven future technologies [32], the more straightforward speculation of the direct investment of VC capital, IPOs and stock market dynamics surrounding tech companies [86] or the speculative economy of exploitation of the earth through extraction, sensor-instrumentation and high-frequency trading [36]. Speculation is, it seems, somehow appropriate to the hype-infused discourse (X and X, forthcoming) of tech – including data, its visualizations and dashboards. The present paper builds on these understandings of speculative design and research, in suggesting design ideas that attempt to interrogate an alternative version of an existing technology [3] and open up a discussion of preferable futures [24]. However, in doing so, the design ideas are strategically crafted [97] so that they may act as "lures" [96] for actors, by trading on the visionary qualities of alternative visions of the futures of organisational data. The notion of the "lure" is also similar to what Auger calls a "perceptual bridge" [3:12] which is the connection that an audience may make between a speculative design object and a context or situation which they are familiar with. The lure is different in that it is predicated on promising a wholly different future, but is similar in that it provides a means of connecting the intended (or unintended!) audience to an object of speculative design. We wish to propose that whilst the speculative dashboard might not immediately be appealing with the present capitalist economies of speculation in digitalisation, it does precisely engage with what the hype of these economies constantly seeks: novelty, newness and trying something different. In this way we believe that the speculative dashboard might be able to actually lure in interest from organizations and actors, especially those that have an orientation towards public goods, culture or have the surplus to try something radically different. Based on this discussion and the reflections in this paper, we are planning to prototype the speculative dashboard within an organizational context.

Conclusion and Future Directions

We conclude the paper by listing a number of questions and considerations which future work can orient itself on the basis of:

- In the context of a speculative economy and hype around novel technologies, try to take an active decision as to how the project relates to these conditions.
- Consider how speculation and hype might be used strategically as "lures" or "perceptual bridges" towards design projects and interventions.
- When encouraging speculation, be aware of existing sociotechnical imaginaries around data and data infrastructures.
- Consider how such existing imaginaries may be disturbed, interfered with or remixed.
- What might a "lure" or "perceptual bridge" for alternative futures for public sector digitalization look like?

The fieldwork that forms the basis of this paper empirically pointed to organizational data being a source of stress for public sector employees. This data was uncertain in quality and purpose, it was associated with cutbacks, and its contribution to central aspects of the work was unclear. Based on CSCW, HCI and STS literatures on speculation, the speculative dashboard has been developed as an intervention into the data infrastructures that support this perception of data.

The speculative dashboard is intended as an exercise or design artefact which can help facilitate positive speculative data work: either as an exercise that can be done in groups or as part of a data infrastructure, connecting different parts of an organisation. It works by the juxtaposition of different types of data within a familiar visualization space, and also by creating different contexts of use focused more on collective discussion and deliberation.

By drawing on speculative design and research practices, the paper has proposed the speculative dashboard as an object of speculation, but also *for* the promotion of a different kind of speculation. In a sense, this kind of speculation is akin to changing dashboards from devices that focus on matters of fact to things which are able to help in articulating matters of concern.

We recognize that the paper might have taken on and engaged in co-design or participatory design together with the users who were present in the ethnographic study, but the goal of the paper has been not to co-create but instead to attempt to think up infrastructures that might help others co-speculate. We suggest participatory design to be a very valuable area for future research on the topic of speculation and data economies.

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