# At the Heart of Smart

*On sociotechnical imaginaries about smart cities and the ways in which these shape data practices and knowledge production in Rotterdam Knowledge Labs*

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## Abstract

Lampposts that serve as CCTV devices, infra-red sensors measuring the current occupancy level of public spaces, hybrid offices; digitization and implementation of smart city technology are on the rise, with covid-19 giving an impulse to both. The dominant discourse about these developments is usually tech-driven, aimed at efficiency and improving the lives of the urban citizen. However, critical accounts of the smart city originating in feminist standpoint theory and feminist Science and Technology Studies highlight the potential harms and dangers when it comes to urban life, whether that be the construction of a new urban morality or a surveillance-city. To bring these meta discourses closer to practice, this thesis is aimed at reconstructing the sociotechnical imaginaries about smart city and smart citizens held by those involved in producing knowledge thereof on a daily basis. By means of an ethnography amongst data practitioners in Rotterdam Knowledge Labs, this thesis shows that with a topic as pressing as smart cities, it is crucial not to forget about the personal and sociocultural elements in an otherwise technocratic discussion. (Re)constructing sociotechnical imaginaries is a helpful tool to understand the political and material aspects of a public issue.

**Keywords:** Sociotechnical imaginaries, Smart city, Digitization, Knowledge production, STS

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## Introduction

Streetlighting has been a critical component of any urban landscape since the Victorian era and increasingly recognized as a major social intervention (Entwistle & Slater, 2019). During the ongoing evolution of the so-called Internet of Things (IoT), enabling the marriage between information technology and physical infrastructures, many businesses, policy makers and scientists experiment with opportunities for urban innovation and creating 'smart cities' (Jin et al., 2016). The CENT-R, a multifunctional lamppost which hardly resembles its Victorian predecessors, is one of these experiments. Cameras and license-plate detectors to enhance neighbourhood safety, a charging station facilitating electric driving to contribute to a sustainable city, the CENT-R lamppost is said to provide many benefits to citizens and those engaged in designing and controlling the urban environment. In January 2020, three of these future-proof lampposts were placed as a pilot in Reyeroord, a neighbourhood in Rotterdam (Rotterdam Innovation City, 2021; Van Ketwich, 2020). The lamppost embodies an utopian vision of the urban future wherein data-driven action results in 'frictionless control, coordinated command and optimal reactions' (Sadowski & Bendor, 2019; p. 541).

Making a city smarter does not happen solely in the public space, as Nam and Pardo (2011) point out; the connotation of 'smartness' in smart city stands for cities making efforts to be smarter in policy and management as well as in technology. During the ongoing Covid-19 pandemic, organisations and companies have made striking efforts to transform themselves into smart, hybrid organisations by adjusting their modus operandi to new types of hybrid working, making use of a myriad of innovative technologies in order to sustain the office life online (Zhang, Cai, Zhang, & Leung, 2020). In a time where co-producing knowledge has become more and more valued to answer societal questions (Sorrentino, Sicilia, & Howlett, 2018), collaborative entities such as Knowledge Labs arise, wherein policy makers and scientists can meet to exchange expertise and attempt to answer (policy) questions that arise around these urgent challenges (Mulder, 2014). This thesis is aimed at (re)constructing the ways in which professionals involved in knowledge production in Rotterdam Knowledge Labs envision issues such as the rise and potential harms of smart technology, and on how these collections of imaginaries contribute to the co-production of the smart citizen and the smart city.

Societies are inevitably becoming more and more digital (Anand, 2020). The overarching discourse in policy documents, news items, commercials about these IoT, data-driven innovations such as the CENT-R lampposts and hybrid offices is generally optimistically voiced. They claim the possible contributions to societal challenges by integrating technology-driven solutions in urban infrastructures. However, in the literature and scholarly fields such as feminist theory and feminist Science and Technology Studies (STS), one also encounters

more sceptical and even distrusting accounts of the surge in smart city projects and its data practices (Fotopoulou, 2019). This term 'data practices' originates in feminist STS and encompasses 'the materiality of data, thinking about labouring bodies, invisible human practices, and social relations and activities' (Butot, Bayerl, Jacobs, & de Haan, 2020; Fotopoulou, 2019; p.2). Some key examples from previous studies using the term data practices are algorithmic disobedience by citizens, self-tracking of personal health and the collection of data by public or private organisations. This thesis focusses on two critical concerns related to big data and smart city technology, being the morality of urban life and privacy in a smart city.

According to critical scholars (Sanders, 2017; Vanolo, 2014), smart cities impress a new moral order on the city by introducing technologies which enable the making of a distinction between the 'good' and the 'bad' city, which results in a new way of disciplining its inhabitants. This results in the construction of the 'smart citizen' and a new way of disciplining wherein 'citizens and local communities are invested with a moral obligation to behave in a certain way and adhere to the collective project of building smart cities' (Vanolo, 2014; p.893). From a feminist perspective, one might question who might be excluded in this notion of smart citizenry. What is more, generalizing every citizen as a 'smart citizens' obscures the unseen consequences of technologies, which are often assumed to be neutral and unbiased but harbour positionalities and potential biases of its makers within them (Bauchspies & de la Bellacasa, 2009).

Furthermore, there is the issue of privacy concerns that come with smart city projects, where an increase in urban safety by means of CCTV surveillance comes at the cost of urban privacy (Butot et al., 2020; van Zoonen, 2016). It has been proven by scholars on numerous occasions that technology and algorithms can in fact have racist and/or sexist outcomes (Crawford, 2016; Zou & Schiebinger, 2018) and feminist STS focusses on the assumed neutrality of technology and aims to situate and contextualize its development (Bauchspies & de la Bellacasa, 2009). Working from home in an online environment has also brought with it its own privacy challenges, as online platforms such as Zoom are often accused of not safeguarding their users privacy-related rights and having unsafe default settings (Khan, Brohi, & Zaman, 2020). Seemingly objective technologies and knowledge thereof are produced by people and (unconsciously) informed by biases and positionality. According to feminist ideas of knowledge production, knowledge and technologies need to be situated and their origins traced, as the sort of knowledge that is produced depends on who its makers are (Haraway, 1991; Harding, 1991). This will serve as the aim of this thesis, as elaborated upon below.

It becomes clear that the rise of the smart city can be imagined in different ways. In the literature however, little attention is paid to what knowledge producers about the smart city,

such as policy makers and scientists, imagine the smart city to be (Sadowski & Bendor, 2019). For the purpose of this thesis, I have named this group the Data Practitioners to stress the material aspect of their work and de-idealise it, in line with the term data practices coined by Fotopoulou (2019). To produce knowledge about the state of affairs, future possibilities and dangers of the smart cities, is to engage with and shape the issue. Although the literature on smart cities and co-producing knowledge in collaborative entities is extensive and crosses disciplinary borders, the feminist and feminist STS perspective on knowledge production has not been directly applied to the specific group of data practitioners. Moreover, seemingly 'neutral' positions of professions such as scientists and policy makers are often left unquestioned. This leads me to the main question of this thesis:

*How do the data practitioners and their data practices in Rotterdam Knowledge Labs contribute to the co-production of 'smart cities' and the notion of the 'smart citizen'?*

The rise of smart cities and smart technologies, such as the CENT-R lamppost and hybrid online offices, are part of a seemingly inevitable rise of digitization our society. Little attention is paid however to the role and preconceptions of those in charge of knowledge production about these issues, even though they possess a high degree of political power over the issue. It is thus crucial to get a better grasp of the ways in which notions of smart societies and smart citizens are co-produced in these Knowledge Labs, as the research and data practices of today will have a string influence on the urban reality of tomorrow. Therefore, this thesis on conceptions of smart city technology, big data and sociotechnical imaginaries in Knowledge Labs is highly relevant. Taking on an STS-conception of 'co-production' enables researchers to describe the relationship between the production of scientific knowledge and the natural and social order (Wehrens, 2014). Using the term sociotechnical imaginaries by Jasanoff (2016) will aid in bringing back the material and praxis side to an otherwise techno-driven discourse. The particular case of the Rotterdam Knowledge Labs provides a particularly well-fit case to do so, as these are institutionally established and acknowledged spaces of knowledge production with a high level of deemed expertise.

## Theoretical framework

A brief history of the smart city

The concept of smart cities did not suddenly fall from the skies, and I want to present a small 'history of the present', tracing how certain contemporary practices and institutions emerged out of specific struggles and often forgotten exercises of power. The notion of the smart city is a logical consequence of previous endeavours concerning urban development, such as the rise of New Urbanism in scholarship the 1980s which was aimed at improving the urban environment and the quality of life in cities through proliferation of forms of development inspired by logics of personal mobility and promoting communitarian ideas (Wang, 2017). The adjective of 'smartness' is derived from the concept of the 'intelligent' city'; 'mainly involving the relationship between urban space and technology and including issues such as the ability to generate innovation, transition towards forms of e-governance, social learning, and the possibility to provide ICT infrastructures' (Vanolo, 2014; p. 888). Big tech corporations were quick to acknowledge the massive opportunities this renewed focus on integrating technology in urban space, which significantly contributed to the exponential spread of smart city discourse and which I will elaborate on more later on in this theoretical framework (Sadowski & Bendor, 2019; Söderström, Paasche, & Klauser, 2014).

In the past year, these investments in creating a smarter urban environment, as well as smarter organisations and working environments have undergone a massive surge due to the Covid-19 crisis (Zhang et al., 2020). Working from home became 'the new normal', which meant there was a need for well-functioning technology to fit the needs of quick communication and suitable working circumstances. The 'smartifying' of work and of whole organisations had been a part of the larger trend of smart cities for years already (Nam & Pardo, 2011), but has gained large momentum over the last year and infiltrated the private spheres of people more and more. For instance, CCTV devices on the streets in smart urban landscapes can be seen as analogous to a laptop webcam used for online videoconferencing in private, smart working environments. This begs the question what role this accelerated implementation of smart technologies in the private sphere plays in the already dubious boundary between public and private issues within a smart city (Evgeny Morozov & Bria, 2018; Warner, 2002).

Sociotechnical imaginaries and 'Labs'

The history and current role of the smart city and smart technologies can be envisioned in different ways, and the concept of the sociotechnical imaginary can be used to get a better understanding of the ideas and principles that steer the imaginaries of those engaged in data practices and knowledge production. The term, originally coined by Sheila Jasanoff (2016, p. 6), entails the 'collectively held, institutionally stabilized, and publicly performed visions of

desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology.' This focus on performativity, on the materiality of engaging with smart cities, reveals that big data and smart cities can be seen as wider political issues in contemporary societies – not just an issue to be resolved technocratically by data activists (Fotopoulou, 2019). The idea of the sociotechnical imaginary inspired me from the moment I first read about it, as it so clearly shows how imagination is a social practice and political systems too make up a particular kind of imagined reality.

The concept of the sociotechnical imaginary has been applied to the case of the smart city before. Sadowski and Bendor (2019) laid bare the dominant corporate imaginary that companies such as IBM and Cisco constructed, framing smartness of cities as inevitable developments whilst plotting out a near future that largely reproduces and maintains existing socio-political systems. Corsini, Certomà, Dyer, and Frey (2019) applied it to the realm of citizen's engagement in smart cities, stating that the co-production imaginary is on the rise. Investigating these imaginaries amongst varying publics in different contexts is an important task. Delina (2018) states that the power of a sociotechnical imaginary lies in its ability to guide and co-ordinate decisions, investments and action across techno-epistemic networks and in being able to include or exclude particular actors in the decision-making process. Multiple imaginations of a certain issue can co-exist and they shape the ontological politics, actively co-producing the conditions of possible realities (Mol, 1999). Different imaginaries are never entirely separable, and data practitioners might move between them during the course of their professional lives. Getting a grasp on what these imaginaries are, though, clarifies the kinds of political and social alternatives that different social imaginaries ascribe to the notions underlying smart city and smart organisations.

Even prior to reconstructing the imaginaries held by people working *in* the Knowledge Labs, one might begin with wondering about the imagined and practical role *of* these labs and of naming them as such. In Science and Technology Studies, where the concept of the sociotechnical imaginary originates from as well, laboratory studies are extensive. STS scholars have produced well-known accounts of the qualities of laboratories 'as privileged spaces that channel and accentuate the power of science' (Evans & Karvonen, 2010; p. 126; Latour & Woolgar, 1979; Lynch, 1985). These privileged spaces, purposefully separated from the world, allow for the testing of hypotheses and experimentation with different accounts of reality. Their 'placelessness' is a common feature (Evans & Karvonen, 2010). Furthermore, the focus on expertise, experimentation and scientific authority of knowledge obstructs easy access and keeps the process of knowledge production in data practices closed off from those who do not meet requirements of entry (Evans & Karvonen, 2010). From a feminist standpoint theory point of view, this is problematic as power positions produce selective blindness with respect to oppression and inequality (Harding, 2004). The Knowledge Labs utilize this

metaphor of the lab, and it might be interesting to investigate what these metaphors represent, seeing them as being 'more than a metaphor' (Haraway & Goodeve, 2000).

The good, the bad and the citizen

Data practitioners involved in knowledge production about smart cities can thus be influences by differing sociotechnical imaginaries. This section will explicate two realms of concern about the smart city that are often named in critical literature: moral concerns and privacy concerns. These concerns can have significant impact on imaginaries and the way certain public issues are constructed, which is central to this thesis. In the literature, more matters of apprehension can be found relating to smart city experiments, such as those arguing that promoting the smart city as a brand is a way for big tech corporations to make profit by selling new technological instruments (Sadowski & Bendor, 2019). Due to a limited permitted number of words for this thesis, I will leave these arguments untouched for now. These concerns should not be seen as entirely separate, but as multiple enacted versions of the same reality, differing from one another and yet in some ways interrelating (Mol, 1999).

Let's start with looking at the moral aspect of the issue. The dominant discourse about smart cities is that of the 'good city', where smartness stands for being resilient, healthy, and technologically advanced through introduction of technologies (Wang, 2017). Critical scholars have however pointed out the rise of a new moral order as a consequence of implementing smart technologies, disciplining urban citizens and implicitly distinguishing itself from the 'bad' city (Vanolo, 2014; Wang, 2017). 'Good' city discourse produces a new set of responsibilities for the city concerning issues such as environmental protection, technological advancements and quality of life (Vanolo, 2014), where technology is presented as the solution to all the problems related to these issues. This hinders those involved in city design and policy making, in for instance Knowledge Labs, from imagining alternative solutions to urban issues. Furthermore, the idea of the good city might even function as Foucauldian disciplining biopower, 'smartmentality', wherein its citizens impose themselves with ways in which they should and should not behave (Vanolo, 2014). The quote below was an eye-opener to me personally, as I had been inspired by Foucault's notion of biopower and this quote inspired me to see how imaginaries about this smartmentality play out in practice during my thesis.

*Citizens and local communities are invested with a moral obligation to behave in a certain way and adhere to the collective project of building smart cities; "government at a distance" […] Another example may be the manipulation of lifestyles towards green consumption and ecological tourism. Smartness is becoming a field of social control that makes intrusion in a person's private life quite natural.'* (Vanolo, 2014; p. 893-894).

This consequentially leads to the construction of a certain type of 'smart citizens', which implicitly stands for the good citizen as opposed to the bad, not-smart citizen (Bull & Azennoud, 2016; Cardullo & Kitchin, 2019a; Shelton & Lodato, 2019). Whereas literature on smart citizenship in fields such as public administration and engineering focused mainly on ways for city planners and engineers to increase so-called user engagement (Bull & Azennoud, 2016), critical scholars have pointed out that it cannot simply be assumed that smart city technology brings forth smart citizens. Furthermore they point out that most 'citizen-centric' smart city initiatives 'are rooted in stewardship, civic paternalism, and a neoliberal conception of citizenship that prioritizes consumption choice and individual autonomy, […] rather than being grounded in civil, social and political rights and the common good' (Cardullo & Kitchin, 2019; p.1). It seems that the notion of smart citizenry applies only to a select few of the city inhabitants that have access to and knowledge of technologies, which means that the smart city is eventually an uninhabitable or even hostile city to others. The Covid-19 crisis is harsh proof of this, as switching to digital spaces as a necessity instead of an amenity has proven to increase digital inequalities between families who have the means to adapt and the families who do not (Beaunoyer, Dupéré, & Guitton, 2020; Zheng & Walsham, 2021). It should be interesting to see what conception data practitioners have on the relation between citizens being smart and being good in the smart city.

Taking all this in consideration, questions arise about who has possession of the power to create these conceptions of goodness and badness, and shape the exclusionary practices that come with it. Feminist standpoint theory might be of aid here, as it investigates and lays bare that production of knowledge is situated and shaped by positionality, being the way in which your identity influences and potentially biases your understanding and outlook of the world (Harding, 1991, 2004). The focus on smart citizens implies a universality of urban citizenship that, according to feminist theorists, is faulty, as 'urban citizenship pivots upon the creation of demarcating lines of inclusion and exclusion in the city, of membership within the imagined urban community, and of claims to urban space and the right to the city' (Secor, 2003; p 164). Smart cities and its moral impediments should therefore be analysed as an issue in motion, housing a multiplicity of controversies and practices of exclusion and it is crucial to see whether knowledge producers on the issue see it as such as well. Looking at the citizens specifically, some feminist scholars have argued that they can be viewed as a subaltern subjects; silent and invisible subjects, deprived of agency and self-determination due to exclusion from hegemonic culture (Spivak, 1988; Vanolo, 2016). This stands in stark contrast to the agency-filled conceptions of smart citizens that dominate classical governance literature on smartness, wherein the smart citizen is described as empowered and able to use smart technology to their own advantage (Bull & Azennoud, 2016; Shelton & Lodato, 2019). Kitchin (2014) noted even leading vendors of the smart city, such as IBM and Google, have put an

emphasis on empowerment of the smart citizen in their communication. We should therefore investigate the multiplicity of actors that engage in knowledge production about and are affected by the moral aspect of smart city making. Who decides what 'good' is concerning cities and citizens and what are the consequences of the rise of smartmentality (Vanolo, 2014) in knowledge production processes concerning the matter?

Big data is watching you?

The second issue that ought to be discussed to get a better grasp on the controversies in smart city developments is the privacy-safety dilemma, which according to some scholars might result in the smart city as a surveillance city (Sadowski & Frank, 2015; van Zoonen, 2016) and the impeding of 'smartmentality' on its citizens (Vanolo, 2014). The racialized and sexualized potential harms of surveillance technology have been accounted for in the literature by critical scholars such as Chokshi (2019) and Crawford (2016), who investigated respectively the racialized workings of facial recognition technology and agonistic workings of algorithms. At the start of the Covid-19, governments, industries and citizens were desperately seeking for ways to convert the home into a suitable office space. Scholars have warned that this sense of 'rushed innovation' has led to people's privacy being seriously at stake, for example when it became clear that a much-used platform for videocalls, Zoom, was sending data to Facebook and showing users IP address, location and device information (Newlands et al., 2020). Getting to know what data practitioners and knowledge producers themselves think of these issues is crucial, as they are the people behind the so-called objective technologies.

It is often assumed that citizens are aware of the privacy concerns that follow from surveillance technology. However, Van Lieshout, Friedewald, Wright, and Gutwirth (2013) pointed out that this assumed dichotomy of privacy versus safety is misguided, pointing out that safety and privacy are in fact multidimensional and contextual concepts and that citizens are not capable of making a well-informed weighing of the two. This way, the 'smart' citizen might become the 'surveilled' citizen, who believes that his or her privacy is well protected but whose beliefs rest on false or uninformed grounds (Butot et al., 2020; van Lieshout et al., 2013). This notion of urban citizenry strips citizens of their privacy, often without them knowing so and transforms them into possible suspects of crime, often based on racialized and sexist notions of who might be suspect and who might not. Another contrasting imagination of the smart citizenry, however, is that of technical citizenship; wherein the citizen has agency and speaks out about their issues with technology, both a priori and a posteriori (Cardullo & Kitchin, 2019b). STS scholars note that notions of citizenship, in relation to technology, is a fluid concept and can take on several roles:

*'The systems enroll individuals in networks which associate them in various roles, for example, as users of the technology or workers building it, or even as victims of its unanticipated side effects. Interests*

*flow from these roles where the individuals have the capacity to recognize them. […] This is conscious co-production: the reciprocal interactions of members of the network and the codes that define roles and designs.*' (Freenberg, 2016; p. 646)

It should be interesting to see whether data practitioners have the same fluid notion on citizenship, or that their idea of the people they are designing and researching for are a uniform group. Central to the field of Science and Technology Studies is the attention paid to the enactment of subjectivities, and showing how marginalised and 'othered' subjectivities have historically been excluded from achievements of 'objective' science and have been subjugated to technological developments (Suchman, 2008). Furthermore, feminist STS scholars pay attention to 'the purportedly asubjective materiality of technological facts', and try to situate them in the webs of power relations and biases in which they have been invented (Bauchspies & de la Bellacasa, 2009; p.227). Applying feminist STS is a fruitful way of peeling off the layers of the apparent neutrality of technologies and pay more attention to the actual practices of constructing these technologies and the dissemination of knowledge thereof. Secondly, feminist STS allows us to take a look at the multiplicity of modern subjects that engage with these technologies and the ways in which they might be overpowered or subjugated by it. I am inspired by feminist scholars such as Gillian Rose (1997) and Donna Haraway (1991), who point out that we should first investigate the positionality of the knowledge producer. This way, knowledge production and discussions thereof can become a more diverse and open process wherein the interests of other actors than corporations and the market are represented. These ideas made me want to explore the ways positionalities play out in practice and the ways they influence the construction of public issues.

## Methods

The ethnography and feminist reflections on methods

The main research question of this thesis is: *How do the data practitioners and their data practices in Rotterdam Knowledge Labs contribute to the co-production of 'smart cities' and the notion of the 'smart citizen?*' I have chosen a qualitative research design by means of ethnography, which comes down to formal and informal interviews, and observations of regular practices and events within the Knowledge Labs. Additionally, I have analysed essential documents, such as yearly team evaluations and mission statements, as analysing use of language is one of the main ways to reconstruct sociotechnical imaginaries (Sheila Jasanoff, 2016) As Skeggs (1994; p. 76) argues, 'Ethnography provides interpretation and explanation by strategies of contextualization. Once we see how something exists by being embedded in a set of relationships, we more easily understand it'. Stacey (1988; p. 22) adds to this: 'Moreover, because in ethnographic studies the researcher herself is the primary medium, the "instrument" of research, this method draws on those resources of empathy, connection, and concern that many feminists consider to be women's special strengths.' The goal is to reconstruct the subjective imaginaries and more general processes of knowledge production within Knowledge Labs, which will provide a deeper insight in the ways in which co-productive entities such as Knowledge Labs steer and contribute to modern issues and the controversies that come with it.

Although there is no all-encompassing guide with a fixed set of rules and criteria that feminist research should stick to, there are still some common features which can be identified. Feminist scholars oppose the widespread positivist approach in research, which rests on detachment, abstractions and universalist notions of knowledge. Instead, most feminist scholars are in favour of integrative, trans-disciplinary approaches to knowledge which situates theory in concrete contexts (Harding, 1991; Stacey, 1988). Feminist STS scholars in particular have devoted a lot of their attention to breaking down demarcations between science and non-science, knowledge and opinion or nature and culture to get a better understanding of how empirically, knowledge is produced (Marres, 2018; Schnabel, Breitwieser, & Hawbaker, 2016). An ethnography is a fitting research design to honour these principles and many feminist researchers have indeed appointed this research method as very well suited to reconstruct subjectivities and experiences within specific contexts. However, there is also critique of the ethnography as a research design, as it might subject research subjects to risk of exploitation, betrayal and abandonment as well as being an intervention into a system of relationships that the researcher is better able to leave (Stacey, 1988).

Situating knowledge, situating myself

Having stressed the importance of situated knowledges and being aware of power dynamics throughout this thesis (Haraway, 1991; Harding, 1991), it should only be logical that I position myself as researcher of this thesis as well. As a student-assistant at the research team Evaluating Societal Impact at the Erasmus University, our team is tasked with evaluating the co-productive collaborations between the municipality of Rotterdam and the university, among which are the Knowledge Labs 'Urban Big Data' and 'Organisations in a Smart City'. The team will be conducting interviews and document studies to see how these collaborative bodies contribute to evidence-based policies, knowledge dissemination and valorisation of research by the university and I chose to pick a thesis topic that would create synergy with this project. During the interviews, I will have time to ask my own questions and I will conduct additional interviews as well, but it should be clear that my own research is informed and shaped by the processes of the Evaluating Societal Impact team.

This interrelation of my own research with a larger research project is both advantageous as well as disadvantageous for my research. The gatekeepers (Reeves, 2010) of the Knowledge Labs were more likely to speak to me, let me join their daily activities and trust me with information, legitimized as a researcher in a team from the university. On the other hand, this constant switching between my roles as master's student and evaluator did lead to some level of role strain which I had to deal with during and after data collection. Then again, trouble in the research process might lead unconventional situations which in turn may lead to useful insights. (Social) research is performative, in the sense that it creates new situations instead of solely extracting information from a certain setting (Markussen, 2005; Marres, Guggenheim, & Wilkie, 2017). It is virtually impossible to provide fully transparent reflexivity on your own positionality and potential biases (Rose, 1997), but by explicating my role as both a master's student and a student-assistant in a research team, I hope to have provided more context to why I have chosen this topic and what my own interests might be.

Research design and data analysis

So, with these methodological considerations attended to, what is it that I have done to gather the stories and subjective experiences and imaginaries of the people involved in the Rotterdam Knowledge Labs? This ethnography consisted of interviews, informal conversations and observations of meetings, conferences and/or presentations that were organised by the Knowledge Labs. I have conducted 12 interviews with data-practitioners and five observations of varying events, from formal presentations to informal team meetings. The semi-structured interviews were aimed at trying to reconstruct the practices and imaginaries of the Knowledge Labs and the data practitioner's engagement with the several controversies of smart cities as explicated in the theoretical framework (Creswell & Poth, 2017). I spoke to a varied group of people involved in the Knowledge Lab, from university researchers to policy makers and from

coordinators to research interns. This is in line with the feminist tradition of doing research as well, as feminist research is aimed at hearing voices that are often left out of data collection as their positions are deemed irrelevant or unimportant (Stacey, 1988). During the observations then, I was able to get away from the artificial context of an interview and see how these imaginaries played out 'in real life' and how these inform data practices and processes of knowledge production. An exact overview of the interviews and observations can be found in Appendix 1. Documents such as yearly evaluations were analysed as well, as objects and things can serve as actants as well in these knowledge producing networks (Ingold, 2012).

As we are living in a world in which measures due to the Covid-19 crisis still restrict large bodies of people to come together, all of these interviews and observations have taken place through the online social platform Microsoft Teams. I do not want to see this as a limitation to the research, but as an enrichment. Besides the practical benefits of people being more inclined to make an interview appointment, it also plays in with the research topic itself; how do people experience working in an environment completely mediated by technology? Taking into account the privacy of respondents is of great importance in research (Creswell & Poth, 2017), which is why I have drafted an informed consent form for respondents to sign as well as fill in the Ethics and Privacy Checklist of the Department of Public Administration and Sociology myself. Respondents' answers are de-personalized and the data that is gathered for the purpose of my thesis will not be shared with other parties and stored on an encrypted drive.

The reconstruction of sociotechnical imaginaries thereof is often achieved through unobtrusive methods such as discourse and document analysis (Delina, 2018; Sheila Jasanoff, 2016; Sadowski & Bendor, 2019). Interviews and observations are less common, although they might be well fitted for a more engaging research project that aims to situate imaginaries in practice. To answer the research question, I have recorded the interviews and made field notes during my observations. The interview recordings were all transcribed and openly coded, through the use of the qualitative data analysis software Atlas.ti. As language is seen as an important medium for the construction of imaginaries, the process of open coding and data analysis of the data focussed mainly on discourse about smart city innovations. Furthermore, I tried to get a grasp on how these imaginaries materialised in data practices by those involved in the Knowledge Labs.

## Findings

Daily data practices in Knowledge Labs

*It's a Wednesday afternoon. I pour myself some tea, open my laptop and click on a MS Teams link sent to me by the coordinator, as do the other six team members of Knowledge Lab Urban Big Data. All from behind our desks at our home offices, spread across Rotterdam and beyond. 'Hi everyone!' The team makes a round where everyone can give an update about their ongoing projects; student hackathons were successfully completed, postdoc research about the use of facial recognition by the municipality is in full swing, someone is congratulated on their new position at the university. After one hour, the coordinator says, 'Any last questions?' The group stays silent. 'Okay, see you next time!' Then, the screen goes dark again.*

It is crucial to outline the actual practices that go on in the Knowledge Labs as it shows how are the smart city and big data actually being *done* in a certain sociocultural context, instead of merely talked about on a more dehumanized and discursive level. I was welcomed at several team meetings and events hosted by the Knowledge Labs Urban Big Data and Organisations in a Smart Society.

In the Knowledge Labs scientists from different career-levels, from master students to associate and full professors, conduct collaborative research with civil servants from the municipality of Rotterdam. According to their mission statements, the Labs strive to bridge the existing gap between science and policy, *'by stimulating collaboration to generate knowledge and translate this to usable products, services and facilities to be implemented in practice'* (Organisations in a Smart City, 2021; p.2). Research questions often arise bottom-up, where one of the core team members from the side of the municipality notices a question or issue within the organisation, discusses this within the Knowledge Lab and together they try to find a possible answer, solution or research set-up to deal with the question. These answers can take the shape of a webinar on a certain topic, workshops for interested civil servants and even complete PhD or postdoc positions, financed at least partly by the Knowledge Labs. All these activities revolve around issues such as smart organisations, data-driven working and smart city applications, such as sensors or the use of facial recognition technology. It became clear however, that these topics played a role in the practitioners' professional lives as well as their personal lives.

*'Last week, I had to make an appointment to pick up bulky waste, it was done in 2 clicks, no fuss!'* The data practitioners do not solely engage in these data practices in their professional lives, but they are dealing with data and smart technology in their personal lives as well. Assistant professor Tim spoke of the London tube system as an example of smart city technology; *'The last time I was there […] I realized I don't even need the Oyster card anymore, just my credit card. And I found that super smart, for me as a tourist.'* Meanwhile, student assistant

Ellen spoke of e-government and the easiness of making appointments to pick up bulky trash as an example of smartness. This goes to show that those who engage in shaping a certain issue by producing knowledge about it, cannot be fully separated from the issue themselves and are in fact influenced by it as well.

What was striking about the practices of the Knowledge Lab was the rather egalitarian way of meeting, discussing and making decisions within a team that consisted of members from all layers of an organisations. Even though all the meetings were held on the online videoconferencing platform MS Teams, which is not highly known for enabling informal and personal conversations, everyone got a chance to speak, reflect on others and bring in ideas. I myself was welcomed as an observant and got to elaborate on my research, as well as ask questions during the meetings. These Labs seem a safe space where people from different organisations can come together to discuss possible research topics and give one another advice. Remarkable too was the absence of private or corporate partners. Even though both labs expressed the wish to collaborate with more partners as well as expand their networks, and corporate institutions are often in the lead in creating smart city discourse (Sadowski & Bendor, 2019), both Labs are yet to join forces with any private partners.

Though the teams operate in an egalitarian and open way internally, through their solutionist stance towards the functions of knowledge, the data practitioners run the risk of excluding other groups of people, as well as other topics to research. A notion that is interwoven in nearly all the activities by the Knowledge Labs, is the idea that producing knowledge about a certain issue or challenge will bring them closer to a solution, or at least to getting a better grasp of the issue at hand. This attitude hints at solutionism, where answers to complex societal issues are sought in clear-cut, (technological) actions and defined as solutions (Morozov, 2014). Thinking solely in terms of 'problems' requiring 'solutions' can be helpful, especially for a large organisation such as a municipality that deals daily with urban challenges. However, this techno-determinist framing can obstruct thinking in terms of alternative imaginations or approaches to a certain issue and there is a high risk of excluding particular groups of human or non-human actants. The result therefore is an egalitarian team, so focussed on scientific authority that they unconsciously exclude other people or perspectives. This is one of the risks of working in a metaphorical lab (Evans & Karvonen, 2010). Approaching and engaging with citizens in the research activities for example, was seen as a real challenge, despite some relevant efforts. As a postdoc researcher put it; *'Because you see that the municipality, how do I say this… They sometimes have trouble approaching citizens, for reasons still unclear to me […] From the perspective of the university it is indispensable and perhaps easier.'*

At the heart of 'smart'

*'But really it is hard to say, it is super hard to evaluate, there are also these indexes and metrics used by magazines about smart cities. Like 'Smart City Magazine has awarded the 10 smartest cities in the world' but most of these things are, at least on some level, bullshit.'*

What is it exactly, that lies at the heart of the word smart? The more I seemed to ask about it, the more versatile the answers became. One of the coordinators of the Knowledge Labs said, *'Indeed, Smart can be a very broad concept to us. Like, sometimes we talked about smart trash containers, or traffic lights, you can make anything smart actually'*. Attempting to define the concept of smartness has led me to two conclusions; that smartness is inherently a relational concept and that by keeping the definition of smart ambiguous, the Knowledge Labs create a productive black box through which they are able to welcome a wide variety of projects.

The concept of 'smart', whether applied to a city, piece of technology, organisation or a country, is multi-faceted and always relational. When during my online interviews I asked if the respondents would call the city of Rotterdam smart, the question that popped up frequently was *'Smart… in relation to what?'*. Kaj, one of the researchers, told me *'Look, in England they have got a whole lot of cameras, but when it comes to innovation or data management, that is really limited to a couple organisations within the government, but not nearly as developed as in the Netherlands.'* The adjective 'smart' then does not merely define the city being referred to as smart, it consequently labels those objects to which it is being compared as 'not-smart'. In the example, the Netherlands might be seen as smart regarding data management by government institutions, which leads the respondent to the conclusion that England is not smart, at least in that regard. This ties in with a Foucauldian notion where exclusion is constitutive for social order (DeLue & Dale, 2021). Social order of smartness is established by determining who or what is not-smart.

Furthermore, at the heart of smart seems to lie the idea that smart cities are good cities, building on the notion of the good versus the bad city, a main concern for theorists as elaborated upon in the theoretical framework of this thesis. All the examples that were given, whether it be e-government, better infrastructure and mobility or hybrid offices, were seen as inherently good things, making people's urban lives easier. Yes, people acknowledged the potential risks, but overall implementation of smart technology was seen as good and inevitable. This has consequences for the ways in which people in the Knowledge Labs go about their work, as the research intern summarized *'It's more about the how, how big data can grow and how more organisations can see its potential, than what it [big data] actually entails.'* Describing what big data and the smart city entailed, seemed a challenge for more of the data practitioners that I spoke to.

This brings me to my second conclusion about defining smartness. By refraining from articulating set-in-stone definitions for concepts such as smart (city) and big data, the Knowledge Labs create productive black boxes of these concepts, enabling them to take on a myriad of divergent projects. These labs have unique positions, both within the university and the municipality, and they are relatively young collaborative entities with a focus on innovation and shedding new light on existing urban challenges. Knowledge production is seen as a broad process and, in line with feminist theory of knowledge production, the labs steer clear of instating unbendable definitions of concepts such as 'smart city' and 'big data'. This is illustrated by the following quote from a student assistant working for the Knowledge Lab Organisations in a Smart City, who told me about her personal struggle trying to define what Smart actually entailed:

*'Well, we discussed this a lot back when I started working there […] We constantly came to the conclusion that the concept 'smart' is very broad and we actually like that, we wanted to pick up on that, so that we could address a lot of different topics in our activities.'*

Trying to define what the word smart exactly entailed proved to be a challenge, but getting a grasp of who the smart citizen is was even more so. We pondered together and it became clear that there was not 'one' type of smart citizen to be defined. In the literature, notions of smart citizenry vary from an emancipated subject, making use of technology in order to better their life's circumstances (Bull & Azennoud, 2016) to a subaltern public, subjugated by technology and made into an agency-less data-provider at most (Spivak, 1988; Vanolo, 2014). A postdoc researcher said, '*The smart citizen, or the "Rotterdammer", it is really the question of who you mean by that? There are so many different neighbourhoods in Rotterdam. Even within one area such as Rotterdam South there are lots of differences already.*' Nevertheless, most respondents did address the fact that digitization is not inherently good for everyone and that some were more easily excluded to smart citizenry. The term 'digital divide' was mentioned in several interviews, with the researchers and policy makers distinguishing between those who can easily adapt to digitization and those 'left behind'. The ongoing covid-19 crisis served as an example for many, where they addressed the gaps between 'those who could keep up' and 'those who could not keep up' with digitization and hybrid working.

Defining characteristics and attitudes of 'the smart citizen' seemed almost undoable, just as defining smartness proved to be. However, respondents spoke more easily about who is *not* a smart citizen. Those who could not keep up with the rise of digitization for instance, and those unaware of what smart city devices were actually already implemented in the city amongst whom were some of the respondents as well. This goes to show that citizenship is not in fact about uniformity and sameness of experience, but as feminist theorists such as

Spivak (1988) have argued, about exclusion and subalternity. This is a process in motion, that is hard to define as it goes on. Is there really a 'smart citizen' to be defined?

Attitudes on potential risks of smartness

*I'm in the middle of an online workshop hosted by the Knowledge Lab Organisations in a Smart Society. The workshop is aimed at civil servants and the topic is hybrid working during and after the covid-19 pandemic. In the MS Teams chat the following questions pop up in the chat:*

> *'I'm exhausted after a day on MS Teams, I fear I'll never have the energy to think of creative solutions?'*
> *'Having conversations about screen time with your boss feels strange, but they will really be necessary!'*
> *'In what way is virtual collaboration a substitution for personal contact on the workfloor?'*

Through their use of language, it became clear that most respondents felt as though this rise of digitization was inevitable. Words and language are essential factors in (re)constructing sociotechnical imaginaries (Sheila Jasanoff, 2016). Words such as '*acceleration*', '*urgency*', '*political pressure*' encompass a certain level of inevitability that was felt amongst most of the data practitioners during my interviews, as well as my observations. One researcher described it as follows:

*'We want our public sector to be conservative to a certain extent, at the same time of course here and there it leads to frustration. […] But something needs to change at some point, because otherwise we will stay in the stone age'.*

This feeling of inevitability is understandable to a certain extent, with the ongoing covid-19 crisis forcing nigh anyone to have a stable Internet connection and laptop at their disposal at all times. However, here too one might ask whether those involved in knowledge production take a standstill enough at imagining alternatives. The speakers at the webinar 'Collaboration after Covid', hosted by Knowledge Lab, did not even seem to doubt the inevitable rise of hybrid working spaces during and after the pandemic. People worried about the consequences and potential risks of this development, but nobody seemed to doubt the development in and of itself or try to imagine it otherwise.

Potential harms and risks are acknowledged by the data practitioners and extensively elaborated upon, yet these harms and risks are always put at a distance from themselves and their personal lives. These data practitioners are dealing with big data and smart city issues on a high level of abstraction and have been trained to do heaps of literary research before making any conclusions. So, it does not come as a surprise that they are aware of the risks that are entailed in rising digitization. They furthermore feel it as their obligation to convey these potential risks to others, as they are the experts who produce knowledge about the issue. This ties in once again with the solutionist attitude that could be found amongst many of the data

practitioners, solving or at least addressing complex issue with more knowledge (Morozov, 2014). What caught my attention however, is the apparent distance that the data practitioners created between themselves and the potential harms and risks they produced knowledge about. Only privacy issues that they had to deal with during their research were bothering them personally. Apart from that, the harms and risks of smart technology were mostly applicable to 'others' who were 'out there', as is illustrated by the following example:

*'Yes, I do think that there is a group that profits less from this, more the executive, yeah, people. So really those at the frontlines for example, the trash collectors or law enforcers, who have to actually be somewhere, you know, physically.'*

This is an interesting quote as it creates some 'othered' being (Suchman, 2008) when, come to think of it, researchers and policy makers have to 'be somewhere physically' for their work just as well. This constructed othered being does not qualify as a smart citizen, but belongs to those left behind. Another researcher said '*[When] thinking about automation and AI, highly educated people should not have to worry that much as they have knowledge based jobs, like [laughs] being at a university!'* This lack of worry about their own positions being affected by digitization might have an effect on the way these data practitioners approach the issue of smart city.

In our conversations, no one really reflected on the risks or harms for their personal lives. One striking moment during my observation of a team meeting was when a researcher talked about his experiences when visiting the security camera control room at the municipality. He spoke of *'some sort of panopticon-like room, with screens all around displaying footage of about 750 CCTV cameras across Rotterdam. It felt very Foucault-like'.* Aside from being an interesting anecdote during a meeting, no one stood still at what this meant for them personally. There were no responses other than 'Interesting!', while this simple anecdote taps into privacy as well as moral issues of the smart city that concern everyone who lives or works in it.

Feminist theorists and feminist standpoint theory note that it is exactly this positionality and these personal reflections that can make knowledge valuable (Harding, 2004; Rose, 1997). There is room for improvement here, the Knowledge Labs are already relatively safe and innovative spaces for knowledge production between more organisations, it might do the knowledge as well as the practitioners good to bring more of their personal doubts and convictions to the front during discussions and meetings. With a topic as pressing and all-encompassing as this, taking the value of situated knowledge seriously might come of aid in bringing back the 'human' aspect in an otherwise techno-driven discourse.

<u>Bringing it all together; the case of trash collection</u>

*'One concrete example I can name, is trash collection within the municipality of Rotterdam. They have placed smart sensors inside of the containers, on the basis of which they know when and where they have to collect trash. Is that smart? I would say yes, the way in which these people work has changed fundamentally. They have less autonomy over their way of working and at the same time there is fear that in the future, their jobs will be replaced by technology, such as self-driving cars.'*

The last part of this findings section concerns one interesting case, that seemed to pop up in at least half of the conversations I had without me having prompted the topic even once. Interestingly, when asking for ways in which data-driven solutions and smart technologies affected people's lives nowadays, many respondents gave answers that were related to recent innovations that were made to the process of trash collection in Rotterdam.

This example shows the multi-faceted character of an issue such as smart city, containing on the one hand technological innovation but on the other hand also a very human aspect about precarity and loss of autonomy. Simultaneously, it shows that smart city is not just about discourse and meta-level analyses by scholars from different disciplines. The smart city is being done by 'labouring bodies' as Fotopoulou (2019) describes in her piece on data practices. Behind every piece of apparently objective technology such as a sensor is a person who designed and manufactured it, a number of strenuous meetings about how and when to implement it and in this case, a garbage man complaining about his usual routes that all of a sudden have been changed. What exactly is smart about it, is left open, however there seems to be a consensus about its smartness and the fact that it is an interesting case for the Knowledge Lab to study. This ties in with the argument of the terms smartness and big data being productive black boxes for these labs in order to work withs a large variety of potential research topics and stakeholders. At the same time, this example is also an illustration of my last point about the supposed distance between the data practitioners and the topics they are researching. The data practitioners empathize with the trash collectors in Rotterdam and the ways in which their profession has changed, whilst at the same time knowing that their jobs are most likely the last to be affected by innovations such as these.

## Conclusion & Discussion

Conclusion

*'Smart city is this global discussion we are having, this global research paradigm. […] But of course, the Knowledge Lab as a local collaboration can focus on what is actually impact on the city itself, which smart city topics are relevant for the organisations and citizens in Rotterdam.'*

In conclusion, data practitioners in Rotterdam Knowledge Labs adopt a generally optimistic discourse about technical innovations and a techno-solutionist understanding of knowledge. Through these practices, they ground a worldwide issue in the sociocultural context of Rotterdam. This is achieved through conducting practical research, mostly for knowledge-based policy ends, and organising team meetings and events wherein these topics are discussed thoroughly. The data practitioners are aware of potential harms and risks of smart city technologies, but seem to place themselves somewhat at a distance from this. This way, the co-constructed sociotechnical imaginary of the Rotterdam smart city becomes something that is mostly 'out there' and affecting others more than themselves. The Rotterdam smart city is geared at bettering people's lives through the use of big data and innovative technology. The data practitioners avoid vast definitions of smartness and create a productive black box that allows their research to stretch amongst several disciplines and policy domains. This can however lead to confusion, especially when it comes to trying to identify who belongs in the smart city and who does not.

It seemed easier to define who was *not* included in this smart urban experience than who *was*. The smart city imaginary runs the risk of being an exclusionary practice, as this thesis laid bare the friction between the overarching discourse assuming that most citizens will be able to adapt to smart city technology and the reality, wherein many groups of people are actually left out of the picture. In Knowledge Labs, the co-constructed 'smart citizen' becomes a reason for concern due to exclusion, with whom the data practitioners do not identify personally. Time and effort should be devoted to making the city accessible to everyone and the concept of sociotechnical imaginaries can be helpful in identifying which citizens fit in with the dominant narrative and which do not. This could be an excellent job for the data practitioners, who are seen as experts on a certain issue and are able to use science and knowledge as a political tool to bring issues to light and do something about it as well. The term 'Data Practitioners' is a suitable new concept, as it focusses on exactly the material and praxis aspect of issues which are often forgotten.

Through an online ethnography amongst data practitioners, namely university researchers and policy workers at the municipality of Rotterdam, I have attempted to get a grasp of the ways in which these people envision the smart city and its citizens. Inspired by feminist standpoint literature and feminist Science and Technology Studies, I wanted to speak with 'the people behind the issue', uncover their positionalities, as producing knowledge

about a certain issue means shaping it as well. Ambitious as this may be, it seems that at certain points during the research process I fell for the trap that the feminist scholars elaborated upon in my theoretical framework were so wary of (Harding, 2004; Stacey, 1988). I wanted to find out 'the truth' about these imaginaries, to fully reconstruct them, but the power of knowledge lies in its situatedness and in being multi-faceted. Finding absolute definitions for concepts such as 'the smart city' and 'the smart citizen' proved to be difficult, as imaginaries are sometimes so mundane and implicit that they are difficult to explicate. Still, it is important to pay attention to the positionalities of knowledge producers, the ways they envision past, present and future and consequentially the situatedness of knowledge.

Discussion

The concept of the sociotechnical imaginaries can be a helpful tool to situate often technically-driven, meta discourses in material practice (Jasanoff, 2016). Language is seen as one of the key determinists for this kind of imaginaries and previous research on smart city imaginaries has often analytically focused primarily on that (Delina, 2018; Sadowski & Bendor, 2019). However, during my thesis it became clear that looking at practices and imagining together with your respondents can also be an effective way of uncovering sociotechnical imaginaries. What is needed then to make the concept even more useful, is further methodological explanation as to how imaginaries can be reconstructed, with a greater focus on practices. Furthermore, future research could focus on (re)constructing other sociotechnical imaginaries held by different parties within the same smart city. Different imaginaries can co-exist and interrelate as multiple versions of the same reality (Mol, 1999), and it would be interesting to see in what ways the imaginaries of citizens, or other types of data practitioners differ or overlap from one another.

During the research process, I have attempted to stay aware of my own positionality and biases as well. In every interview, I shared my own personal experiences and doubts about smart city technology as well in order to create an egalitarian setting. Although one can never be fully reflexive about their own positionality and presence of potential power relations (Rose, 1997), I hope to have conducted an ethical ethnography in the feminist scholarly tradition. In spite of my whole ethnography having had to take place online, mediated through numerous e-mails and videocalls, I do believe that I was able to speak with people in a 'natural' fashion. It would have been a nice addition to the research however to converse with people in their own working contexts or walk around the city with them to gain more insight in their personal experience of the smart city. This would ground the research in practice even more and might be a helpful method for future research into sociotechnical imaginaries.

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## Appendix 1: Interviews and Observations

| Interviews | Pseudonym | Position |
|---|---|---|
| **Respondent 1** | Ruud Zandeveen | Data Analyst at the Municipality of Rotterdam |
| **Respondent 2** | Boris Steenbergen | Professor at Erasmus University Rotterdam |
| **Respondent 3** | Roos Meijer | Assistant Professor at Erasmus University Rotterdam |
| **Respondent 4** | Frank Hazim | Senior Lecturer at Erasmus University Rotterdam |
| **Respondent 5** | Tim den Bergen | Assistant Professor at Erasmus University Rotterdam |
| **Respondent 6** | Inez Boersma | Policy Advisor at the Municipality of Rotterdam |
| **Respondent 7** | Janna van Meerdervoort | PhD Candidate at Erasmus University Rotterdam |
| **Respondent 8** | Kaj van den Prinsen | Postdoc Researcher at Erasmus University Rotterdam |
| **Respondent 9** | Willem Okkema | Assistant Professor at Erasmus University Rotterdam |
| **Respondent 10** | Ellen Wagemakers | Student Assistant at Erasmus University Rotterdam |
| **Respondent 11** | Daniël von Essen | Master's Student at Erasmus University Rotterdam |
| **Respondent 12 & Respondent 13** | Aaron Bergsma & Lily Verstegen | Policy Advisor & Senior Policy Advisor at the Municipality of Rotterdam |

| Observations | Date |
|---|---|
| **Online Knowledge Lab Festival** | 22-03-2021 |
| **Webinar 'Samenwerken tijdens Corona'** | 20-04-2021 |
| **Webinar 'De Toekomst van Werk na Corona'** | 01-05-2021 |
| **Core Team Meeting Urban Big Data** | 26-05-2021 |
| **Core Team Meeting Organisations in a Smart City** | 27-05-2021 |