Methods and technologies for transformative planning

Towards a better understanding of upcoming challenges related to technology and data usability within design practice. Key reflections from a collaborative process in Amsterdam city.

Irene Luque-Martín[1]

[1] *Researcher and Urban designer at FABRICations and Visiting scholar at University of Twente - Faculty of Geo-Information Science and Earth Observation (ITC) - Netherlands – Enschede*

Abstract: The digital turn of the twenty-first century has unleashed an unprecedented amount of high quality data. Whereas most industries have eagerly taken advantage of this information to cut costs and improve their products, designers are still searching for an instrumental approach to implement data as a design tool. Technology companies and research institutes seem to have the tools to investigate today's challenges for better cities. However, their tools are not reaching into the design practice. We argue that we need to start a dialogue between the worlds of design, data and technology to find out what the real value is of big data for the spatial design disciplines. We propose to run an experimental case study using data as force of design and share our findings with the discipline. This paper describes and reflects on a process carried out by a project funded by Creative Industries NL and the Municipality of Amsterdam to develop a Smart City-Scan (an experimental data-driven Sustainability Scan) applied in the city of Amsterdam. This project aims to map spatial challenges and opportunities for sustainable and resilient urban design, hereby creating an integral foundation for healthy urban ecosystems. The Scan is executed in collaboration with experts on sustainability, data analysts, decision makers and other urban design offices through a series of six workshops. In conjunction with this paper, we will reflect on the role of these discussions between academics and practitioners aiming to bridge the rift between theory and its application within practice, specifically regarding research on potential technological methods and tools which could be potentially useful for daily practice struggles. This paper aims to provide insights on the content discussions carried out, but also reflects deeply within the methodology and potential outcomes obtained from the multidisciplinary discourse of shaping the smart city scan.

Keywords: sustainability design; collaborative planning; urban analytics; multidisciplinary design

Introduction

Global challenges of air pollution, climate change, increasing socioeconomic inequality and the disruption of the phosphorus cycle have given rise to a number of globally shared ambitions such as the Paris Agreement and the UN Sustainable Development Goals. These ambitions have profound spatial implications, including large-scale implementation of infrastructures for renewable energy, expansion of green-blue networks and providing better accessibility to services to vulnerable populations. Such complex issues require a new generation of tools and methods in order to make adequate decisions; we cannot design the 21st century with the tools of the 20th. Yet, as we approach the middle of the 21th century and face crises unlike any others before, urban designers seem to

stick with old tools and methodologies to solve these issues. Medicine is not practiced with outdated technology; why should urban design be different?

While urban complexity increases rapidly, cities face the demand to comply to the urban agendas (such as SDG, WCR, WEEL, Breem, and so on) which define the pathway towards more sustainable and healthier urban environments. This tension between the rising complexity and the demand to develop more sustainable and healthy cities lands on designers' desk as one of the most important contemporary challenges. It demands the reflection about how could we approach to achieve those sustainable goals. Which are the available tools/methods that we can use to make it possible? What is the role of designers into this technological and data era? In regards of responding to this, Offenhuber and Ratti in the book "Decoding the city"(2014, p.7) argue a key point:

> But planners, policy experts, and economists are no longer the only specialists responding to these challenges. New actors enter the stage and bring new approaches to the field. Perhaps the most significant developments have happened in the domain of data-intense methodologies.

Those new actors are related to the understanding the city as a complex system which demands the use of complexity tools such artificial intelligence, and complex theory of cities in order to approach it. As De Roo and Silva argue in their preface of "A planner's encounter with complexity":

> […] planners need to understand that complexity is not a notion expressing basic feelings about an encountered situation. On the contrary, it goes far beyond that. Complexity stands for a 'reset'of our positivist mind frame, to be able to view the world differently, to make the switch from 'normal 'science to a 'post-normal 'science…which represents an understanding of reality that could very well be more promising than the reality proposed by 'normal'science (2010,p.17)

Many authors in the past has framed differently the idea of complexity, but all of them aimed to try to unravel that complexity as key aspect for the potential successful design outcomes (Alexander 1964; McLoughin, 1969; among others). This complexity gives meaning and breaks our established routines, this is the driving force of serendipity in cities, which promotes uncertainty and unexpected dynamics within the urban scene.

The demand of performative analysis

Understanding urban complexity overlaps with the sustainable goals aforementioned above. This stress designer's situation and pushes them to have the urgency of find tools and methods to unravel complexity. This urgent agenda demands shift from the most fixed and static vision of cities originated and established during the last centuries and move further on methods and tools towards the understanding of performance of cities as a way to get closer to read urban complexity.

> To the extent that these technologies (and how we use them) influence how we experience the city and the choices we make there, they challenge the role traditionally played by architects in shaping the urban environment, a tool which has historically –with a few notable exceptions- focused predominantly on the organization of space and material in terms of built form (Shepard, 2011, p.10)

Cities performance shows us the contemporary demands, which is essential in order to promote more healthy and inclusive cities. Understanding how space is used, we could approach how space could be better shaped. This is a matter of starting to use the advantage of our existing knowledge of the data available on performance in cities, and thereby, understanding that design could promote more accurate and tailored solutions to the performative demand.

In order to approach how we could understand the performative side of cities, it demands an update and advanced understanding of the contemporary technologies and data sources available. The digital turn of the 21st century

has unleashed an unprecedented amount of high quality data. Whereas most industries have eagerly taken advantage of this information to cut costs and improve their products, designers are still searching for an instrumental approach to implement data as a design tool. The first companies to extract this information and apply it to the built environment are companies that are not traditionally associated with the design of cities. Tech-giants like Cisco, IBM and Microsoft are developing data-driven systems to advise urban planning authorities on transport, waste management, law enforcement and energy use.

Some of these projects provide insights about the integration of data and technology into the design disciplines. Take for example Alphabet's (Google's parent company) Sidewalk Labs in Quayside, Toronto. The neighbourhood is described as being "built from the internet up … merging the physical and digital realms" and advocates underground waste disposal, modular timber-frame construction methods and deep-water cooling systems. Although these ideas in themselves are not innovative, the fact that they are integrated and monitored with the assistance of technology is.

Moreover, they are combining its tech-centricity with a collaborative and community-oriented approach to decision making. Projects like Sidewalk Lab seem to offer a new way of looking at urban planning, bringing new questions to the table about the position of the design disciplines in the 21st century in relation to innovations in data and technology.

The endless debate

Although apparently technology and data seem normalized within design practices, the reality is that design discipline is still and continuously in an endless debate around the question: is data and technology useful for design practice? Are they replacing designers' tasks? Are they a threat or a useful tool?

This has been continuing debate for over fifty years. It oscillates like a pendulum between two extreme opposite positions. On one hand, we have the technocratic discourse believing that technology and data will come to solve all our issues. Cities are understood as a mathematical issue which can be tackled from a systematic approach, by simply generating the right formula we could solve urban problems. On the other hand, we have the humanistic discourse which believes on cities as a composition of human´s interactions where systematization or formulas have nothing to say. The cities are understood as a composition of complex networks, therefore demanding a collaborative and inclusive decision-making process as a key method to understand and intervene on urban networks.

Both discourses are part of our contemporary practice, and although these were discussion from fifty years ago, it is still present on our everyday life. From Adam Greenfield stating "technology will kill us" till SideWalk Labs applying the use of data as the solution to cities' issues with a non-transparent and out of design discipline understanding. The debate about if design and decision making in cities should be informed by data and till what extend, it is not an old debate. Indeed, it is a contemporary debate which keeps oscillating between the two extreme opposite positions unless practices and theories start to make the extremes converge.

In the endless debate whether technology and data add value in design practice, there are usually two main arguments: 1) the threat towards human driven design, and 2) the ethical use of the tools and data. In regards the first argument, we could say that the starting point of discouraging the use of technology as a universal solution of cities raised around the seventies. Indeed, the article "Requiem for large scale models" published by Lee (1973) was an inflection point on the debate of the potential results that technology was offering. While the technological revolution promoted the idea of design and planning as a mathematical exercise, the technology and data availability was not the most suitable one in order to be able to tackle the urban complexity in our cities.

There was a need at that time for better analytic and quantitative procedures, and there was also a need for the development of theory. Now, the need for both theory and method is even greater. It is not about our intent to

discourage those who would apply quantitative methods to urban problems, but, rather, to redirect their talents into more valuable pursuits than repeating the mistakes of the last decade. (Lee, 1973, p.163)

The contemporary availability of data and technology

Almost fifty years later, we still reflect on the need of both theory and methods to give us tools and better understanding of urban problems. The difference today is that we do not lack either technology or data. While fifty years ago a computer used to take spatially half of a room, nowadays those computers are carried in our bags everywhere. It is not just about their size, but their capacity which is largely bigger than what those fifty years old computers were able to process. Hence, if we reduce space and increase power of those technologies, the equation of its usefulness and usability within design practices should be updated as well.

Although in a completely different scene and with completely different status of availability of data and technologies, why is seem data still a threat to designers? Coming back to the words from almost fifty years to read the still valid Lee´s article (1973, p.176):

> If planners fail to adopt and adapt theory and methodology as these become available, they will find themselves working less and less on the problems; on the other hand, if planners pick up ideas naively and uncritically, the field will simply jump from fad to fad. Somewhere between lies the optimum path.

Design practice needs to understand the role of the current technology and data available in order to commit to accurate, rigorous and potential successful outcomes from its practice. Hence, it is demanded designers reflecting on the usability, the usefulness and the way these technologies and data resources could potential support their daily activities.

However, even if this reflection is urgent, design discipline generally keeps oscillating whether it is suitable using data and technology either because of the fear of stealing its practice or because of the sensitivity of the ethical dimension, big companies -which are far away from what the ideological core of understanding what design is- are taking over projects and processes. They do not hesitate on experimenting the usability of technology and data, they do not doubt that complexity demands advanced tools and methods.

As important as understanding what tools, what data, and how to implement it on design practices, there is the need to gather the knowledge and experiences which already are leading towards a rupture of the oscillations of the endless debate between technocratic and humanistic. The balance between hard and soft data is a reality in contemporary practices which aim to promote a combination of the most quantitative and qualitative approaches in order to take advantage of best tools and complexities. Then they could approach analysis and interventions with a more accurate and rigorous knowledge of the urban problems.

During the endless questioning dynamic of whether data will make designers obsolete, or whether it kills the creative process and the romantic side of the profession. Other, more optimistic practitioners see the potential in big data analysis, arguing it could save time and inspire new spatial answers to contemporary questions. Regardless of which side you are on, it seems that there is a rift between the worlds of data and design. Spatial designers in practice seem largely unknowing of the potentials, challenges and risks of using big data analysis as a design tool and enter the debate with mere emotion and intuition. It is time for the debate to be fueled with empirical arguments.

The action then is not just the reflection, but the discussion and the dialogue to use this research as a gathering tool of experiences and potential outcomes from theory and practice. An empirical research to understand by dialoguing which tools and methods could potentially be useful and meaningful on design daily practices.

Tech companies and research institutes seem to have the tools to research today's challenges for better cities. However, their tools are not reaching into the design practice. As such, we argue that we need to start a dialogue between the worlds of design, data and technology to find out what the real value is of big data for the spatial design disciplines. We propose to do so by running a real-world test – an experimental case study – using data as force of design, and share our findings with the discipline.

This paper analyses and reflects on the results of an empirical process based on the development of six workshops reflecting on the data and technology usability and usefulness within design practice. It applies specifically to Amsterdam city and it is realized by a project called "Smart City Scan Amsterdam" lead by FABRICations design office in coalition with the CTO Innovation office of Municipality of Amsterdam and the GIS Lab from University of Amsterdam. The project is funded by Stimuleringfonds Creative Industries of Netherlands with the CTO Innovation Office from Municipality of Amsterdam.

Smart City Scan of Amsterdam. Project overview.

The Smart City-Scan of Amsterdam aims to map spatial challenges and opportunities for sustainable and resilient urban design, hereby creating an integral foundation for healthy urban ecosystems. The Scan is executed in collaboration with experts on sustainability and data analysis, decision makers and other urban design offices through a series of six workshops.

The relevance of the project stems from the belief that information technology and data is changing the discipline, and that all spatial designers share responsibility in responding to this. The Smart City- Scan case study essentially serves as an example to inform and promote debate on the use of data for sustainable urban design. Throughout the workshops, the public debate, the report, and the project aims to illustrate and discuss the following points:

- What data is available and useful for designers and which sources to use;
- How to process data using indicators and technology;
- How to translate building standards, academic research and ambition documents into measurable indicators;
- The obstacles between the world of tech, sustainability, design and finding ground for mutual understanding between big data analysts and urban designers;
- The potential of using big data in urban design and to what extent the research process can be automatized, sped up and quantified using information technology and big data;
- Potentials of applying big data in making sustainability assessments, and;
- Future growth opportunities of the spatial design disciplines; i.e. whether urban design should adopt big data technology as an integral research capability.

In order to explore the role of data and technology in the design discipline it is proposed as case study the city of Amsterdam with the following coalition which contribute on different roles: 1) The Municipality of Amsterdam being advanced in urban data collection and in their urban agendas, they provide the data and the setting for the case study. 2) GIS (Geographic Information Systems) Lab, University of Amsterdam which has the technological expertise to ensure the correct use of the data and the tools. 3) FABRICations in charge of transforming data into spatial assessments that can inform the design process.

The research project will be based on the validated Sustainability Scan methodology which FABRICations developed over the past 10 years. The Sustainability Scan investigates the built environment using a holistic framework of Six Themes of Sustainability (Future Urban Regions, 2015), including vital economy, sociocultural solidarity, healthy living, material cycles, resilient systems and energy transition (see Figure 1).

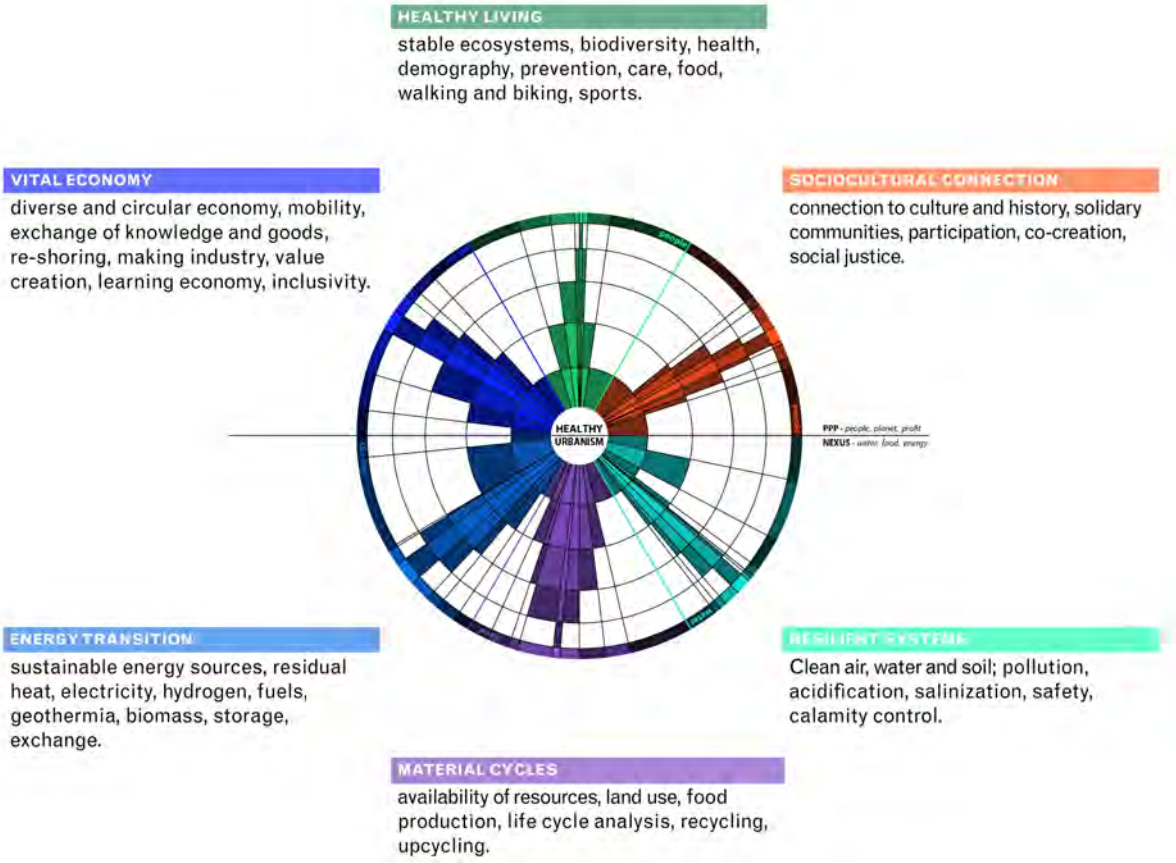

Figure 1. Six themes diagram. Future Urban Regions Research..

Six workshops. Key actors.

Six workshops were planned with two-week intervals between them. Each workshop discussed one of the Six Themes which are the theoretical background of the urban analysis within Amsterdam (healthy living, vital economies, sociocultural connected, material cycle, resilient system, energy transition). Each workshop will be composed of experts on the theme, data analysts, decision makers and practitioners. The goal of the workshops is to exchange knowledge between disciplines regarding indicators, data and technology, in order to create mutual understanding between target groups and to receive critical evaluation about the Smart City-Scan.

As key actors during the process, and mainly regarding the workshop participation, has been identified three target groups that were reached during the workshops:

- Design Practitioners Designers are included in the research process in the form of workshops and will be invited for the public debate. Furthermore, the findings of the Smart City- Scan itself (i.e. opportunities and challenges for sustainable urban design) will be of use to design practitioners working on projects in Amsterdam.

- Decision and City Makers Decision makers from municipalities and central governments and city makers (i.e. real estate developers) are an important target group for the project. The

project aims to inform them on the spatial requirements for sustainable city development, on how data can be applied to assess them and how they can contribute to promoting data-driven urban analyses. We also aim to inform them on data that would be relevant for urban designers, but that is currently missing.

- Research Institutes. The academic world has been exploring the potential of data-driven design for the past few years. The issue is that their progress has not been adopted by the design practice. The project aims to build a stronger connection between the academia and practice when it comes to implementing big data analysis in the spatial design disciplines. Similar to the previous target group, the project also aims to inform them on data and technology that would be useful for urban designers, but that is currently missing.

Key reflection 01: a multidisciplinary approach is a myth

Multidisciplinary is defined as the combination of several academic disciplines and professional specializations in an approach to a topic or problem. In this vein, Smart City Scan aims to modify the conventional methodologies promoting a collaborative approach. The root of this approach is promoting discussion and the stakeholder together in the beginning rather than approaching collaboration just as a check on the results already decided on previous stages.

Although the participatory approach of the six workshops was attracting diverse disciplines together. The aim to promote and then observe the interactions between diverse disciplines that could be generated. The overall idea was to gather key actors who are involved at any level/scale to the specific theme addressed on each one of the six workshops. The key groups involved: data/technology experts; designers; policy-makers; practitioners; and researchers.

Elaborating a quantitative analysis on participation from the diverse target groups approach (Figure 2), we could generally conclude that researchers have been the ones who most attended, while designers the least. This might be related to their different policies in regards of workshop attendance but might be also potentially related to the amount of invitations sent.

In addition, what needs to be highlighted is that design offices were counted as group units while researchers were individual (i.e. there were several moments where researchers from the same institution carried out different projects and research). Indeed, it was easier to find more individual researchers than several design offices. It is important to understand those details under the quantitative analysis between disciplines before doing assumptions on what profile of attendant was more attentive.

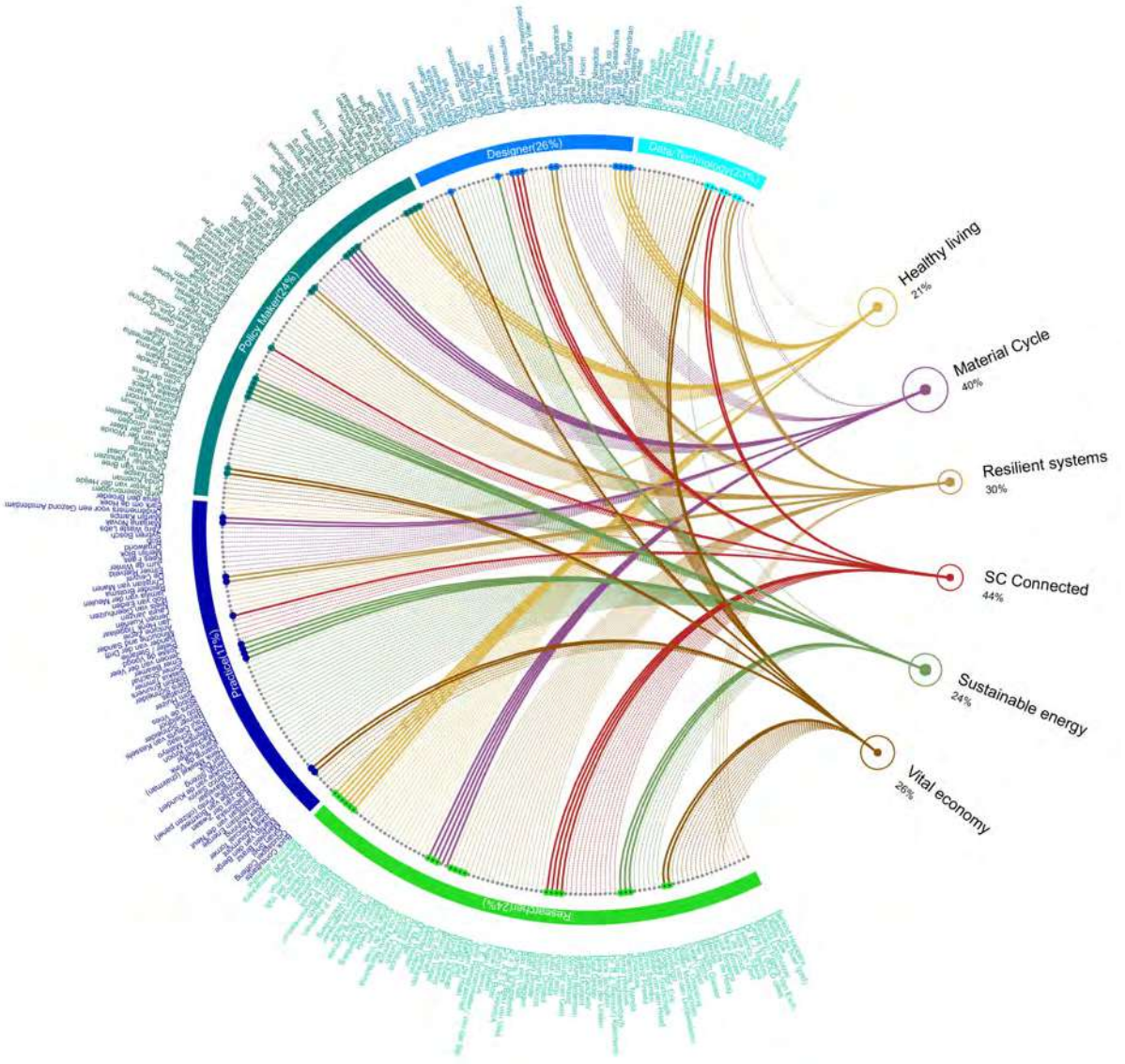

Figure 2. Six workshop quantitative participation analysis. Smart City Scan project, FABRICations.

Besides the quantitative side of participation during the workshops, at the level of qualitative interaction we found a general pattern during all the workshops: experts and key decision makers within a topic did not of one another, or even more important, they did not know what the others were developing either as research or praxis. One of the most common comments in the feedback section organized from the workshops was related to the interest from participants to know each other since workshops became a platform to facilitate a multidisciplinary knowledge exchange.

Hence, it is interesting to highlight that during the participation most of those researchers and practitioners were claiming that within their own projects they have a multidisciplinary approach. However, to what extent is the exchange between multiple disciplines really occurs? Is it usually a private exercise inside of specific teams? Is it not important to externalize efforts to understand other discipline´s concerns/visions?

In order to respond to the question, the workshop provided a clear vision of the two main challenges that Smart City Scan project should face regarding multidisciplinary and that will be worth to keep researching and experimenting: on one side the importance of visualizations as potential tools to facilitate communication, and on the another hand the demand to also show the spatial implications as a way to increment the interconnectivity and

common agreements between the participants in order to understand complex urban issues from a multidisciplinary approach.

Regarding the communication, it was found that while most of the participants were linked by the understanding of the topic itself, the type of words and conceptus used demanded several times clarifications and promoting of collective understanding of the language used from the facilitators. Regarding the collective construction of knowledge it was found that most of the participants had their own line of work. Indeed, for several of them it was difficult to leave behind in order to open to other's understanding and point of view of the same theme.

Figure 3. Six workshos. Highlighted photos. Smart City Scan project, FABRICations.

If what has been witnessed in the six workshops is remotely showing part of the reality, then a multidisciplinary approach is a myth. Therefore it is necessary to ask ourselves: how do we overcome the words which are mere definitions and pursue truly collaborative processes which aim to establish a common language of communication between diverse disciplines, in order to promote the construction of a collective knowledge? There is where the two challenges converge into a common goal which needs to be faced from the design practice as well as from the theory: a truly multidisciplinary process.

Key reflection 02: Data labyrinth

Data is our daily reality. We are in the era of digitalization generating an intense production of digital information every second through any activity we do. Beyond the ethical concerns (which would be addressed in the next point), there was a common concern occurring systematically along the six workshops related to the accessibility and availability of data.

> In the near term, sensors will be integrated into nearly all parts of the physical urban fabric, creating a 'digital skin' composed of connected, digitally enabled objects, network nodes, communication devices and posts for monitoring and analyzing data fed into servers. (Rabari, & Storper, 2014; p. 27)

So if the data production and storage is our contemporary reality, its usability should be reflected in our contemporary practices and research. Why are designers lack to take the full advantage of data usability? As

Batty (2013; p.192) mentions: “These datasets are everywhere, although are often locked away from those like ourselves who wish to mine and interpret them for purposes of understanding and design.”

Data has become the holy grail of any urban analyst. However, the reality is that in regards to the accessibility of data it is either private (i.e. pay walls or privacy concerns) or if it is public it is encrypted. Hence, data is becoming a labyrinth for designers who aim to find the right information in the right format. The availability of data is a multidimensional issue, however, the reality is that every time the discussion about data availability appeared within the discussions of the workshop, there was always someone saying: “that data is available”. However the way it is available makes a significant difference for the user. The online availability of these data sets is merely is not sufficient (which may not necessarily be the case for other disciplines), the user should be able to extract and process the information to see its full value (cvs, shapefile, raster, dxf,, etc).

These issues are important if we begin to talk about the way designers use information to inform their design projects. In order to maximize the data usage, the possibility of integrating such information in their current systems and technologies is vital. Otherwise, practice reverts to conventional tools with the fear of having to invest significant time and effort on updating software, finding the needed layer within the data labyrinth and exhausting large amount of time processing the encrypted data formats. Designers demand data that is easily treatable and easy to integrate to their current tools.

Beyond the concerns regarding data availability and accessibility, the relationship to ownership seems rather interesting. Data is not the same universally, nor it is its accessibility. Therefore, the time invested on understanding (decrypting data) which specific data sources and software to be used will be entirely irrelevant in the next project due to varying contexts. This promotes a sense of skepticism with designers who find difficult believe the worthiness of data where the main goals of a project could be compromised due to the effort required in processing data. When the search for data becomes the project, designers lose hope on its usefulness.

The ownership of data is intrinsically related to the institutional composition of every location. Although there are some universal and worldwide data sources (such as Open street map or Google), design at its traditional scales (regional, city, sector, block, public space or building) demands accurate information. As scalability is important, the fact of using rigorous data is the same, since most of the works related to designers are meant to become physical future realities. This implies having official and institutional data sources, which are differently arranged both in structure and accessibility. In those cases, the availability is directly related to the ownership of the data.

Through the workshops, the discussions become pivotal regarding availability, accessibility and ownership. Although the original aim for the Smart City Scan was to pursue what the idea of Big Data meant to the designer, it slowly became clear that it was not about the amount of data they could get but rather to seek what was the right data. Therefore, the clarity on the conceptual question is key to not get lost in the sea of data. The question will guide an effective and productive data search which will lead to support to answer it.

Through those workshops, a reflection comes up: designers do not need big data, they need the right data. The question now revolves around the accessibility. How does an individual navigate through the existing labyrinth of data? It will depend on the ownership and availability of the data sources. However, if there is something to be can taken away from the Amsterdam case (knowing that it exemplifies an open data source for urban problems) is the importance of generating right coalitions with the owners of the right data demanded. But also, about imagining and hacking the pathways towards to the conceptual aims. The design concepts will guide the data accessibility rather not the other way around.

Key reflection 03: The ethical dimension of data

During the six workshops the ethical side of the data usability has been one of the main concerns from participants. It required a significant effort in each workshop to debate till what extent data inclusivity and the influence it had

on decisions made under interpretations on the final outcomes. However, regarding the ethical use of data is demanded to approach it as a key reflection on the project. However, in regard to the demand of the ethical use of data, it became a key reflection in the project.

While being confronted with the two extreme approaches (technocratic vs humanistic) oscillating on a pendulum, an interesting approach to these struggles from an ethical dimension began to take shape. Data is not the devil, but requires mindful use under specific principles. Indeed, in the first workshop about vital economies in Amsterdam, there were two key participants from "Tada" who work towards an understanding of the ethical dimension of data in order to make better cities. The website of the company states:

Data: a promise for life in the city. Data enables us to tackle major problems of modern cities, making them cleaner, safer, healthier… but only as long as people stay in control of the data, and not the other way round. We – companies, government, communities and citizens – see this as a team effort and want to be a leading example for all other digital cities across the globe. To get started, we have come together to set out the following shared principles. https://tada.city/en/home-en/

As they were key actors in introducing to organizers the demand to incorporate the ethical dimension of this project while it is important to mention their principles. They summarized their idea of how to use data in an ethical way. Their six principles are: 1) Inclusive use promoting equality; 2) Control promoting that data and technology contribute to the freedom of people, so the people stay in control over their data; 3) Tailored to the people which defends that humanity always come first leaving room for unpredictability; 4) Legitimate and monitored providing control to the citizen and users over the design of our digital society; 5) Open and transparent about what type of data purposes and outcomes; 6) From everyone – for everyone, which demands the data from government authorities, companies and other organizations from the city should be open and everyone could benefit from it.

These principles could potentially sound as a utopia, but indeed, after six workshops discussions about what data/ownership and the way it is exploded to develop interpretations, it is key to maintain those principles as guide towards being in control of the usability of certain data sources and technology.

Key reflection 04: Fieldwork is not out of fashion

"Not everything that can be counted counts, and not everything that counts can be counted." This statement made by Albert Einstein is key in this reflection about how qualitative approaches could potentially complement the quantitative ones. In regards to the methodology that was used to approach the six themes as preparation (i.e. preliminary computations regarding each one of the six themes) there was a underlying criticism made by many participants; the use of a computational method will unravel complexity so designer will believe data as a totalitarian true ignoring their own knowledge and experience. The project was far away from this assumption, but became a leading and systematic criticism during the socially themed workshops. The main insight from participants was that in order to develop a deep knowledge of the urban challenges regarding those themes, a perspective from the other side (soft data) was crucial to consider.

> […] the models will be built through machine learning, how to understand and run cities will manifest itself largely without the need for any deep domain knowledge about cities – their history, their politics and culture, their political economy, their inequalities and tensions and battles, their modes of governance, their environment. (Interview with Rob Kitchin, p. 110)

Where will be the experience, insights, and intuition of experienced designers if we are driven by technology rather than the other way around? Cities are complex systems which are comprised of intricate socio-economic networks which cannot be easily computed. Even less the interrelations between those networks. Therefore, there is the need and the logic of integrating the hardest and most soft way of analyzing the cities.

> Hard facts and models trump other kinds of knowing and undermine and displace other scientific forms of urban knowledge that are less systematic and continues, such as policy analysis, interviews, focus groups, surveys, etc. So as a new form of knowledge is developed, other forms are potentially sidelined. That, I think, will be to our detriment because for all the hoopla about big urban data and urban science, it has numerous limitations, including methodological and technical shortcomings and data quality issues. I would prefer to think about big urban data as complementing –non replacing- other urban knowledges. It's not necessarily better: it offers another perspective. (Interview with Rob Kitchin, p. 110)

In order to promote inclusive readings of the environment, it must be viewed through the lens of technocratic and humanistic methodologies. As many participants mentioned, it is key from their experience and practice to work with and for the people related to the issues. For instance, during the socio-cultural connected and healthy living workshop we received reoccurring and persistent remarks of 'not without fieldwork. As one participant mentioned clearly during healthy living workshop: "this project lacks the qualitative approach".

However, in the same discussion, another participant clarified the interesting gap of data sources, which unbalanced the conceptualization of healthy living systems. In this case regarding playgrounds, she elaborated the critique based on children dynamics who are not monitored, and who do not provide data on apps or google. It demands a qualitative approach. This tendency potentially and several times leads to data driven analysis that tends to ignore or even overlook urban issues which are based on experiential that cannot be tracked by data monitors.

A simple analysis of data is not enough. A process in which a qualitative approach is necessary to go beyond and more in-depth into reading social dynamics. However, it seems clear that a coexistence of a qualitative and quantative analysis can be complimentary. And, if design can seek a balance, then it will be able increase its accuracy and overall productiveness in urban analysis.

Key reflection 05: The trap of blind spots in the interpretation of data

Blind spots are one of the crucial issues in regards to data interpretation. It became the bottom line under several workshops , mostly within the socially driven groups. The data produced, gathered, and interpreted usually becomes fact. However, and as one of the participants mentioned during the socio-cultural workshop: "data needs to be processed to become information". If we refer to social data, then the way it is processed, and the assumptions developed become a key part of the question.

> They (cities) are affected by structural forces and political and business decisions made in a multitude of places. They are full of millions of people who act in all kinds of ways and are thoroughly infused with culture, history, and politics. Even with more data, new analytics, and enhanced computation, it is therefore very difficult to create robust models of city development, and even more difficult to translate these contextually into policy. (Interview with Rob Kitchin, p. 110)

As Kitchin argues, the city goes beyond a static and physical environment. Indeed, if we aim to understand the most social themes and the urban challenges related to them (such as vital economy, socio-cultural connected, healthy living) it demands an understanding of the social dynamics of the city. Certainly, a performative analysis of the city. This discussion usually belongs to the idea of the blind spots, which are the realities we suppress from our interpretations on data. This relates to the idea of black boxes, which stem from the assumptions arise when data is treated through diverse technologies (such as modeling).

There are two examples that can clarify this black box concept. During the healthy living workshop a participant explains that if a dataset from Strava is used in order to understand the optimal spaces of exercise are, we are understanding the users (producers of data) that are providing key data which could be interpreted as a pattern or tendencies of spaces of high attractiveness. However, if the goal of the analysis is to encourage people to do more

exercise and encourage healthy living conditions, then the data source of strava is not appropriate. It creates numerous blind spots. The strava data set solely represents the population practicing exercise, it does not represent the population that do not use application. It means that the use of this data misaligns itself with the target group that needs to be addressed. The combination of blind spots, narrow interpretations and assumptions could potentially lead to conclusions that are misleading.

"This is classically known as a 'black box'. What goes in and what comes out are known exactly, but the process by which one is transformed into the other is a mystery." (Lee, 1973, p.167). The author promoted the idea that technology could potentially have interesting usability but not before understanding it limitations: "A balance should be obtained between theory, objectivity, and intuition". (Lee, 1973, p.175-176)

Future research

This paper is part of a five-phase project. The first phase as the theme's hypothesis and the second as a gathering of knowledge through the six workshops. In parallel, as the transition from the participatory process move towards the computing phase, it is now a process of which in depth interviews with key participants from the workshop promote the creation of coalitions for the development of computations. These coalitions differ from decision makers, experts, and researcher who are providing the key insights to build six test cases of the usability of technology regarding the six themes. This transition helps to go beyond these five-key reflections of the workshops,towards an in depth theme specific analysis in aims find the right conceptual ideas to be tested.

After the computation and assessment phases (parts three and four), the project's aim to conclude with a public debate as the final phase. This discussion will be comprised of the entirety of workshop participants to come together and discuss the reflections and computation results. After, the validation of these outcomes and reflections, they will provide the design practice an additional perspective. A viewpoint that is empirical in which the main challenges, advantages and disadvantages of data and technology usability are made visible. Ultimately, the reflections and key outcomes will help guide and support designers with their agendas of making cities more sustainable and healthier.

Acknowledgements

This paper belongs to a Smart City Scan Project in Amsterdam. A project funded by Stimuleringfonds Creative Industries NL and CTO Innovation Office of Municipality of Amsterdam. Firstly is to acknowledge the FABRICations team. Specially to Eric Frijter and Olv Klijn (Directors of FABRICations). And the core team composed by Max Augustijn as urban analyst specialist, and Chong Yao for their important interdisciplinary exercise during the workshops organization and coordination. Moreover an acknowledgement to the coordination effort and the conceptual insights from Juan Carlos Goilo (CTO) and all the participants who attended the workshops bringing and contributing meaningful insights to the project.

References

Alexander, C., 1964. A city is not a tree. *1965*.

Batty, M., 2013. *The new science of cities*. MIT press.

De Roo, G. and Silva, E.A., 2016. *A planner's encounter with complexity*. Routledge.

Interview to Robin Kitchen, 2015. Grounding Urban Data. *New Geographies 07: geographies of information edited by Ali Fard & Taraneh Meshkani. Harvard University Press, (7), pp.109-115*

Lee Jr, D.B., 1973. Requiem for large-scale models. *Journal of the American Institute of planners*, *39*(3), pp.163-178.

McLoughlin, J.B., 1969. *Urban & regional planning: a systems approach*. Faber and Faber.

Offenhuber, D. and Ratti, C., 2014. *Decoding the city: Urbanism in the age of big data*. Birkhäuser.

Rabari, C. and Storper, M., 2014. The digital skin of cities: urban theory and research in the age of the sensored and metered city, ubiquitous computing and big data. *Cambridge Journal of Regions, Economy and Society*, *8*(1), pp.27-42.

Shepard, M., 2011. *Sentient city: Ubiquitous computing, architecture, and the future of urban space*. The MIT press.