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Data in the smart city: How incongruent frames challenge the transition from ideal to practice

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Abstract

This paper presents an analysis of interviews, focus groups and workshops with employees in the technical administration in the municipality of Copenhagen in the year after it won a prestigious Smart City award. The administration is interpreted as a 'most likely' to succeed in translating the idealised version of the smart city into a workable bureaucratic practice. Drawing on the work of Orlikowski and Gash, the empirical analysis identifies and describes two incongruent 'technological frames' that illustrates different ways of making sense of data and the smart city within this single organisational unit. One is called *the experimentalist's credo* and it is characterised by inspiration from the development of an Internet of Things as well as a readiness to learn from the open source community in software development. The other is called *the data-owners vocation* and it is characterised by a more situated approach that interprets data as strategic and political. It is argued that the existence of these frames provides two insights relevant for the literature on smart cities. First, they illustrate that one should be careful not to reify the smart city as a phenomenon that can be criticised in generic terms. Second, they suggest that *even if* there exists a transition toward the implementation of a technocratic smart city paradigm across public administrations, this paradigm is not unique in its focus on markets and evidence in governance.

Keywords

Smart city, technological frames, Big Data, sense-making

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Introduction

The concept of the 'smart city' has gained traction within academia and urban planning. On one hand, it has spurred dreams of new and more effective modes of urban governance (Harrison et al., 2010). On the other hand, it has been criticised for being yet another neoliberal utopia blueprint (Hollands, 2008; Zook, 2017), and a form of new public management (Przeybilovicz et al., 2018) that is blind to the urban ecologies in which it is situated (Colding and Barthel, 2017). Even though no standard definition of a smart city exists, projects falling under this category focus on how information and communication technology (ICT) can improve urban governance. Kitchin (2014) argues that such improvements are related either to developments in Big Data and real-time city planning, or to the

emergence of the new knowledge economy, in which app development is used to spur innovation.

Proposals for smart-city projects often include images of data-analytics centres, where data across organisational units are cross-fertilised on real-time dashboards (Marvin et al., 2015). Such dashboards have become paradigmatic illustrations of the smart city, as they are believed to empower city planners (and potentially citizens) with new technologies to

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enhance insight and control (Shelton et al., 2015). Even though they rarely exist in practice, their future existence often is assumed in the literature. For instance, Kitchin (2014: 6) argued that 'over the next decade, the real-time city is likely to become a reality'. This new reality is believed to afford new modes of governance (Flyverbom et al., 2017) that involve a combination of market-based logics, data-driven evidence and technologies of control. Conversely, critical literature on the smart city has elicited important discussions about, e.g., epistemology of data, the use of data to control populations, links between business and government, and privacy issues. Each of these discussions has challenged important assumptions within the smart-city paradigm and has enriched the debate over what data-driven governance practices could be implemented *if* smart cities were realised.

However, this paper takes a different analytical route. Rather than critically examine assumptions about data and governance that are explicated in presentations on smart-city strategies, it expands on a suggestion from Shelton et al. (2015) on how to understand the 'actually existing smart city'. This deliberately contrasts with the idealised – but often unrealised – vision that dominates the social imagination. Whereas the critical deconstruction of this ideal is a good strategy for exposing a certain epistemological and political naiveté across a broad range of smart-city projects, it also risks reifying the smart city. Discussions of the pros and cons of a generic paradigm risk losing track of the way smart-city ideals are situated and integrated into existing constellations of urban governance in specific cities.

Accordingly, this paper focuses on the work involved in turning a smart-city strategy into an actual workable practice in a specific organisational unit. Through interviews with public servants within Copenhagen's technical administration, the analysis identifies two radically different modes of sensemaking around data that challenge the ideal of a smooth translation from ideal to practice. One is called *the experimentalist's credo*, which is characterised by inspiration from the development of the Internet of Things (IoT), as well as a readiness to learn from the open-source community in software development. The other is called *the data owner's vocation*, and it is characterised by a much more situated approach that interprets data as strategic and political.

Drawing on Orlikowski and Gash (1994), these two modes of sense-making are conceptualised as distinct 'technological frames' that mobilise different ideas about the nature of data, as well as its proper use in public administration. The paper identifies incongruences between these frames with the purpose of illustrating concrete challenges in translating an existing smart-city strategy into practice even within a single organisational unit in one city. Furthermore, the paper contributes to literature on smart cities by arguing that these discovered incongruences challenge the argument that the smart city is characterised by injecting market logics and evidence-based decision-making into the urban bureaucracy. Rather, the two frames share a perspective on these elements, while interpreting them differently.

Technical administration in Copenhagen

In 2014, the municipality of Copenhagen won the prestigious World Smart Cities Award at the Smart City Expo in Barcelona. The winning project was titled 'Copenhagen Connect', and it exhibited many of the aforementioned characteristics of an idealised smart city. It linked the development of ICT to improved urban planning, promoted the use of new forms of sensor data to understand the city and provided a plan to integrate third-party app developers into a newly developed, crowd-sourced market that seeks data-based solutions to problems such as traffic jams. Furthermore, the project was promoted through ideas for a dashboard-equipped 'control room', like the one shown in Figure 1.

After winning the award, Copenhagen Solutions Lab (CSL) – a new unit within the technical administration – was assigned the task of coordinating the realisation of the project. As a new unit within the established system, its employees had to resolve the meaning of *smart city* with existing employees across the municipality, as well as within their own administration. Their task was to translate a smart city existing mostly on slides and in strategy documents into actual workable data practices.

After the award ceremony in Barcelona, I began attending meetings and workshops related to this process. Furthermore, I conducted interviews and focus groups with individuals who either voluntarily showed up to the workshops or occupied an organisational position in which they controlled some of the data that were central to realising the project. This work forms the present study's empirical background, but the specific analysis below is restricted to three interviews, one focus group and one workshop that included employees in the city's technical administration.[1] The reason for this methodological choice is that I interpret this organisational unit as being what Bent Flyvbjerg (2006) would call a 'most likely case' to succeed in translating an idealised smart-city strategy into a workable practice. The reasons for this interpretation are the following:

First, Copenhagen is a city with a relatively high degree of digital inclusion (Roy, 2017) in a country where citizens have a history of trusting public servants with their personal data (Pedersen, 2011). This means
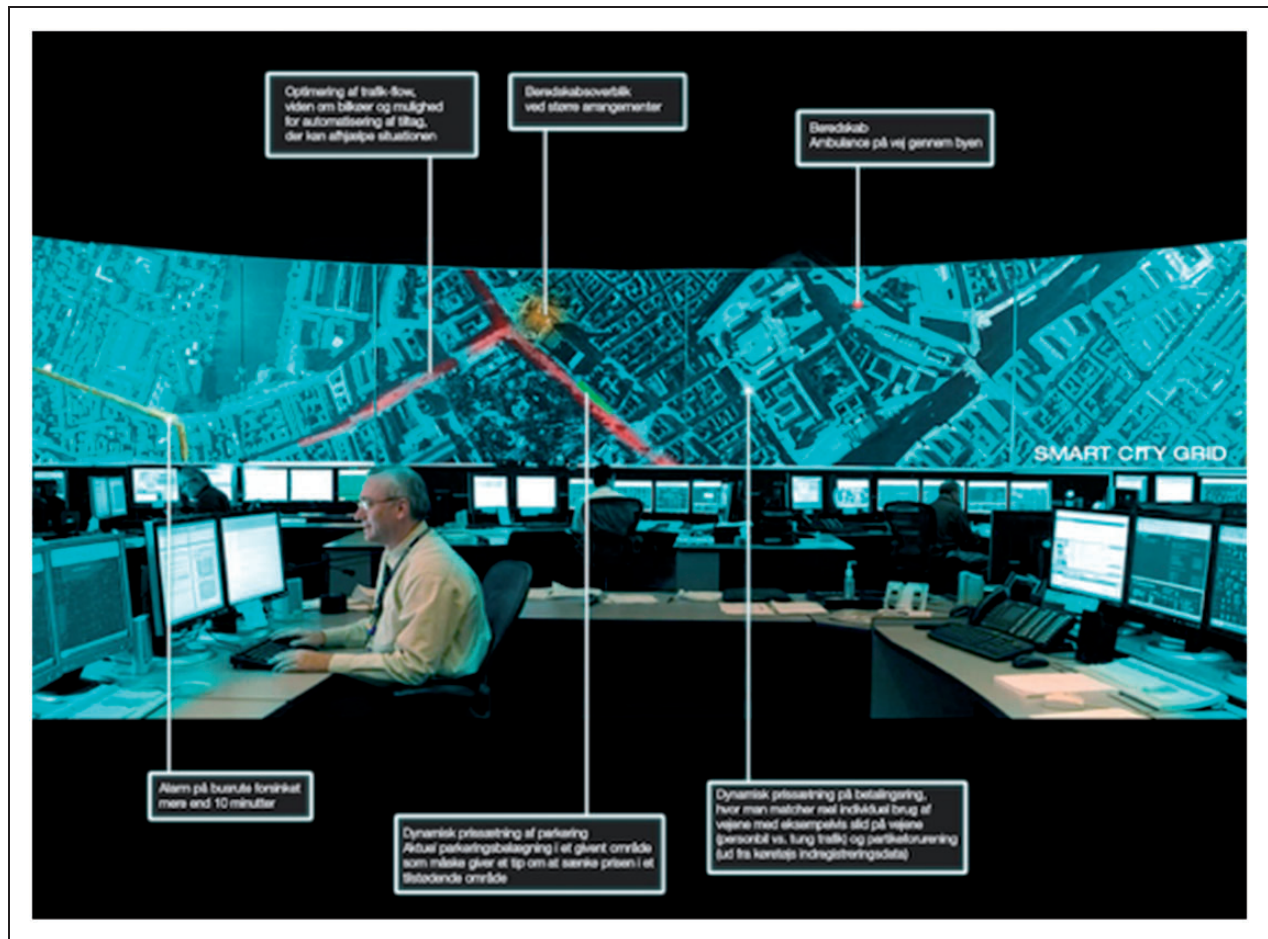
Figure 1. Dashboard illustrating the potentials of Copenhagen Connect (The picture can be found at https://www.dailyscandinavian. com/copenhagen-connecting/).

that people share data, use apps and are accustomed to balancing privacy concerns with a functional welfare state. Second, Copenhagen's top management in 2014 decided that each administration was obliged to deliver data to what ultimately would become the dashboard-equipped control room. Accordingly, organisational pressure was exerted to make the transition work. Third, the technical administration was pioneering the project from the start, and it was working with the least-sensitive data sources. Compared with, e.g., person-sensitive data in the administration of children and youth, the technical administration managed data on items such as cars and trash cans.

The logic of the 'most likely' case selection goes as follows: If the translation of the idealised version of the smart city into a workable practice is challenged by radically different interpretations of data in this specific administration, then the problems of translation most likely would be even worse in other administrations. While much literature on smart cities starts from the assumption that the realisation of a 'real-time city' will happen within years, such a finding would question that

assumption. Therefore, this paper's research strategy was to look for incongruences in a place where the existence of such incongruences would indicate some fundamental challenges in realising smart cities. Rather than discussing assumptions about data and governance in the idealised vision that won the award in Barcelona, the goal was to identify and describe the challenges involved in fitting such ideals into existing constellations of urban governance (Shelton et al., 2015).

Technological frames

This research strategy motivated the choice of a theoretical lens that could help explicate differences between modes of sense-making around data in the administration. The connection between sense-making and organisational change, of course, has a rich theoretical history in organisational theory. For instance, Karl Weick (1995) introduced psychological theories of sense-making as an alternative to explaining organisational forms with reference to demands in their environments (e.g., Lawrence and Lorsch, 1967). Rather

than looking at how organisations fit themselves into external forces, he focused on the ways in which organisations 'enact' themselves by promoting specific practices and crafting narratives that make these practices understandable and legitimate. Every act in an organisation (e.g., the decision to link data across administrations on a dashboard) will be met by a response (which could, e.g., be compliance or silence), and it is between such acts that a collective interpretation and mutual commitment to a shared organisational form (e.g., an agile smart city) are even possible. However, this outcome is dependent on whether employees within the organisation can justify this commitment with respect to their existing standards on what constitutes proper fulfilment of their organisational roles. Collective sense-making is – on this account – a process situated in specific organisational contexts and realised with references to existing standards or structures.

This paper follows this tradition in the sense that it actively looks for incongruences that challenge collective sense-making in the technical administration. More specifically, it identifies such incongruences with inspiration from Orlikowski and Gash's (1994) concept of 'technological frames', which similarly proposes understanding organisational forms with roots in the psychology of interpretation and sense-making. The concept of technological frames originally was introduced to investigate interpretive processes related to information technology (IT) in changing organisations, and the authors define it broadly as '[...] assumptions, knowledge and expectations expressed symbolically through language, visual images, metaphors and stories' (Orlikowski and Gash, 1994: 176). They suggest that such frames will influence the way in which an ideal (such as the smart city) is translated into actual work practices in a specific setting (e.g., the technical administration).

Orlikowski and Gash (1994) suggest that technological frames are composed of three elements, of which this paper discusses two. First, they offer views on the *nature of technology,* which refers to the ways in which people imagine the capabilities and functionalities of a specific technology (Orlikowski and Gash, 1994: 183). In our case, this manifests itself as ontological assumptions about what data are and epistemological assumptions about the role they can play in producing knowledge and decision-making. Second, technological frames include thoughts about *technological use,* which refers to people's understanding of actual consequences associated with its use. In our case, this might entail, for example, expectations about the ways in which new data infrastructures fit into existing work practices and thoughts about what potential implementation problems/benefits might be.

These concepts guided the analysis of the transcribed empirical material. The coding strategy was deductive

in the sense that I used coloured markers to underline quotes that exhibited these two aspects of technological frames. For instance, if and interviewee voiced assumptions about the ontology of data or indicated preferences for specific epistemological positions, I would code it as pertaining to the nature of data, whereas comments about consequences of specific analyses within the municipality would be coded as pertaining to the use of data. I thereafter looked at the highlighted quotes with the aim of identifying incongruences that would reveal diverse 'expectations around the role of technology in the organisation' (Orlikowski and Gash, 1994: 180). I deliberately organised my material to identify juxtaposing positions because explication of incongruences can increase our understanding of potential conflicts when new technologies – such as data infrastructures – are introduced into organisations. Furthermore, since technological frames are social and embedded in interactions, I took notes on whether they were justified with respect to the environment (e.g., the smart-city paradigm and the tech industry) or renegotiated with reference to existing situated standards for good bureaucratic practice. This helped me get a sense of the ways in which different references were mobilised to make a specific framing legitimate and understandable.

Two technological frames: The experimentalist's credo and the data owner's vocation

The analysis below describes two distinct technological frames that illustrate different methods of interpreting data and smart cities in the technical administration. These frames should be read as ideal types, with each having its own ways of translating the idealised version of the smart city into workable practices. Even though these ideal types are written up to highlight differences, they are, to a large extent, rooted in units within the administration. The first technological frame is the *experimentalist's credo*, and it is mobilised primarily in a specific sub-section of the technical administration called 'development', which is where CSL employees are located in the larger organisational structure.

Frame I: The experimentalist's credo

When it comes to the *nature of data*, this frame evokes distinct expectations. First, data are conceptualised with reference to the paradigm of IoT (Atzori et al., 2010; Jin et al., 2014), which suggests that the cheap availability of sensors and Radio-Frequency Identification (RFID) chips means that movements potentially can become data points mapped according to their latitude and longitude. This assumption often is connected with dreams

of pervasive and ubiquitous computing (Saha and Mukherjee, 2003), which is an aspect of the smart-city paradigm with obvious roots in the technology industry. In the empirical material it is argued that pervasive computing will lead to a situation in which our imaginations – rather than data and technology – will set the limits for governance solutions:

> [...] You can find out where bikes are if they are stolen, where the trash cans are, where the material possessions of the municipality are – because [the chips] are so cheap, it is only the imagination that sets the limit. (Focus Group 1, p. 5)

This quote rests on the assumptions that data are objective mirrors of the world and that algorithmic processing of this data can produce an endless variety of insights on top of this data. It is the imagination – not the data infrastructure – that sets the limits. This also entails that a relevant task for CSL is to ensure that every new infrastructural development in the municipality integrates the production of new forms of data by making room for sensors. Data production is viewed as a goal in itself, even though its benefits may not be obvious from the beginning:

> Well, Brønshøj was the first neighbourhood where all city lights had to be changed, and this became the place where we had the possibility to insist on making the poles empty – without even knowing what to use it for.

This way of understanding the nature of data and data infrastructures is accompanied by a crowd-based understanding of the proper *use of data*. The argument goes as follows: Because data will, in the future, be produced in massive amounts without any clear idea of their use, it is necessary to have as many minds as possible working on translating those pervasive data sources into insights and improvements in urban planning. This is talked about as a potential market of analytics:

> The culture has so far been that we have had employees sitting and collecting data with very specific purposes in mind [...] in order to make sure that their own little project succeeds. [What we want to explore is the] kind of solutions the market can produce if we make this data freely available. (Workshop 1, p. 9 & 11)

This belief in a distributed market of solutions is something that CSL employees repeatedly express, and it is often legitimised with reference to 'best practices' of open-data projects in other cities:

> [...] There are so many indications [...] that people are just creative in their re-use [...] It is utterly impressive

what people can get out of something that nobody saw any relevance in. Just getting more eyes on the data and start comparing it [with other data sets]. I believe that we can use it in so many ways that we never thought about when we collect it in the first place (Workshop 1, pp. 7–8)

At other times, this belief in the crowd-sourced market of analytics is manifested with reference to the first results of the CSL's own attempts to make data available to third-party actors:

> I have seen data sets that we have made part of our open strategy, where citizens have given feedback with corrections. This is very cool. For instance, they say: 'Wait, there is no parking lot there anymore – it's been removed' [...] There is a basic value in having more eyes on a problem (Focus Group 1, pp. 4–5).

Analysis here is interpreted as a process of turning raw data into actionable insights, and the assumption is that this process is fertilised by enabling 'many eyes' to explore patterns – and spot noise – across data sets. The nature of data is such that patterns and noise can be detected if data are used correctly. One interviewee from CSL contrasts this open philosophy with what could be termed 'silo analysis':

> This idea that data is made openly available in a systemised fashion – that it is [removed] from the silos and drawers [in the sub-units] is, in my opinion, a huge advantage for a municipality the size of Copenhagen. [However], the IT-department [wants all data stored in specific environments]. The result is that the agile approach we would like to champion goes down the drain. (Interview 1, p. 1)

This quote paints a clear contrast between data infrastructures that cater to agility and creativity – e.g., open data and hackathons – and those that do not – the silos. The prevailing norm of keeping data in dedicated organisational units until they are clean enough to tell perfect stories does not match the agile experimentalist's credo. The contrast between these two uses of data is exemplified further by a discussion about the 'precautionary principle' as a guideline for data use:

> I am still exposed to the precautionary principle [...] this is a bit annoying [I think we need] a shift in culture, a paradigm shift – another way to think about [our] data. (Workshop 1, pp. 14–15)
> [...] The choice seems to be that we want to ensure the quality so we know it is 100% correct [...] But that is never going to happen! So why not release

it in the – probably great – quality that we have now? (Workshop 1, pp. 4–6)

Rather than understanding data as something scarce that needs to be cultivated and refined to be useful, these quotes call for understanding data as pervasive and good enough to release to a crowd of developers who can build insights on top of the data. Using data within a 'zero-failure culture' that is driven by a fear of drawing incorrect conclusions is an obstacle to the kinds of iterative solutions that would be possible if the municipality would risk working with censor data in real-time:

> Today, we do these things with […] historical data and hunches and say 'OK, this is how it must be' and then we figure out that there is a daily traffic jam on Åboulevarden, and then we go back and redo the models, implement them and wait half a year to do evaluations. It would be really cool to be able to see, in real time, how a given solution works. (Workshop 1, p. 4)

This quote draws a distinction between measurements and models that indicates something important about the use of data in the experimentalist's frame. Models work by sampling data from strategic points and, subsequently, model the whole city based on assumptions. For instance, Copenhagen measures traffic at a few intersections and roads, then makes city-wide traffic models based on assumptions about the way people drive at specific times on certain days of the week. According to the experimentalist's credo, this method of using data exhibits an unproductive balance between, on one hand, prioritising perfectly crafted models, and on the other hand, prioritising fast inputs for solutions. Spending half a year building models for a fast-changing and unpredictable city is viewed as an obstacle to a more responsive and agile mode of regulation.

Finally, the experimentalist's frame contains an assumption about data use that – unlike the ones just discussed – is not directly related to finding solutions to city problems. Rather, it concerns the democratic value of being a transparent administration. Once again, building on references to 'best practices' in other cities, an interviewee from CSL expresses the hope that early release of data and collective discussions about analytical procedures can increase the democratic legitimacy of regulations that the municipality proposes, approves and enforces:

> It makes the municipality more trustworthy when we can say that we are open and transparent. We saw a fantastic example from [a city] that had a giant

dashboard with all their KPIs [key performance indicators] exhibiting the goals the municipality had set for themselves. This meant that the citizens could follow the progress toward meeting these goals almost in real time […] I found this approach extremely trustworthy […]. (Interview 1, p. 11)

The quote advocates for showing the 'state of the union' to the citizens and illustrates that the experimentalist's assumptions about the nature and use of data are linked to epistemological, as well as democratic, concerns.

Frame II: The data owner's vocation

When the so-called 'data owners' in the municipality talk about the smart city, they propose much different ideas about the nature and use of data than the ones outlined above. In the technical administration, 'data owners' is the name used for people who are responsible for producing, storing and analysing data used to maintain the city's daily functions. This could be, for instance, data about trash or traffic flows. The data owners typically belong to the administration's maintenance unit, which differs from the developmental unit, as it focuses strictly on the bureaucracy's more mundane daily workings.

We call the frame emerging from this unit *the data owner's vocation*. It is explicated by interviewee 2, who challenges the assumption that data are a raw resource that can fuel neutral algorithmic and crowd-sourced analyses. Rather, his daily task of working with data from the garbage system entails interpreting data as something crafted for a specific task in a specific context. The production and circulation of the data points he works with are often the result of heavily detailed agreements between the municipality and subcontractors hired to solve a specific practical problem (e.g., sorting garbage). From his perspective, it is problematic to decouple it from its original context of production:

> [This idea that] data is free, and we can trust a crowd of people to analyse it, is kind of a big leap for me because I get a lot of data […] that is on the verge of being company secrets. [Data from garbage-sorting facilities] can tell competitors about what is done to the garbage […] It reveals the efficiency of the technologies that [a facility has invested in]. (Interview 2, p. 2)

The argument that data are contextual and situated is made here with reference to lived experiences of very mundane data transactions between a data owner and a subcontractor. The interviewee knows the structure of the data well enough to foresee that freely combining

data sources might reveal company secrets and thereby violate the trust between the municipality and the subcontractor.

This way of thinking about the nature of data as situated in specific transactions also leads to a less-ambitious formulation about data-driven governance. In the case of garbage management, the interviewee explains that data often are used merely to calculate simple summaries of garbage waste to determine what the municipality owes the subcontractor, or perhaps to conduct simple checks for anomalies that might indicate something that needs urgent attention. For instance, a sharp rise in the garbage processed by a facility might indicate that citizens are dumping illegal garbage on the premises. In short, data owners see value in using data within the boundaries set by the original negotiations because derived use can cause problems.

This tells quite a different story about the use of data than the one encountered above. Data are used here as a resource for planning and control, but they also are a medium through which trust between a municipality and subcontractors is upheld. The consequence is a suggestion that the bureaucracy must design data infrastructures that balance these functions. Good design should be evaluated not only on its ability to find quick solutions to problems in the city, but also on its ability to underpin fair procurements and maintain lasting relations with important partners to solve these problems.

Another use of data that illustrates its situated and contextual nature can be found in a story about the way data sets are used as political assets in discussions among different sub-units of the technical administration:

> We are located in a branch called 'maintenance', and we sit on a lot of data which is useful for the branch called 'development' when they make long-term plans. However, if we do not agree with them on the plans they make, I have, on occasion, said: 'Fine, if you want input from [our data], I need to be there in person. [...] you have to listen to my experiences from the field if you want to get the numbers right'. [...] This means that I show up, and I am part of the meeting. (Interview 2, pp. 13–14)

Data here are viewed as a key that provides access to strategically important meetings. The quote frames data as political at their core, and the interviewee even talked about them as a 'deck of cards' that one will not willingly let others peek at. Once again, data are interpreted as a situated phenomenon – a valuable, strategic resource in a specific situation precisely because they are not distributed to many people. Again, this method of framing the use of data is

made comprehensible through references to the data owner's mundane daily experiences.

However, the quote above also formulates an epistemological reason for having data owners present when doing an analysis on top of data. They are not just there to win a political battle. The quote contains the argument that 'if you want to get the numbers right', you need to align with someone who knows the context of data production – someone who has 'experiences from the field'. Proper use of data requires intimate knowledge of its production context. This requirement is exemplified in the following quote explaining problems involved in releasing data on cardboard waste to third-party analysts:

> We have carried out an experiment with the purpose of investigating how much extra cardboard we could collect in an area of the city [...] such isolated experimental data is not necessarily ready to go on an open data portal because they are born under these strange circumstances that need careful explanation. (Interview 2, pp. 14–15)

Again, the important point is that data lose value as they gets de-coupled from the situations in which they are produced. Because data often are an outcome of specific experiments (in this case, allowing certain types of garbage to be sorted together), they are born with such a complex context of production that it would take detailed explanations in the metadata before any third-party analysts could use them properly in an open portal. In the workshop, a data owner raises questions about how necessary concerns about context and quality can run counter to the hopes of crowd-based insights:

> To me, data is a tool that I use in my daily work [...] If a journalist contacts me in order to get some data, I want to make sure that I tell him about all nuances of the data and make sure that I get to see the story before it goes to print. This enables me to check for potential errors. This has been my role – to check the quality and ensure that the context is not forgotten. (Workshop 1, p. 10)

What is implied here is that sometimes, it actually may be preferable for journalists and other interested third parties to apply for access to data, rather than make data available automatically. The push for transparency in the administration needs to be balanced with other interests such as sensitivity, political processes and the risk of spurious conclusions produced on top of complex data. In other words, describing the nature of data as inevitably situated and political carries with it much different scenarios about the ways in which data can be used.

Ultimately, these thoughts about the contextual nature of data make the dream of the real-time dashboard a chimera. As stated by the owner of garbage data: '*The ideal about real-time data. . . that's impossible*' (Interview 2, p. 8). Referring to the practical experience of data as something that is situated in subcontracting relations, experimental set-ups and other messy contexts, it is argued that the smart city realistically should view data as something counted in months – not seconds. Furthermore, even *if* data were available – released with proper metadata and used to build an actual working product – it would not be easy for a public bureaucracy to take advantage of it:

> The municipality is not geared to take advantage of all these innovative solutions [. . .] As soon as we build some solution, it has to be accessible [. . .] for blind people, hearing impaired and so on. But this makes it very complicated [to recommend and take ownership of solutions] – and this is why it doesn't happen. (Interview 2, p. 9)

These comments illustrate that *even if* the open-data project resulted in high-quality apps, it would be difficult for the municipality to take ownership of them. The risk, then, would be a situation in which several apps were circulated, but were not updated because the programmers lost interest in them. Such a situation potentially could leave citizens more confused, instead of helping them in their daily lives. Again, this way of framing the potentials of data use is grounded in actual mundane experiences in the bureaucracy.

Incongruences with reference to literature on smart cities and Big Data

The analysis above outlined two technological frames, illustrating different ways of interpreting data and the smart city. As mentioned above, these frames are ideal types in the sense that they are designed to dramatise differences. However, they are, nonetheless, mobilised by specific interviewees who occupy specific positions in the organisation. The *experimentalist's credo* primarily was explicated by CSL employees who reside in the developmental unit, whereas the *data owner's vocation* was formulated by interviewees responsible for sub-contracting in the unit of maintenance. This section will discuss incongruences between the identified frames with respect to existing literature on smart cities and Big Data.

'Critiques from within' as an alternative to reify the smart city

The first relevant finding is that different frames exist even within the technical administration, which was

argued to be the 'most likely case' for translating the idealised version of the smart city into a workable practice. Even though it is perhaps not surprising that this translation was met with resistance, it is still interesting that *the data owner's vocation* so clearly problematises core aspects of the smart city ideal as promoted by CSL. Whereas much smart-city literature, in the words of Shelton et al. (2015), reifies the smart city and focuses analytical power on critiquing the ideal, the analysis above spotlights critiques that already live inside the bureaucracy. Rather than dissecting demonstration-cases and de-constructing their assumptions, it seems relevant to understand how divergent frames exist among employees who have the task of realising the data infrastructures that are supposed to underpin the dashboards imagined in the demonstrations.

The analysis above takes the first step in doing that, and the resulting ideal types challenge a tendency in the literature to define the smart city as a mode of governance that increases the role of markets and evidence in public administration (Kitchin, 2014). In fact, both technological frames view markets and evidence as central elements in their version of how a data-driven city should be designed. They are not incongruent because the experimentalists focus on these elements, whereas the data owners do not. Rather, they mobilise quite different versions of markets and evidence that need to be understood to understand how the smart city, in the words of Shelton et al. (2015), can be situated and integrated into existing constellations of urban governance in this specific setting.

Markets and the smart city

In terms of the interplay between markets and urban planning, the *experimentalist's credo* is rooted in a philosophy of markets and collective problem solving that can be traced back to 18th century utilitarianism, then all the way forward to modern theories of collective intelligence. Starting with contemporary times, the belief in, e.g., hackathons as innovative organisational forms echoes writers such as Shirky (2008) and Surowiecki (2005), who have argued for the possibility of using crowd-sourced solutions to tackle complex social problems. These arguments are inspired by open-source developers such as Eric Raymond (1999), who famously called for solving problems more like a bazaar, in which tasks are organised from the bottom up – instead of like a cathedral, which operates as a top-down organisation. The way the experimentalists interpret regulations on data access, as obstacles to bottom-up organisation of data, highlights this link, and it becomes even more clear when the interviewees actually paraphrase Raymond's famous slogan that 'with enough eyeballs, all bugs are shallow'.

This philosophy of problem-solving and organisation is the foundation from which markets are understood within the *experimentalist's credo*. The market here is understood as a place where anyone can present a product, and a crowd of users can react to it either by choosing to use it or not. A working example of such a market is the business strategy of social-media platforms, whose APIs release data to third-party developers, who then build plug-ins and other add-ons that users may or may not employ (Vestergaard, 2017). Ultimately, this way of conceptualising market-based problem-solving can be traced back to economists like Adam Smith (1950 [1776]), who famously argued for free competition as an important organising principle in an economy, as well as utilitarian philosophers like those of Jeremy Bentham (2001 [1776]), who argued that regulations must be judged on whether they increase a nation's overall happiness. *The experimentalist's credo* arguably translates this tradition into a quest for a municipal bureaucracy that produces 'solutions' that work for the greatest number of people possible.

Looking at recent literature on Big Data, this method of connecting markets and governance shares many traits with what Evgeny Morozov (2013) has critically termed 'solutionism'. This is a mode of planning that has roots in the entrepreneurial spirit of Silicon Valley, where promises of 'algorithmic regulation' recently have been championed (O'Reilly, 2013). Morozov sees this tendency as the latest attempt by utopian technocrats to practice 'politics without politics' by hiding normative choices behind a belief in the existence of raw data and neutral algorithms. By focusing on finding effective solutions in data patterns, this is a form of regulation and governance that effectively bypasses important epistemological and democratic dilemmas. In the words of Morozov, it promotes stressing the 'what' of politics rather than the 'how'.

The *data owner's vocation* mobilises a much more situated version of the market, which is exemplified by specific transactions with the municipality and subcontractors who already have existing solutions to sell. Rather than using a creative and collective force to enable innovative solutions on top of data, the market here is a set of rules and agreements that build relations based on trust between actors. Such relations require work and maintenance that often involve regulations on potential third-party utilisation of data. Part of the *data owner's vocation* is to cultivate these relations and ensure these concerns get priority in a data-driven city.

Transparency and the smart city

These different methods of conceptualising the link between markets and governance also explain why the two frames are incongruent in their approach to transparency in the public sector. As noted by Grasten and de Montoya (2009), the notion of transparency has emerged as an organisational buzzword that acquires specific meanings depending on the interests of those promoting it. In some contexts, the 'transparent organisation' is viewed as an arbiter of accountability and control, whereas in other contexts, it is justified in terms of the efficiency it promotes or even merely on its democratic merits. Therefore, when translated into organisational practices, it can materialise in many different ways. Examples are open-office environments (disclosing who is at work), sharable Outlook accounts (making planning more effective) or – as in our case – calls for open-data repositories (making the public sector accountable to its constituents).

The *experimentalist's credo* calls for this latter organisational intervention, which thereby translates the notion of transparency into a very specific practice of data management and storage. In doing this, it first draws on organisational principles from the open-source community, which is characterised by a tendency to release early and often (Neff and Stark, 2004; Raymond, 1999). The underlying belief is that early adopters will correct potential failures in early releases if 'enough eyes' are exposed to them, a belief often accompanied by an almost fundamentalist adherence to the ideal of 'transparency'. In Internet communities, we have, for instance, seen the coupling between transparency and good governance in movements such as Wikileaks (Sifry, 2011). The *experimentalist's credo* echoes this adherence to transparency in its philosophy of epistemology, as well as ideals of democratic legitimacy.

The data owner's vocation frames the issue of transparency in a more ambivalent fashion. It is an ideal that needs to be balanced with other concerns, such as the need to conceal information to maintain working relations. We can see this as a form of 'counter-transparency doctrine' (Hood, 2006) that is mobilised as an alternative organisational reality to the one promoted by the *experimentalist's credo*. The situation will determine the right balance between what to reveal and what to conceal. In making this argument, the framing echoes recent theoretical work promoting the idea that transparency has – in practice – more ambiguous consequences than just increasing organisational accountability (Flyverbom et al., 2015). Ideals of transparency, themselves, are sources of power, as they contribute to making people, objects, and processes knowable and governable in specific ways. When transparency is used to manage visibilities, it becomes a mode of ordering that is just as strategic as other modes of ordering (Flyverbom, 2015). The idea that transparency is one among a competing set of

organisational values is what is adhered to when the *data owner's vocation* touches upon the value of secrecy and trust in public administrations.

Evidence and the smart city

In terms of the interplay between evidence and urban planning, the *experimentalist's credo* builds on a radically empiricist approach in which data are considered to be raw signals on top of which neutral algorithms can find useful patterns. Historically, this evokes classic positions from British philosophy, such as John Locke's (2003 [1690]) 'tabula rasa', which posits that rules for data treatment emerge from interactions with data. Data points are understood as imprints that make a mark on a passive and blank mind that subsequently becomes active in processing and finding patterns in these imprints. This is a model of perception and thought that emphasises sense inputs, as well as logical procedures, for organising these inputs into insights and understanding. It can be argued that the *experimentalist's credo* translates this philosophy into a modern version in which sensor data replace sense inputs, i.e., algorithms replace the synthesising mind.

In recent debates on Big Data, the *experimentalist's credo* echoes the suggestion that behavioural data can be viewed as signals that are more honest than other sources (Pentland and Heibeck, 2010), as well as the idea that algorithmic pattern-detection can foster more neutral insights than analyses that originate from idiosyncratic human hypotheses and concepts (Anderson, 2008). Furthermore, the suggestion that evidence should be judged by its practical effects alludes to an idea recently promoted by Victor Mayer-Schönberger and Kenneth Cukier (2013). They argue that Big Data should be evaluated according to each individual case, i.e., whether it is 'good enough' to handle the specific purpose for which it has been employed. This resonates with a critique of the municipality as prioritising perfection and a zero-failure attitude in situations in which lower standards would be acceptable because it would increase the use-value of data (e.g., by enabling faster analyses).

The criticism of traffic modelling voiced in one of the quotes above is also paradigmatic of this discussion. First, it has been argued that models build on hunches, which are easily translated into unfounded theories or vague assumptions in the sense of Anderson (2008). The insistence on building these assumptions into models arguably runs counter to the promise of working with raw data and neutral algorithms. Second, the models are criticised for being too slow. They trade balance for perfection, which is not a sensible trade-off if one believes that traffic regulations would perform better if they simply were grounded in slightly less valid

– but much faster – data inputs. To the extent that the *experimentalist's credo* can be said to insist on an evidence-based mode of governance, it mobilises, at the very least, a very pragmatic version of evidence.

Conversely, *the data owner's vocation* mobilises a much different interpretation of evidence and knowledge. In a philosophical sense, this frame has roots that go back to Immanuel Kant's (1998 [1781]) initial critiques of British empiricism. Kant's fundamental claim was that the organisation of sense perceptions was not a task for neutral minds. Rather, he argued that sense inputs are perceived and synthesised in ways that cannot be separated from the characteristics of the person doing them, i.e., there is no 'tabula rasa'. Variations of this idea since then have motivated different formulations of the epistemological claim that data and analysis are situated phenomena. The quotes about the role and value of data as something contextual echo this critical approach to evidence and knowledge.

In recent debates about Big Data, we have seen the critique of the empiricist position translated into a body of scholarly work that shares the claim that '*raw data* is an oxymoron' (Gitelman, 2013). One line of thought is represented by scholars such as Danah Boyd and Kate Crawford (2012), who argue that data always are imagined with root-specific questions and world views. The moment of production is never neutral, and the idea of a world with pervasive and honest data is a dangerous chimera around which to build governance. This insistence on understanding production contexts is echoed in many of the quotes used above to illustrate the *data-owner's vocation*. Another relevant theoretical resource that highlights the importance of context is 'critical algorithm studies', which explicitly discuss the politics of algorithmic knowledge production (Gillespie, 2014). For instance, they urge analysts who use algorithms to guide their explorations of large data sets toward thinking about the logical procedures and scripts involved as being active in the sense that they make important selections in deciding what's relevant in data. Again, this is something that may be lost in the kind of crowd-based analytics advocated for in the *experimentalist's credo*, but it might be maintained in the ways in which the *data owner's vocation* links analysis with field experience.

Conclusion

This paper presented an analysis of interviews, focus groups and workshops with employees in the technical administration in the municipality of Copenhagen during the year after winning a smart-city award. This administration was chosen as a case study because it exhibited characteristics that made it 'most likely' to

succeed in translating the idealised version of the smart city into a workable bureaucratic practice. Drawing on the work of Orlikowski and Gash, the empirical analysis aimed to identify and describe incongruent 'technological frames' that could illustrate different methods of making sense of data and the smart city within this single organisational unit. The outcome of the analysis was a description of two distinct technological frames that shared a focus on links between markets, evidence and governance, but that had much different ways of making sense of them.

One frame was termed the *experimentalist's credo*. It took inspiration from the IoT and exhibited a readiness to learn from the open-source community in software development. Trademarks of this approach to organising are beliefs in crowd intelligence, explorative-analysis transparency and agile processes. Its method of framing data and the smart-city primality rested in the developmental unit of the administration, and it was legitimised with references to best practices outside the municipality. Its conceptualisation of markets and evidence was traced back to 18th century British empiricism and arguably held theoretical affinities with contemporary theories about honest signals and theory-free analysis.

The other frame was termed the *data owner's vocation*, and it was characterised by a situated approach to data. For instance, it was emphasised that all data must have a production context that is both strategic and political. Accordingly, data must be interpreted and analysed with knowledge of this context present. Furthermore, it was emphasised that organisational values such as transparency and innovation must be balanced against classic bureaucratic values such as trust and control. This way of framing data in the context of the smart-city primarily was located in the maintenance unit of the administration, and it was legitimised with references to personal experiences from existing mundane data practices in the municipality. Its conceptualisation of markets and evidence was traced back to 18th century critical idealism and arguably held a theoretical affinity with contemporary theories about the politics of data and algorithms.

It was argued that these findings contribute to literature on smart cities in two ways. First, they illustrate that one should be careful not to reify the smart city being analysed. Many critiques of the smart city delve into an idealised version of the phenomenon, which easily leads to the isomorphic argument that public administration is headed toward a mode of governance that is shaped by environmental factors, such as Silicon Valley trends. In the case of Copenhagen, one could, for instance, have made this argument by referring to the demonstration case that won the prize in Barcelona. However, the analysis illustrates that translating a technological trend into prize-winning slides is much simpler than translating those slides into a shared understanding of the essence of data and the smart city. Rather than crafting external critiques of ideals, the analysis illustrates the potentials in problematising the smart city from inside the organisation, which should realise it.

Second, the findings suggest that *even if* a transition toward implementation of a technocratic smart-city paradigm exists across public administrations, this paradigm is not unique because it proposes a role for markets and evidence in governance. Both technological frames identified in the analysis emphasised the need for such links, but differed in how they were created. In relation to the market, the interesting distinction was whether it was understood as an infrastructure that enables collective intelligence to produce solutions, or as a regulated space that makes stable relations between partners possible. Regarding evidence, the important divide existed between the empiricist's tendency to think of knowledge as a synthesis of already existing data, or a more critical reflection toward the way data and evidence are situated and mobilised in different contexts.

Theoretically the paper drew on literature that stemmed from a specific reading of the sense-making paradigm. As Holt and Cornelissen (2014) have argued, there is a risk that such a theoretical move becomes overly anthropocentric because the predominant unit of analysis is agents with linguistic, embodied and cognitive capacities. The interview technique in this paper amplifies this risk as the identified frames are grounded in stories and descriptions, rather than observed practices. Future studies that build on this paper productively could expand the theoretical and methodological criteria by which 'sense' is understood and thereby explore how to make sense of data beyond articulation. The kind of sense-making that occurs through everyday data use is an important line of study that could provide the materiality of data infrastructures with a more prevalent place in descriptions of the contemporary smart city.

Note

1. Each interview lasted between 1 hour and 90 minutes and they were based on a semi-structured interview guide asking questions about the interviewees existing practices of working with data and their interpretation of the role of

data in a future 'smart' Copenhagen. The focus group included three employees from Copenhagen Solutions Lab and lasted for an hour and the workshop was organised as a design game (Brandt and Messeter, 2004) where groups of people were placed around a table. One person would pick an image and the others had to tell a story related to their data-practices with departure in this image. For instance, an image of doctors working on an operation got one of the participants talking about the need to care for data and the importance of not rushing an analysis. The workshop was attended by 12 participants and lasted for 2 hours.

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