DATA FOR DESIGN

Adopting Data-Driven Approaches for Long-Term Citizen Participation and Social Sustainability in Design for the Public Realm

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TRADERS

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Author's Declaration

This thesis represents partial submission for the degree of Doctor of Philosophy at the Royal College of Art. I confirm that the work presented here is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

During the period of registered study in which this thesis was prepared the author has not been registered for any other academic award or qualification. The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

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Date: 29 January 2019

Abstract

The world is flooded with more information than ever before. Ubiquitous digital technologies have enabled direct access to large amounts of empirical data to inform a wide range of topics and investigations. This thesis set out to explore how these novel data technologies offer new opportunities to designers to greatly increase their knowledge of the built environment and how people inhabit it, to inform design in the public realm.

The research has been developed under the umbrella of TRADERS ('Training Art and Design Researchers in Participation for Public Space'), an EU-funded international and interdisciplinary research project. My research on the TRADERS project explored the intersection between digital data analysis (including the topics of Big Data, data mining, smart cities, algorithms, and more) and citizen participation in design for the public realm. Moving beyond temporary effects of many current 'disruptive' participatory design projects that have adopted digital technologies, the thesis concentrates on public realm projects that aim to facilitate their active afterlife beyond the designers' involvement. The research identifies a recurring issue in current participatory design practices: designers tend to create a community around themselves, and therefore place the wrong actor at the centre of a project's social network. Rather than building social constructs from scratch, the research demonstrates that analysing socio-spatial digital data could help architects identify existing active communities, design the physical conditions to facilitate long-term citizen engagement, thereby helping to shape socially sustained, resilient public space projects that are able to adapt to changing demands and a dynamic demographic.

There is a vast amount of digital data on users available today; however, their potential as empirical input for the social dimension within spatial design has so far remained underexplored by designers. While digital tools are not new to the spatial design professions, technologies they have adopted, such as computer-aided design (CAD) and parametric modelling, all concentrate primarily on the built object. By introducing

a human-centred focus, the thesis moves beyond the current object-oriented fixation of digital technologies for architecture and urban design. Through several case studies from practice, the thesis demonstrates how digital data analysis could help design firms conduct more thorough and in-depth explorations of the social layer of a local context. Furthermore, the thesis argues that an extensive and advanced analysis of a local context in an initial phase of the design process can help develop a more relevant initial premise, and therefore help develop a more context-appropriate and socially sustainable design.

While it can be tempting to use technology for technology's sake, the thesis argues that data-driven approaches should become another tool in an architect's kit. New digital tools do not have to be foregrounded within the architectural discipline; instead, they can function as an aid to develop and consolidate more empirically-based human-centred designs. The thesis concludes that digital data technologies are useful instruments that enable alternative approaches and interventions aimed at serving the public. Incorporating these technologies into existing design practices, however, requires training and education.

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Introduction

Over the last two decades, community engagement in the design and development of urban environments has reappeared on the political agenda. Ever since the turn of the millennium, citizens in Europe are demanding more direct forms of democracy. New national policies, such as the 2011 Localism Act in the UK, aim to counter traditionally centralised, bureaucratic, and autocratic planning systems by dispersing power to local governments and communities. The idea that greater community engagement in urban development processes will result in more successful and sustainable designs has become widely accepted both among politicians and spatial planning and design professionals. Within the art and design community, citizen participation has become an established and (sometimes uncritically) adopted agenda intended to empower local communities. The Participatory Design (PD) community, for instance, concentrates on experimenting with new forms of participation to disrupt top-down hegemonies by directly involving people in the design of the things, spaces, and the technologies they use. Such disruptive experiments often manifest themselves as ephemeral art or design interventions in the public domain that aim to raise awareness on some social, political, or environmental issue.

This thesis moves beyond the ephemeral approach of many current disruptive participatory design projects, and instead concentrates on designers who want to create public realm projects that have an active (social) afterlife beyond their own engagement. Such design interventions generally intend to go beyond raising awareness and focus on changing a problematic social or spatial condition within a particular context, by improving or revitalising the public realm. Furthermore, such interventions often aim for a local community to take over the project when the professionals have left. While these projects often do succeed in engaging a public during the design intervention, practitioners frequently fail to facilitate this long-term engagement and citizen appropriation.

In response, the thesis introduces digital data analysis as a tool to help achieve this. Responding to an emerging criticism of participatory design, the starting point of this research is a concern with spatial designers being promoted as social workers in order to try and ensure long-term citizen engagement (Miessen 2010). The research challenges this aspect of socially-engaged design and explores how adopting digital data technologies offer opportunities for practitioners to re-engage with (spatial) design while enabling (social) continuity of their public realm projects.

The world is flooded with more information than ever before. Ubiquitous digital technologies in a Big Data era have enabled direct access to large amounts of empirical data to inform investigations. These offer scholars, including art and design researchers, opportunities to generate novel insights and new theories. The thesis title, 'Data for Design', refers to its ambition to contribute to a better understanding of the possibilities for integrating digital data technologies in the architectural and urban design disciplines. The subtitle 'Adopting Data-Driven Approaches for Long-Term Citizen Participation and Social Sustainability in Design for the Public Realm' summarises the second objective of this research: to introduce data-driven approaches for socially-engaged design to help safeguard the afterlife of public realm design projects.

In the thesis, I refer to *data* as the plural form of datum (i.e. an item of factual information derived from measurement or research), and I use *Big Data* in a singular form as an umbrella term to describe the phenomena of analysing large data sets, which includes various actions such as data mining, machine learning, algorithmic computation, and so on.

TRADERS – An Interdisciplinary Collaborative Framework

The research process and design have been framed by TRADERS ('Training Art and Design Researchers in Participation for Public Space'), an EU-funded Marie Curie project enabling interdisciplinary collaboration across academia and practice, and between various European countries. TRADERS comprised six researchers, of whom I was one, all focusing on a different theme while working within a participatory public space context. The TRADERS theme that framed my research is *data mining*, which addresses the opportunities of novel digital data technologies for participatory design practices in public space. Rather than exclusively concentrating on the intersection of *data mining* and *citizen participation*, I chose to add TRADERS' interest in *public space* as well, since it is the physical context where citizen participation in every day (urban) life is most manifest. Furthermore, many participatory art and design projects take place in public spaces, which raises crucial questions on ownership, 'publicness', and inclusion: Can participatory design methods be representative of entire populations? How does one reach those excluded from decision-making processes, such as existing marginalised populations and unknown future users? Participatory design often revolves around those engaging in the process and therefore risks only catering to the needs of the few. But should all public spaces be all-inclusive all the time? How could such 'publicness' be reconciled with appropriation of spaces by different publics? Does citizen appropriation inevitably mean that a specific group of people is included, and others are excluded? The public space context offers valuable opportunities to explore essential questions on citizen participation in design, and therefore forms an integral part of this thesis.

Being part of TRADERS required a commitment to advancing the group project (and the shared research agenda concerning participation in public space) and simultaneously developing my personal research on data mining and Big Data. This dual commitment helped me focus my research within the overall project and theme, and provided opportunities to unpack the subject of participation from the vantage point of 'the digital'. Being part of a multidisciplinary research group helped me explore the often troublesome relationship between the art and design disciplines and digital technologies. Furthermore, being exposed to various critical views from research colleagues challenged me to demonstrate how digital data technologies could be relevant and beneficial within the design of participatory public space interventions. Conversely, working closely with researchers from different disciplines inspired my critical examination of the adoption of digital technologies within architectural practice.

Citizen Participation in Art and Design

Citizen participation can be seen as an end in itself, for instance to achieve a more democratic, interactive society. Participation can also be considered as a means to an end to serve multiple purposes, such as empowerment, emancipation, giving voice, taking control, facilitation, self-management, and so on. At the same time, citizen participation has often been exploited to legitimise predetermined plans, for instance by property developers or planners who sometimes merely pay lip service to the needs of local communities (Hamers et al. 2017). The TRADERS project aimed to rethink, develop, and test practices and methods that could help art and design researchers and practitioners scrutinise and critically engage with participation in public space. Through TRADERS, several questions and concerns on participatory art and design were raised, such as: How can artists and designers handle the often opposing values of a pluralistic public? How can practitioners upscale and translate people's local and individual experience into more general insights? How can abstract concepts, such as agency and empowerment, be materialised and put into practice? To expand the breadth and depth of the discussion on citizen participation, the thesis has raised several supplementary questions about the longevity of participatory public space projects, such as: When is the right moment for artists and designers to leave a project? Can professionals become too involved? When do art and design practitioners and researchers become social workers? To what extent are participants able to take ownership and continue a project after a designer or artist has left the scene? Does the network that has been developed provide sufficient support for the local community to keep the project intact?

The thesis also raises questions of equal representation in participatory processes. While participation in design often does not intend to get everyone to take part in the process, it does aim to attract a broad audience and promote divergent critical perspectives to achieve the most diverse picture of a situation as possible. The lack of equal representation is a common challenge in (participatory) design projects, and in democratic processes in general. Such processes tend to only include voices of those who have the means, time, and opportunity to participate. Digital innovations are often believed to be able to eliminate this imbalance in democratic decision-making. However, the field of e-participation struggles with similar problems (Hansson et al. 2013). The thesis investigates how these imbalances can be made visible through digital data technologies, and explores how digital tools could help inform more representative design proposals that also cater to the needs of non-participants, whatever their reasons.

Big Data and Spatial Design

We live in a world where every click, payment, call, crime, illness, online post, purchase, transaction, credit application, movie recommendation, and more, is encoded as quantified data (Marr 2018; Mayer-Schönberger and Cukier 2013). These data are logged and stored, and form a rich collection of experiences which can be analysed through powerful computer algorithms. Even traditionally qualitative phenomena, such as social interactions, which were difficult to measure before, are now quantified through social media platforms and can be analysed in an automated way (Strong 2013). As a result of these ubiquitous digital data technologies, the amount of data grows every day. This, along with the exponential growth of processing power of computers, has characterised the era of 'Big Data.' Big Data allows us to create new insights, in or near real-time, into what is happening in the world on an unprecedented scale. Data produced by such ubiquitous technologies, however, are often unstructured and too large to be processed and stored via regular infrastructures, and therefore require different methods and techniques of analysis (Bollier 2010).

Data mining enables us to explore large amounts of data through a semi-automated process to discover consistent patterns and/or relationships. In the business and finance worlds, data mining has proven successful in its use for stock exchange, banking, and customer and market behaviour analysis. Over the last decade, Big Data and data mining have also become fundamental to very different disciplines such as astronomy, oceanography, and engineering. The arts and humanities have also recognised the opportunities for transformative research offered by Big Data. The Arts and Humanities Research Council (AHRC), for instance, introduced a research theme called 'Digital Transformations' in 2012, to fund research exploring the potential of digital technologies.[1] In comparison with the sciences, however, research on novel digital data technologies in the humanities is still very limited (Halevi and Moed 2012). This thesis

1 https://ahrc.ukri.org/research/fundedthemesandprogrammes/themes/digitaltransformations/, accessed 2 July 2018.

aims to expand this by exploring new applications for digital data analysis in (socially-engaged) spatial design practice.

While digital tools are not new to the spatial design professions, the ones they use, such as computer-aided design (CAD) and parametric modelling, primarily focus on the built object (i.e. to test the structural, environmental, material or economic outputs of a design). So that although there is a vast amount of digital data on users available today, captured through all kinds of digital devices connected to the Web, it remains underexplored by designers. The thesis aims to move beyond the current object-oriented fixation of digital technologies for architecture and urban design, by introducing a human-centred focus and exploring the intersection between digital data analysis and citizen participation.

Research Focus

Many socially-engaged designers have adopted citizen participation as an instrument to create socially viable public realm projects. The thesis aims to identify the challenges designers face in such projects and aims to explore how digital data analysis could inform spatial design practice by answering the following research questions:

> **Central research question:** How can digital data analysis help designers create more socially viable public realm projects?

This question divides into three subsidiary questions:

- **RQ1:** *What are the limitations of data-driven approaches currently adopted by architects and urban designers?*
- **RQ2:** *How do socially-engaged designers currently use digital tools in their public realm projects aimed at long-term citizen engagement?*
- **RQ3:** *How could analysing socio-spatial digital data help designers generate public realm projects that are more likely to become appropriated and sustained by local communities?*

Currently, many design projects that engage with digital technologies use them for ephemeral art or design interventions. The examples here demonstrate that digital technologies can be useful tools to engage a public in a dynamic and short-term activity, but their use for long-term, sustained, systematic change remains underexplored. The research presents alternative uses for digital data technologies that focus on long-term outputs instead. The ideas of citizen ownership and appropriation of public spaces in this research follow Henri Lefebvre's 'The Right to the City' (1968) in which he maintains that citizens have two central rights: the right to (1) participate centrally in the production of urban space, and to (2) appropriate urban space (Purcell 2014). This thesis translates these as *participatory design* and *design for participation.*

Both forms of participation concentrate on the idea of appropriation, which has been explored at length over the years by academics such as Mitchell (2003), Marcuse (2009), Harvey (2008) and Purcell (2002), and by neighbourhood and city organisations, activist groups (e.g. right to the city initiatives) and human rights activists. The right to the city is often interpreted as a spatial dimension of human rights related to the production and use of spaces in the city. It is considered to be the opposite of the right to property, which is personal and exclusive; the right to appropriation should therefore be collective and inclusive. Sadri and Sadri (2012) lament that public spaces are usually produced by design under the hegemonic forces of the state, capital and institutions, and therefore inherently exclude free use and accessibility to people. The researchers argue that citizens need to be engaged in the design and production of public spaces to free these spaces from hegemony. The thesis refers to this type of citizen engagement as *participatory design*.

While participatory design can be a valuable tool for producing public spaces that cater to people's needs, the thesis argues that this is not the only approach to enable citizen appropriation of urban spaces. Different to participatory design, *design for participation* does not necessarily rely on citizens being involved in the design process. In design for participation, the designer's involvement is temporary; resources are limited, and socially sustainable public spaces are produced without direct input from citizens. Design for participation may cater to an existing (neighbourhood) community, but also aims to include different populations over time. The thesis explores the relationship between inclusivity and longevity through in-depth empirical inquiries using action research and three major case studies. These provided opportunities for incorporating digital data technologies in practical contexts. To explore the central theme of this thesis (i.e. *data mining*), digital data analysis forms a fundamental research method throughout the various studies.

Thesis Structure

The thesis is divided into six chapters. The first chapter reviews relevant literature on the two central themes of this research: (1.1) digital data analysis (including Big Data, data mining, smart cities etc.) and (1.2) citizen participation in spatial design. 1.1 is concerned with the contemporary discourse on digital data technologies and discusses its implications for research, city planning and governance, and citizens. It begins with an exploration of the innovations that initiated the so-called 'Big Data era,' which is thought to have also caused a paradigm shift in scientific research. The chapter questions whether data mining really allows for a different epistemological approach to research, where rather than exploring the *why* (i.e. traditional sciences' search for causality) the emphasis lies on exploring the *how* (i.e. searching for correlation instead of causation). The second part of this chapter (1.2) reflects on the history and varying interpretations of citizen participation in relation to spatial design. A distinction between two different forms of participation in design practice emerges from the review of literature (*participatory design* and *design for participation*), which is used to construct and frame the research presented in the subsequent chapters.

Chapter 2 outlines the methodological approach and institutional frameworks that have shaped the research design and determined the selection of research methods. To enable insights to emerge from the practice-led inquiry, Grounded Theory was selected as the methodological framework of the research. Case study research, action research, and digital data analysis are all used to structure discovery-led empirical investigations.

The first research chapter, Chapter 3, critically evaluates existing digital data technologies already in use by architects and urban designers. The chapter describes various sources of digital data on users, which have so far remained underexplored within architecture, and which designers could make use of to create designs that better respond to, and match user needs. By exposing the limitations of existing uses of digital data technologies, the chapter identifies a gap in knowledge and lays the foundation for the following two chapters, where alternative uses for digital data are proposed that focus on the social aspects of design. Finally, the chapter proposes that the adoption of CAD technologies by spatial design disciplines should function as a precedent for architects and urban designers to incorporate other kinds of software and digital data technologies in their design practices.

Chapter 4 builds on this premise and returns to the central issue of the thesis: public space design projects that succeed in engaging a public during the design intervention, yet fail to achieve long-term engagement and citizen appropriation to safeguard a project's afterlife. After carefully studying the shortcomings of such projects, both through case studies and action research, two approaches are introduced that could answer the challenges identified in real-world examples.

Chapter 5 begins with a case study of public realm design guidance for Whitechapel, London developed by muf architecture/art, and explores how digital data analysis could help the practice generate an empirically-based social design strategy. Different from the previous chapter, which concentrated on *participatory design*, this chapter focuses on *design for participation* and explores how digital data analysis can help architects generate socially viable designs in projects with limited budgets that do not allow for extended public consultation and engagement processes. The second case study is a public space design by OKRA landscape architects for the Afrikaander neighbourhood in Rotterdam. By demonstrating how digital data analysis in an initial phase of a design process could have resulted in a more successful proposal, the chapter introduces the sequence of actions in a design process as an essential factor that can determine the social sustainability of a design.

The Conclusion discusses the importance of training and education to enable architects and urban designers to expand their use of digital data. The proposed approaches for analysing and using digital data in the design process form the thesis' original contribution to the field.

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Chapter 1 – Literature Review

Since the turn of the millennium, many European governments have increasingly put citizen participation at the centre of their policy objectives (such as 'Neighbourhood Planning' in the UK and the 'Participation Society' in the Netherlands). At the same time, citizens are demanding more direct forms of democracy through various civic movements (such as the 2011 citizen occupation of Puerta del Sol in Madrid). Over the last decade, there has been an increasing interest in and demand for citizen empowerment and civic self-organisation, where participation is advocated as a radical form of direct democracy. Furthermore, innovations in information technology, such as social networks and Web 2.0, have introduced new opportunities and alternative methods for citizen engagement in many fields, including spatial design.

By covering some of the themes that emerge from advances in digital data technologies (e.g. Big Data, data mining, and more) and the so-called 'participatory turn' in spatial design practice, this chapter establishes and examines the relationship between these two developments (Kivy and Kaminer 2013:1). It presents the background research that provided a starting point for further empirical investigation. Throughout the thesis, additional literature is introduced to complement the theoretical framework, which is used to evaluate the validity and quality of existing practice examples to reveal weaknesses, inconsistencies, and useful ideas. Finally, the literature review helps to contextualise theory within the field, and put into perspective the outcomes of practice-based inquiries so they can feed into the propositional part of the thesis and help expand on existing, or develop new, theories.

The relevant literature on both digital data analysis (section 1.1), (Big Data, data mining, smart cities, algorithms and machine learning etc.), and on citizen participation in spatial design (section 1.2) illustrates the breadth and depth of the existing body of work and helps identify some of the gaps in literature this study intends to fill (section 1.3).

1.1 Big Data – the era of digital data analysis

The term 'Big Data' was coined by scientists and computer engineers and is a result of advances in digital sensors, communications, computation and storage that have allowed us to capture and store much larger amounts of information that is of value to business, science, government, and society (Cukier 2010; Bryant et al. 2008). Big Data allows us to explore relations between items of information that were difficult or even impossible to analyse before. The thesis moves beyond the 'Big' in Big Data, and deconstructs this concept to understand the implications of the 'data revolution' for socially-engaged design practice, spatial design research, and for user participation. I have therefore broken Big Data down into a study of:

1. the availability of new (real-time) digital data (sources), e.g. social media, Internet of Things, open (governmental) data etc.,
2. the shift in science from hypothesis- and theory-driven research towards data-driven research,
3. computational analysis, i.e. complex algorithms, to discover patterns in data (often used for predictive analytics).

1.1.1 'Datafication' – the availability of new digital data

The world is flooded with more information than ever before. The amount of data we produce is estimated at 2.5 quintillion (2.5 10^{18}) bytes per day. Furthermore, 90 percent of the total amount of data in the world has been produced in the last two years (Marr 2018). This information, which now can be stored almost endlessly, is still growing extensively every day. At the same time, the processing power of computers is growing even faster. These developments are believed to mark the dawn of the era of 'Big Data' which allows us to create new insights into what is happening in the world on an unprecedented scale (Strong 2013). In their seminal book 'Big Data – A Revolution That Will Transform How We Live, Work and Think,' Viktor Mayer-Schönberger and Kenneth

Cukier (2013) define this shift as follows:

> [B]ig data refers to things one can do at a large scale that cannot be done at a smaller one, to extract new insights or create new forms of value, in ways that change markets, organizations, the relationship between citizens and governments, and more. (Mayer-Schönberger and Cukier 2013:6)

Next to the immense volume of the data sets, Big Data is also high in velocity (i.e. it is created in or near real-time); it is diverse in its variety, and it aims to be exhaustive in its scope (i.e. including entire populations or systems in the analysis) (Kitchin 2014). Where do all these 'new' data come from?

'Datafication,' a term coined by Mayer-Schönberger and Cukier (2013), lies at the heart of Big Data. Once a phenomenon is put into a quantified format, it can be systematically tabulated and analysed in a different way from qualitative data. Qualitative data is about observation; quantitative data, on the other hand, is about measurement, and can ultimately be broken down into binary code and computed in systematic and automated ways. We live in a world where every click, payment, call, crime, illness, and more, is encoded as quantified data. Each online post, purchase, transaction, credit application, movie recommendation, and so on, is logged and stored. These data sources form a collection of experiences which can be analysed (O'Neil and Schutt 2013; van Dijck 2014). Computers have become essential for handling and learning from this unprecedented volume of data (Siegel 2013).

The notion of capturing quantifiable information is not new: for many centuries, and long before the digital era, different phenomena have been numerically measured and recorded. However, since the dawn of the digital age, and since the digital has become more ubiquitous, we have become able to measure and track what was difficult to measure before. Social media, for instance, have enabled us to measure human interactions in a quantified way (Strong 2013). And while words were already digitised, Google has been making efforts to turn them into quantified data. In 2004, Google announced their plan to 'datafy' as many books as they could so everyone could search and access them freely through the Internet. Advanced scanning machines were developed, and millions of books were scanned. The pages were first stored as digital images. This already meant that people could retrieve the books through the Internet, however it would require them to know which book they were looking for, and it would take some time to read through the text in order to find the useful parts. There was no efficient way of searching the text for particular words or analysing the text in any automatic way. The texts were images that were only useful by reading what was on the page; they were not yet 'datafied.' In order to achieve 'datafication' of the texts, Google used optical character-recognition software that could identify letters, words, sentences, and paragraphs in the digital images and transform them into quantitative data. Through 'datafication,' computers can now process these texts, and algorithms can analyse them.

The 'datafication' of words has numerous uses. One clever application of these data can be found in Google's machine-translation service. By analysing which alternatives are used in different versions of translated books, Google can reconstruct a translation as a mathematical problem. Computers (machine learning) can now measure and identify which words serve best for accurate translation into different languages. Furthermore, the translation service is constantly optimised by collecting another type of data: user-interaction on the Web. The 'Google Translate' service helps users translate words into a wide range of other languages. Google suggests a translation to the user, but the user can also select multiple alternative words provided by the service. Whenever a user selects a different translation for the word, Google stores this data and feeds it back into the predictive model. This way, the service is constantly collecting and feeding data into its model to optimise prediction, and therewith optimise the translation algorithm.

Another important source of digital data is a result of the 'Internet of Things' (IoT). Everyday objects can have embedded chips, sensors, and communication modules that allow them to form networks. IoT allows physical objects ('things') with embedded electronics to transfer data through a network without any human-to-computer, or human-to-human interaction. Each 'thing' can operate within the Internet infrastructure but has a unique identity through its embedded computing system. This way, the object can exchange its data with the manufacturer, operator, and other connected devices, which can improve the service of a specific object. Automobiles, for instance, can be fitted with sensors to predict engine trouble and communicate this directly with the manufacturer's headquarters. IoT can refer to a wide range of 'things'; from the example of automobiles with built-in sensors to heart monitoring implants to 'smart thermostats' that use Wi-Fi for remote monitoring. Since increasingly more objects are designed to become 'smart,' the amount of data that is collected, stored, and exchanged through IoT is expected to increase exponentially.[2]

Finally, next to 'things', words, and human interaction, location is another type of 'datafied' information. Some companies use digital geo-located data to learn more about the public and its use of the city, for example, the most popular areas for nightlife or the number of protesters that show up for a demonstration (O'Neil and Schutt 2013; Mayer-Schönberger and Cukier 2013). Such geo-located digital data can offer new insights into people's use and behaviours in urban environments and are therefore a particularly interesting source of data for the spatial design disciplines. 'Datafication' has resulted in a vast amount of (quantitative) digital data on the public, which could help inform the social dimension in spatial design. These data offer new opportunities for socially-engaged, empirically-driven design for the public realm.

1.1.2 The scientific turn – correlation trumps causation

In computer science, Big Data refers to data sets that are too large to be processed and stored via regular infrastructures. They require different methods and techniques of analysis (Bollier 2010). Data mining is a method of exploring large amounts of data in a semi-automated process to discover consistent patterns or systemic relationships between variables in a data set. Identified patterns are then verified or invalidated by applying them to, and testing them against, new subsets of data. The most common use of data mining, particularly in business applications, is predictive modelling: predicting

2 The amount of 'smart' devices (IoT) is expected to grow from 2 billion in 2006 to 200 billion by 2020 (Marr 2018).

outcomes of a particular phenomenon or system based on past observations. Data mining can develop useful predictions without detailed comprehension about any underlying causality (Carpo 2014).

Computers are fundamental in data mining explorations; they allow for the manipulation and analysis of large volumes of data through powerful algorithms. The data mining process typically consists of two or three stages: (1) an initial exploration of the data; (2) pattern identification (or model building), including validation; and in the case of predictive analysis (3) applying the model to new data to generate predictions. Data mining is based on conceptual principles of statistics and shares the same general approaches and techniques as traditional Exploratory Data Analysis (EDA) (StatSoft 2013). EDA can be applied to identify relationships between different variables in data sets, without a priori knowledge of the nature of these relations. As in data mining, different variables are compared in order to explore possible systemic patterns. A significant difference, however, is the goal of the data analysis: different from EDA, data mining generally does not focus on exploring and identifying the nature of the emerging relations between the variables. Instead, data mining concentrates on generating effective predictive models based on identified correlations or patterns.

Current developments in data mining technologies are primarily driven by neo-liberal forces, where analysing Big Data enables companies to learn about our spending patterns, social relations, and so on, with the purpose to increase their profits. The image created around data mining has therefore been strongly influenced by the actions of companies such as Amazon, Google, and Facebook. From a business perspective the ‘peta-’ and ‘zeta bytes’ of data, from and on the public, have proven to be a successful marketing tool. Amazon, for instance, collects data on online user interactions to look for correlations in product sales, and suggesting correlated products to customers has increased their sales significantly. Google has created an entirely new business by collecting data that’s freely available on the Internet, and providing that data to users in useful ways. Facebook collects and analyses user profiles, likes, and posts to enable more personalised and targeted advertising. Big Data champions use these businesses as examples of how data mining will change how we learn everything, without having a specific question in mind.

They argue that large-scale explorations in simple models trump small-scale analysis with little data in more elaborated models (Halevy et al. 2009; Anderson 2008).

In traditional research, data analysis generally follows the formulation of a hypothesis, and aims to answer a specific predetermined question. Conventional databases, in a data-scarce world, were designed to answer that question efficiently. In the Big Data world, however, this approach to data storage and analysis is argued by some to have become obsolete (Anderson 2008; Bollier 2010). The enormous amounts of data are diverse in quality and format and seldom fit in predefined categories (Kitchin 2014). Therefore, the formulation of a refined question or hypothesis will only emerge after collecting and exploring the data (Mayer-Schönberger and Cukier 2013).

In an age where the amount of information is growing exponentially, it becomes very appealing to gather more and more of it. However, it is not yet clear into what theoretical framework this activity might fit (Chomsky 2012). As we move from a hypothesis-driven world to a data-driven one, some Big Data champions argue that we should get rid of theory altogether (Anderson 2008; Bailenson 2012; Bollier 2010). In Wired magazine, Chris Anderson claims we are at 'the end of science' and that while 'the quest for knowledge used to begin with grand theories, now it begins with massive amounts of data' (Anderson 2008). In his opinion, science can advance even without coherent models, theories, or any causal explanations. Scientists used to think that data without a model is just noise. However, 'faced with massive data,' Anderson poses, 'this approach to science - hypothesise, model, test - is becoming obsolete' (Anderson 2008). Instead of hypothesis-driven science, the focus has shifted towards pattern recognition (Pisani 2010). These ideas are reinforced with arguments against causality. According to Mayer-Schönberger and Cukier (2013), humans are conditioned to search for causes, which can often be very difficult and might even lead us down a wrong path. Traditionally, data was scarce, which meant that both causal explorations and correlation studies were based on a hypothesis, which would be invalidated or verified through research. However, since both these approaches depended on the formulation of a hypothesis early-on, they were equally exposed to bias and false intuition. Moreover, in many studies, the data that was needed for the research would not be available. Nowadays, with the ever-increasing volume of data, a hypothesis is no longer central to the study of correlations. Big Data, Mayer-Schönberger and Cukier maintain, would allow us to stop being fixated on causality and instead uncover patterns and correlations in data that can offer new insights. Even if a causal exploration is an ultimate goal within scientific research, correlation can help frame a direction for further, causal, investigation. Correlation can uncover phenomena that are possibly related, which could allow researchers to investigate the underlying causes of such correlation.

Big Data allows us to find patterns in large data sets by using statistical algorithms, something that conventional research could not achieve. Big Data champions therefore argue that we can stop constructing causal models. Big Data and the 'age of petabytes' allow us to say 'correlation is enough' (Kelly 2008). However, there is still causality after the Big Data exploration: decisions are made based on identified correlations, and that relies heavily on the unavoidably subjective interpretation of data. Many dominant narratives, however, claim the exact opposite, by characterising Big Data as self-evidentiary (Dourish and Cruz 2018). The idea that Big Data can speak for itself, and has supplanted theory, has formed the foundation of many data science programmes, such as predictive policing or diagnostic visual analytics (McKie and Ryan 2015). This idea, however, has been subject to significant critique, including problems of bias (Angwin et al. 2016), error (Garnett 2016), power (Currie et al. 2016), and opacity (Burrell 2016).

The thesis argues that data are not able to speak for themselves. They are given shape and meaning and are put to work through a narrative. Data are employed to reveal phenomena, justify decisions, test theories or assumptions, generate new understandings, or challenge dominant narratives. Data are used to tell stories, which are shaped, explained, shared, and interpreted by people (Gabrys et al. 2016). Latour (2007) argues that data in itself cannot sustain truth claims without narrative frameworks to make them effective. Such narrative frameworks often follow a linear model, which can restrain the multiple perspectives and alternative interpretations that live within data and change its undifferentiated nature. By selecting a particular point of view, other perspectives and interpretations are de-emphasised. Furthermore, narrative structures selected to frame data are often pre-figured and influenced by particular contexts, cultural settings, or (political) agendas. One could therefore ask: Do data shape a narrative? Or does narrative shape data? Can data escape being interpreted by pre-existing ideas and theories?

The purpose and underlying question for Big Data analysis in businesses such as Amazon or Google is evident: How can Big Data help increase revenue? But what about data mining research in other contexts? Is it possible to research blindly, without a question or hypothesis in mind? The thesis aims to demonstrate that while personal biases are inherent in any research, it is possible and useful to postpone the formulation of a research question or hypothesis in data-driven research. After an initial exploration of the data, a question or hypothesis can emerge from it, which can then enable the researcher to organise, classify, and understand the data in a particular way. Finally, a theoretical framework can be valuable to make sense of, and critically assess, the data to gain better insights into a phenomenon.

1.1.3 Algorithms – More data equals more power

> *'Personal data is the new oil of the internet and the new currency of the digital world.'* – European Consumer Commissioner Meglena Kuneva, Brussels, 31 March 2009

A lot of the data used in Big Data analysis are raw; a by-product of other activities, and generated with no specific question in mind. Similar to unrefined oil, it is not the data that are valuable; instead it is what is discovered within the data through analysis that is of genuine value (Siegel 2013). Until recently it was too complicated a task to make sense of such large amounts of data. Computational advances, including higher processing power and novel analytical techniques rooted in artificial intelligence and machine learning, have enabled us to mine patterns and build predictive models based on these (Big) data (Han et al. 2011).

Machine learning has its roots in mathematical statistics and computer science and is a process of developing predictive models by constant trial-and-error. Predictive analytics is a technology that predicts future behaviours by learning from past observations (i.e. data). In machine learning, computers automatically develop new knowledge by feeding on (i.e. learning from) data. Computers learn to predict by systematically, and scientifically, developing and continuously improving predictions.

Predictive analytics use data to understand individuals' decisions and is therefore different from forecasting (Siegel 2013). While forecasting makes predictions on a macro scale, e.g. the total number of iPhone purchases in London in one year, predictive analytics paints a more detailed picture of what kind of Londoners are most likely to buy an iPhone in that year. By accumulating a multitude of smaller predictions, machine learning can create more generic predictive models that can inform decision-making in government, healthcare, business, science, and more. Big Data champions claim that data mining enables the development of objective predictive models. This thesis argues that while data in itself might be unbiased, the focus of the analysis and the chosen algorithm that runs the analysis are always selected by someone with a specific goal in mind, and are therefore inevitably selective. The following example illustrates how such biased algorithmic models can have severely detrimental effects on human lives and demonstrates the importance of awareness and transparency of subjectivity and personal biases in data mining explorations.

In 2012, a Silicon Valley start-up developed a piece of software for predictive policing called *PredPol*. The software uses historical crime data to calculate, in real-time, where crimes are most likely to occur. Many police departments in the United States purchased the software to help them deal with a demand for increased efficiency of their police force. By spending more time patrolling the areas where crimes were predicted, police officers were able to discourage criminal activities such as burglaries from taking place. However, because police patrolled such areas more frequently and more thoroughly, a lot of minor crimes, such as selling small quantities of drugs, which would typically be unrecorded, were now on the record too. This led to a lot more arrests for victimless crimes in impoverished neighbourhoods, where a majority of the population is from a Black or Hispanic background. Similar minor crimes committed by college students would go unpunished since they occurred in other, unpatrolled, neighbourhoods.

The UCLA anthropology professor who founded *PredPol*, Jeffry Brantingham, ensured that his predictive policing model is blind to race and ethnicity: the program does not focus on individuals but targets geography instead (O'Neil 2016). The input into the model only consists of the type, location, and date and time of each crime. However, even if the data model is colour blind and unbiased, geographic and cultural segregation in cities - especially in the United States – resulted in a system of criminalising and punishing poverty. *PredPol* unwittingly created a system where the less fortunate and marginalised were more likely to fall into a cycle of incarceration and re-incarceration.

The Spatial Information Lab of Columbia University and the Justice Mapping Center in New York came up with an alternative approach to studying criminal justice data. In their study, researchers investigated the same crime data sets used for predictive policing, but instead of looking at the location of the crime, looked at the home addresses of incarcerated citizens, prison admission rates, and the public cost of incarceration. As a result of this study for five cities in the US, the researchers came up with the term 'Million Dollar Blocks': single urban blocks where public expenditure would exceed one million dollars a year to put people into the prison system (fig. 1.1). Mapping these urban blocks helped the researchers identify urban 'hot spots' – sources of mass incarceration - and demonstrate the importance of geography as a root cause of imprisonment. The researchers argued that public investment used for mass incarceration could be redirected to improve and uplift civic infrastructures, such as education and other community resources, in order to address the causes and not just the symptoms of crime and to ultimately break the cycle of incarceration.

The Million Dollar Blocks initiative demonstrates how the same data can be used to form an entirely different narrative when approached from a different angle. The thesis therefore argues that while data can be unbiased, the analysis hardly ever is. Finally, while data do hold power, the individual or team that analyses the data shapes the narrative and decides how agency and power are exercised.

Figure 1.1

Million Dollar Blocks highlighting prison expenditure across in Brooklyn, New York (top) and two blocks in Brownsville, Brooklyn where 31 men across two blocks are imprisoned, and 4.4 million dollars is spent on their (re-) incarceration

1.1.4 Big Data and the City – 'smart cities' as the future of urban developments

A large amount of information that is collected today is about the built environment and the people that inhabit it. Information on online social networking platforms, smart transit ticketing, credit card transactions, and mobile phone usage all contain geo-located data. These data are integrated, analysed, and visualised to create new insights into environmental, economic, social, and spatial dynamics in cities (Serras et al. 2014). The previous section demonstrated how numerous industries have already reaped the benefits of Big Data by developing innovative ways of improving their businesses. More recently, city authorities have also started to recognise the benefits of Big Data for improving city management operations and becoming 'smart' (RIBA 2013).

Generally, there are two main lines of development that qualify as 'smart cities.' First, there is the small number of newly planned cities developed on a blank canvas, such as *New Songdo* in Korea, *Masdar City* in the United Arab Emirates and *PlanIT Valley* in Portugal (Greenfield 2013; Townsend 2013). These urban scale developments are designed with information processing abilities embedded in urban spaces, surfaces, and buildings, and serve as radical examples of the future 'smart city' (fig. 1.2).

The second and more commonplace development of 'smart cities' takes place in existing urban environments. An increasing number of city councils are cooperating with tech companies[3] and research institutions to integrate Big Data technologies and networked information systems into the existing urban fabric. Sensor and network technologies developed by 'intel' companies help cities monitor and optimise urban processes such as water supplies, transport and logistics, and environmental quality (such as air pollution) (De Waal and De Lange 2013). Big Data helps uncover and visualise such urban processes, which managing bodies can use to optimise the flows of information, energy, and materials in urban environments. Over the next decade, many aspiring 'smart' cities are expected to devote a large number of their resources to integrate such information

3 Intel companies that work on strategies for 'smart cities' include IBM, CISCO, AT&T, Microsoft and Philips.

Figure 1.2
Masdar City in
Abu Dhabi

technologies into their urban management structures (Greenfield 2013). Adopting Big Data technologies can help cities tackle some of the significant challenges they face in the near future (growing populations, increased traffic congestions, air pollution, energy waste etc.) while maintaining and improving the quality of life of its citizens.

While Big Data can potentially contribute to more efficient forms of city governance, techno-centric approaches to urban management often portray the city as a data-generating machine and therefore risk reducing the city to processes that can be quantified (Mattern 2013). Morozov (2013) denounces the increasing interest in 'smart city' governance along with prevailing 'solutionist' attitudes in which complex social situations are defined as problems with computable and explicit solutions, or as comprehensible processes that can be optimised if one uses the right algorithms. Such 'solutionist' techniques often offer inexpensive and instant results, and therefore undermine more complex, socially-oriented, and demanding approaches to urban governance. Mattern warns us for the possible effects of this technocratic shift: 'If we can simply automate the depersonalized dispensation of social welfare, there may not be sufficient motivation to get our hands dirty digging for root problems like poverty, unequal access to healthcare and information services, and socioeconomic disparity (…)' (Mattern 2013:6).

The notion of the 'smart city' originates from businesses rather than urban planning theory or practice. Within the history of urbanism, it is unprecedented that the commercial sector influences ideas about urban design and city planning at such a large scale. Greenfield describes the uniqueness of this situation through the following analogy: 'It is as if the foundational works of twentieth-century urbanist thought had been collectively authored by United States Steel, General Motors, the Otis Elevator Company and Bell Telephone rather than Le Corbusier or Jane Jacobs' (Greenfield 2013:7). Commercial parties generally tend to adopt a birds-eye perspective when it comes to urban planning and governance (Greenfield 2013). From such a perspective, only large-scale urban and infrastructural forms are perceptible, while more complex influences and phenomena, such as social interactions, are invisible and therefore remain overlooked. Smart city technologies developed from a birds-eye perspective reduce urban life to a matter of managing infrastructures and reinforce the illusion that cities can and should be controlled top-down (Fernandez 2013). By scrutinising several 'smart city' initiatives and critically examining their effects on peoples' quality of life in urban environments, this thesis argues for a more bottom-up socially oriented approach to 'smart' urban planning and governance.

This section will touch upon some of the topics and debates in the smart city discourse, both within and outside the urban design and planning discipline, and discusses how contemporary examples of smart city initiatives fit within the entrepreneurial turn in urban governance (Shelton et al. 2015). Smart city initiatives have so far failed to resolve important societal problems, such as socio-economic inequality, and are more likely to reproduce such problems in new ways. While the smart city discourse offers interesting opportunities to explore issues of civic participation in urban planning and governance, this thesis concentrates on architectural design, particularly socially-engaged practice, rather than large-scale urban systems. Architects usually work with specific commissions in specific locations. Moreover, socially-engaged architecture offices, such as muf architecture/art, are rarely concerned with large-scale implementations of urban technologies in their daily practice. Their day-to-day reality rather revolves around empowering citizens, particularly marginalised community members, by engaging them in the design of neighbourhood spaces. The thesis therefore concentrates on particular public spaces in local urban contexts and discusses how digital technologies can be used in specific situations to help architects design more socially sustainable spaces.

Aspects of the 'smart city' have been scrutinised by various academics, also outside urban planning and design disciplines, particularly in urban geography and media studies. Kitchin and Dodge (2011), for example, examine how data and algorithms are operationalised in everyday urban life. By following three people in London, the researchers trace how code influences and mediates different aspects of their lives, including travel, work, communication, consumption, and domestic life. With this approach, their study demonstrates how data exercise power over people's everyday lives. When people become dependent on code, issues of bias and error can have significant consequences (O'Neil 2016). This thesis demonstrates that such issues are very common in Big Data explorations, and argues that there is a need for more public awareness of these deficiencies (see Chapter 1.1). Other scholars focus on the interface between politics and the environment, and examine how the material manifestation of smart technologies (such as environmental sensors and city dashboards) affect urban governance and society as a whole (Braun 2014; Gabrys 2014). Again, there are issues of bias and error in data gathering and analysis that need to be considered, but there are also issues of opacity (do people know what data are gathered on them and their environment?) and power (who decides where environmental sensors are placed, and do citizens have a say in such decisions?) (see discussion in Chapter 1.1). By examining a smart-city design proposal developed by MIT and Cisco (the 'Connected Sustainable Cities' project - CSC), Gabrys (2014), for example, explores the spatial and material distribution of power through urban technologies. Her research argues that rather than approaching individuals as governable subjects, smart city proposals often portray citizens as sensing nodes – i.e. 'citizen sensors'. By developing an alternative approach to Foucault's notion of 'environmentality' - a term Foucault uses to describe the current nature of governance which instead of governing individual behaviours, or 'players', concentrates on regulating environments to influence 'the rules of the game' (Foucault 2008:206) - Gabrys evaluates and criticizes the CSC project's understanding of urban citizenship, which she demonstrates to be limited to a series of actions focused on monitoring and managing urban data.

Some researchers focus on how data from social media and smartphone applications may misrepresent the social geography of cities. In their study on 'Extracting Diurnal Patterns of Real World Activity from Social Media', Grinberg et al. (2013) analyse Foursquare and Twitter data's ability to capture real-world activities and explore behaviours on social media platforms regularly as compared to occasionally with rare events such as Hurricane Sandy in 2012. Their research demonstrates how data on social media activity could inform computational event detection systems. Their study of data produced during and in the aftermath of Hurricane Sandy, however, also demonstrates that data on these particular social media platforms did not accurately reflect the situation on the ground (Crawford 2013). Due to a widespread power outage caused by the hurricane, Twitter became the main platform for communication for news agencies and civilians, but also for emergency and disaster relief organisations. The high level of tweets coming from Manhattan, where the overall smartphone ownership and use of Twitter are generally higher than other parts of the city, suggested that this part of New York was affected most severely. At the same time, however, there were significant gaps in data from more critically affected locations, such as Coney Island and Rockaway. Particularly in situations where disaster relief is reliant on real-time information from social media, misrepresentations in data can have extremely harmful consequences.

As these last two examples demonstrate, studies on Big Data and smart cities in the social sciences are fairly critical, scrutinising the way data are gathered, analysed, interpreted, and operationalised. These commentaries correspond with the discussion on the limitations of Big Data in this thesis, which includes issues of bias, error, power, and opacity (see Chapters 1.1.2 and 1.1.3), and the issue of uneven representation of communities through digital data.

Another general concern within the smart city discourse is city governments' tendency to adopt 'smartness' to amplify and extend their neoliberal agendas (Cardullo and Kitchin 2018; Saiu 2017). Cities' 'smart' initiatives are criticised for focusing too much on economic gains through efficiency and innovation and failing to address societal issues that are more central to everyday urban life. There are, however, smart city initiatives in which city governments aim to oppose predominant neoliberal, technology-centred attitudes by experimenting with an alternative decentralised and more citizen-centred approach (March and Ribera-Fumaz 2014; Carvalho and Vale 2018).

Barcelona's vision of the smart city, for instance, revolves around technological improvements to enable self-sufficiency (in terms of energy production and consumption) and citizen empowerment (Barcelona City Council 2012). The first step in achieving this goal is the implementation of several small-scale pilot projects. One of these initiatives is the 'illes autosuficients' (the self-sufficient block). Barcelona City Council plans to develop two urban blocks in a former industrial area in which sustainable technologies, including solar panels, district heating, water recycling systems and parking lots for electric vehicles, together with a 'smart' management system, aim to deliver buildings that can take care of their own energy supply and produce zero net emissions. Information on these plans is scarce, and since the blocks have not been developed yet it is difficult to evaluate how exactly this approach to bottom-up smart urbanism will empower citizens. Some critics are concerned that the city's true ambition behind these plans is to develop a new economy based on the export of knowledge and technology produced in their smart city pilot projects (March and Ribera-Fumaz 2014).

Such an entrepreneurial attitude can also be found in the UK, where the Greater London Authority (GLA) aspires to become a leader in 'CleanTech' by investing in innovative products, such as lower-cost air quality sensing technology (GLA 2018). The GLA also created the London Datastore platform, which makes available much city government data for free (data.london.gov.uk). While this Datastore already provides free access for the public to a number of government datasets, the GLA aims to become a global leader in open data by persuading other public sector organisations, such as Transport for London (TfL), to release their data onto this platform too, providing a single, easily accessible location for a wide variety of datasets. While providing a single platform for all of the city's open data would improve accessibility, it is questionable whether such an initiative would make the smart city trend more democratic. Examples of civic applications built on open data (see Chapter 3) demonstrate that democratic values do not always benefit from such technologies (i.e. issues of uneven participation and representation), and that economic benefits often prevail in civic tech innovations.

Another example of a smart city initiative that claims to challenge and counteract top-down governance takes place in Lisbon (Carvalho and Vale 2018). About a decade ago, the ambitious PlanIT Valley project placed Portugal on the global map of smart cities being built from scratch. Over the last years, however, the smart city discourse in Portugal, as well as in many other parts of the world, has been down-scaled and has become more nuanced: top-down, tech-centric visions have been exchanged for notions of transparency, citizen engagement, flexibility, co-creation, and innovation in public service provision. In Lisbon, this shift resulted in an open data initiative: similar to many other city governments worldwide, several types of city data were released to enable more democratic access, participation, and collaboration by a broader scope of actors, including entrepreneurs, academics, activists, NGOs, journalists, and more (Townsend 2013). By shifting their focus from large tech corporations to smaller communities and organisations, Lisbon's open data initiative promised to distribute power more equally and stimulate new innovations and smart solutions for its government and citizens (Hunsinger and Schrock 2016).

Although closely related, Big Data and open data are two different developments. While Big Data is defined to a large extent by size, open data is defined mostly accessibility. Open data can reinforce Big Data by making it more accessible and therefore more democratic. However, open data does not have to be Big to be useful, even smaller amounts of data can have a big impact when made public (e.g. data from local governments can help citizens participate in local budgeting or help individuals and start-ups build apps to improve public service delivery). Through the Commonplace case study (Chapter 3.4), this thesis demonstrates how open government data can help innovate social enterprise and advance research on citizen participation.

Privacy issues are a great concern when working with data from and on the public. Not only are people worried about government agencies and businesses collecting their personal data, individuals often don't know which data are collected and how they could get access to these records. Open data could help increase transparency, and could therefore potentially help empower people by gaining control over their data (Mattern 2016; De Lange 2017; Odendaal 2019). Some government programmes, such as Midata in the UK (pcamidata.co.uk), and Blue and Green Button in the US (greenbuttonalliance.org), have already taken initiatives that encourage businesses to share personal data with their customers. Lisbon's open data policy also promised to foster accessibility of data and active citizen engagement while promoting economic development through technological innovation. The city's ambition to deliver results, showcase solutions and accelerate companies, however, resulted in increased financial and political support for established start-ups who could deliver data-driven innovations. This prioritisation of practical outputs and short-term economic gains ultimately led to the demotion of more citizen-centric purposes, including civic participation and data openness (Carvalho and Otgaar 2017).

The Lisbon example is just one demonstration of the many open data pilots that intended to contribute to a more participatory democracy, yet merely ended up promoting innovation and economic development by tech companies and start-ups. City governments' motivation to actually commit resources to open data experiments often result in their ambitions superseding civic values for more profit-driven incentives, such as attracting new labour and capital (Goldstein and Dyson 2013; Shelton et al. 2015). By opening up their data, Lisbon invited large tech companies and local start-ups to develop and test new smart solutions that could reduce inefficiencies and improve public service delivery. Not only would these innovations benefit the city, the developed apps and software solutions could also be exported to other places and governments to generate profits. This entrepreneurial mindset reappears in many other aspiring smart cities.

The Streetbump app (see page 122) developed by the City of Boston's New Urban Mechanics programme, for example, has been directly transferred and replicated in Philadelphia and is planned to potentially expand to other cities as well (GovTech 2012;

Shelton et al. 2015). In Dublin, the open data initiative 'Dublinked' aimed to revitalise the local economy during the recent financial crisis by investing in smart city innovation and fostering a partnership between the city, local universities, and Intel company IBM (Carvalho and Otgaar 2017). Kitchin (2014) suggests that the ways in which city governments' ambitions (i.e. transparency, participation, economic development, and efficiency) are materialised through open data depend on their socio-economic and cultural contexts, as well as the interests, agendas, and priorities of local policy-makers. This section argues that, at the moment, open data initiatives are primarily evaluated by city governments for their potential to advance economic development and increase efficiency (e.g. realising more cost-effective public service provision and help build new start-ups). Even if they are communicated as citizen-centric initiatives, open data programmes in a neo-liberal political context are often only realised if they are considered economically viable and profitable. Although scarce, examples of cities that prioritise civic values over financial gains in their open data policies do exist. The city of Helsinki, for instance, was able to preserve openness and transparency in their open data pilot ('Helsinki Infoshare') by prioritising the use of data to help improve interaction between citizens and local government (Forum Virium Helsinki 2016).

A final practice example of a smart city project that claims to counteract the traditional top-down model is Sidewalk Labs' urban renewal plan for Quayside, Toronto (sidewalktoronto.ca). Sidewalk Labs, a sister company of Google, is Alphabet Inc.'s urban innovation hub set up to improve urban infrastructure and developments through technological solutions. In October 2017, the company won a competition to develop parts of Toronto's waterfront by realising a pilot project in Quayside, a 4.9-hectare site in the city's East Bayfront, which the city ultimately plans to scale up across the 325 hectares of Toronto's Portlands. Sidewalk Labs aims to build a new urban neighbourhood that makes extensive use of digital data by integrating various types of smart sensors in the public realm; experimenting with self-driving cars; reconfiguring the regulatory relationship with local government, and building platforms to attract investments by civic-tech companies. 'By combining people-centred urban design with cutting-edge technology we can achieve new standards of sustainability, affordability, mobility, and economic opportunity' (sidewalklabs.com). Intel companies such as Sidewalk Labs are keen to invest in the digitization of urban environments, as it forms a new market for their products (Kitchin 2015). Such a large influence of tech firms in urban planning and governance can, however, have negative externalities on civic life (such as the commodification of public services to make them profitable).

Sidewalk Labs' ambitious redevelopment project raises several questions on the digital infrastructure that will be embedded in the physical urban fabric of the neighbourhood and, more generally, on the relationship between local government and tech companies (Carr 2018; Lorinc 2018). When does data gathering become surveillance? How can local government strike a balance between encouraging technological innovation for advancing local economic activity while protecting citizens' privacy and interests, particularly of those who don't benefit from the data-driven economic systems? Particularly issues of data ownership (who owns the data collected in the public realm, for how long, and under what terms and conditions), transparency (how will citizens know when they have entered a data-gathering environment), and consent (how will individuals be able to provide their consent for the use of their data that is gathered when they pass through the neighbourhood's public spaces) are core issues that need to be addressed (Lorinc 2018). Branding their Toronto project as a 'lab' suggests that many of these questions will be subject to testing and experimentation 'on-the-ground' through trial-and-error.

Kitchin (2014) classifies the sources and production of Big Data into three categories: directed data, automated data, and volunteered data. Directed data refer to human operators using technology to monitor a person or place - these data are commonly generated by traditional forms of surveillance. Automated data, on the other hand, are generated as an undirected automatic function of the device or system (e.g. data from smartphones, sensors, and online interactions). Volunteered data is described as data which people offer a system voluntarily in trade for a service (such as social media platforms, or online transactions) or to contribute to a greater goal (such as crowdsourcing). The data described in the Sidewalk Labs project can be categorised as automated data; data on the public is gathered automatically by sensors and devices, which raises numerous ethical concerns. The thesis aimed to avoid such directed and automated data sources and instead focused primarily on open government data and volunteered data, i.e. data that are voluntarily shared by individuals on online platforms. These platforms include social media channels, such as Twitter and Instagram, and crowdsourcing services, such as Commonplace.

1.2 The participatory turn in spatial design

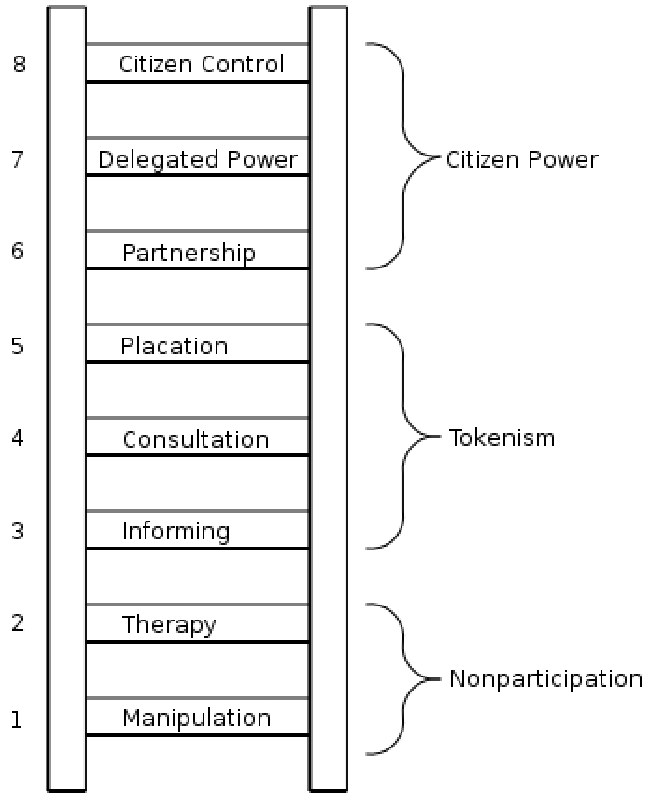
> '[P]articipation can be seen as a means of making architectural practice more relevant to, and more engaged with, the everyday world.' Peter Blundell-Jones in *Architecture and Participation* (2005)

1.2.1 Evolution of citizen participation in spatial design

The idea of citizen participation as a radical form of direct democracy have evolved and expanded over the last decade. Innovations in digital technologies, such as social networking platforms and Web 2.0, have contributed to a so-called 'participatory turn' in many disciplines (Krivy and Kaminer 2013). This turn can also be identified in architecture and urban design, where some of the ideas on participatory design of the 1960s have re-emerged (Hansson et al. 2013). 'Participation' captured the idea that people should be able to influence the decisions that affected them. In the late 1960s, Sherry Arnstein described participation as 'the redistribution of power that enables the have-not citizens, presently excluded from the political and economic processes, to be deliberately included in the future' (Arnstein 1969:216). While participatory planning and design has remained important in many Latin American countries ever since, in Western Europe citizen participation became integrated into planning policies and was often reduced to public consultation processes. After a long period of absence, in the late 1990s, under New Labour, interest in participatory design reappeared through many different terminologies, including communicative planning and design, co-design, and collaborative planning. This renewed interest in citizen participation was partly due to a reconsideration of power relations, justice, and social resilience against the backdrop of rapid global, social, and environmental changes. More recently, European governments have placed citizen participation at the centre of their policy objectives. In the UK, for instance, David Cameron's coalition government, which took power in 2010, introduced concepts such as the 'Big Society,' 'Localism,' and 'decentralisation' in their rhetoric to support the idea of citizen participation. Explicit demands for inclusive decision-making and the decentralisation of power through civil movements, such as Occupy Wallstreet, more convincingly demanded a break with top-down power structures and institutions.

Participation in spatial design can take many different forms, ranging from basic questionnaires to more meaningful dialogues between citizens and stakeholders in public hearings, design charrettes, or participatory design processes. Different strategies enable different levels of quality of participation. In her seminal publication 'A Ladder of Citizen Participation', Sherry Arnstein (1969) describes a hierarchy of eight rungs, starting from 'manipulation' as the lowest form of participation, to 'therapy', 'informing', 'consultation', 'placation', 'partnership', 'delegated power', and 'citizen control' at the top (fig. 1.3).
The rungs on the ladder symbolise a linear hierarchical model, ranging between non-participation, tokenism, and citizen power. The higher the rung, the better the level of participation. Arnstein argues that the lowest levels of participation, such as 'therapy' and 'manipulations', have no effect on redistributing power. Instead, they are often exploited by property developers and planners to justify existing plans and proposals.

Figure 1.3
Arnstein's ladder of participation



While Arnstein's model was very relevant at the time, when planning committees held power, there have been significant changes since then. The availability of affordable media technologies and free online information have helped break down some of the traditional hierarchies and enabled new ways for citizens to stay informed, and even to self-initiate collective action. Innovation in information and communication technologies (ICT) have offered new opportunities for scrutinising and reforming traditional decision-making processes in representative democracies. New digital technologies enable better service provision for citizens and introduce new ways of engaging them in local decision-making. Numerous digital initiatives, such as 'The Digital City' in Amsterdam, explore how the Internet can be used as a means for reinforcing deliberative democracy in local contexts (Hansson et al. 2013).

Hanssen et al. (2013) argue that the underlying ideology of participation has changed too since the 1960s. The radically democratic ideology that emphasised the implications of power imbalances and unequal economic conditions was replaced by an ideology that highlights the accessibility of information and stresses the importance of public participation in local decision-making for establishing a more creative and efficient society. This has also caused a shifting of focus from economic inequalities between different communities to a focus on unequal representation and the uneven influence certain dominant communities have on local decision-making. Research into new media has demonstrated that the relationships between those who participate in Internet discussions are equally unbalanced and no more egalitarian than other forms of participation. Only particular groups participate in political activities online, and gender, race, and ethnic discrimination are just as prominent online (Wright 2005; Herring 2008; Postmes 2002).

In his article on A*dvocacy and Pluralism in Planning*, Paul Davidoff (1965) argues that the ultimate goal for urban planning and design is the redistribution of power, and equal representation in the planning process is a necessary condition and important vehicle to achieve this redistribution. In his view, participation is not just a means to engage citizens in decision-making processes, but a highly influential mechanism that requires defining who is a legitimate, representative 'citizen.' While innovations in digital technologies might not automatically increase participation, they do hold the potential to improve the conditions for participation. Rather than focusing exclusively on online methods to enable equal representation, participatory methodologies in spatial design could acknowledge and adopt a wide variety of both on- and offline tools to reach a broader audience. Furthermore, rather than planning single events, a process of long-term engagement with locals could help facilitate equal representation by offering forums and spaces for a variety of public spheres where different agendas can be presented and developed over time (Hansson et al. 2013).

1.2.1.2 Contemporary critical discourse - 'the political' in participatory design

According to several socially-engaged design practitioners and scholars, participation has become an established term that is used uncritically in many 'socially relevant' practices (Miessen 2010:120; Blundell-Jones et al. 2005; Petrescu 2007; Till 2005). They lament that participation has become a romanticised concept that is interpreted as a consensus-driven process, and argue that the term 'participation,' as well as the term 'political,' should be scrutinised and redefined in design practice.

According to Mazé and Keshavarz 'the political' in participatory design processes '[is concerned with] how society is constituted as the organisation of human coexistence' (Mazé and Keshavarz 2013:9). Within this definition, design is interpreted as one of the practices that can actively shape and coordinate human coexistence. Political theorist Chantal Mouffe links the political to the 'dimension of conflict that exists in human societies (...): an antagonism that is ineradicable' (Mouffe 2010:107). According to Mouffe, reaching a 'consensus beyond hegemony' in participatory decision-making without excluding anyone is unattainable (Mouffe 2010:107). With her 'agonistic model of democracy,' she advocates public spaces that can materialise and facilitate pluralistic, participatory processes (Mouffe 2010:108). Carl DiSalvo argues that spaces for confrontation are vital for pluralist societies and democracies to thrive. With his coined term 'adversarial design,' he pleads for the design of spaces for conflictual participation (DiSalvo 2012:5). This notion of confrontation also appears in Mazé and Keshavarz's work, where design is understood as a mode of intervention 'in which a particular social order may be confronted with others' (Mazé and Keshavarz 2013:9). These conceptual ideas closely follow the work of French philosopher Jacques Rancière, who argues for the need of 'dissensus', or the disruption of power relations, in emancipatory processes and practices (Panagia and Rancière 2000).

Ideas on conflictual participation (i.e. 'adversarial design,' 'agonistic public spaces,' and 'dissensus') have become prevailing concepts in contemporary art and design discourses that deal with citizen participation and public space. Particularly cities have become the place for staging such friction. A large number of art and design scholars and practitioners seem to champion the idea that conflict, struggle, and contradictions can be productive (Hirsch 2006). However, how would this take shape in practice beyond ephemeral interventions?

One interpretation of provoking agonistic democracy in spatial practice emerges in the work of Markus Miessen (2010). He introduces an analogy of crossbench politicians in the British House of Lords to describe a new task for spatial practitioners. Much like the crossbench politician, critical spatial practitioners should provoke conflict in consensus-driven systems by introducing 'zones of conflict' to facilitate change in the cultural landscape (Miessen 2010:249). Miessen argues that the next generation of spatial designers should act as outsiders who are deliberately negligent of existing protocols, who enter an on-going process not from the bottom-up, but from the side, and who cause friction in order to enable space for transformation. Miessen's disruptive approach, however, is grounded in ephemerality: the 'crossbench practitioner' concentrates on the act of intervening and therefore tends to focus solely on the temporary. Contextual complexities, which often only rise to the surface when one is involved in a process over a more extended period, remain overlooked in this type of disruptive design.

Disruptive interventions include guerrilla gardening, weed bombing, chair bombing, yarn bombing, and temporary infill, and are often grounded in ideas of socio-political agency and activism, and involve reinterpreting existing infrastructures and urban spaces for alternative purposes (Wortham-Galvin 2013). While these disruptive activities are often dynamic, participatory, and offer critiques of the status quo, they are all ephemeral actions, often with no lasting permanent effect. Instead of operating as a means to catalyse social change, such types of participatory urban interventions are classified rather as provocations and performance art (Lydon and Garcia 2015).

A large number of participatory design projects that focus on facilitating an agonistic public space share this temporary character. They often concentrate on the disruptive action, rather than taking a more complex approach to constructing long-term engagement and socially sustainable public spaces. This thesis contributes to the discourse on citizen participation in public space by taking a critical stance towards the idea of 'dissensus' and disruption, and seeks for a more constructive approach for collective appropriation of urban spaces: an approach that moves away from the illusion of harmony, acknowledges space for conflict and tension, yet tries to establish a space for sustained coexistence and cooperation through a data-enhanced understanding of social context. By proposing alternative approaches to the design process of socially sustainable public spaces, the research aims to move beyond the dominant 'leftist aestheticism' within the contemporary discourse on citizen participation in art and design (Hirsch 2006:301).

One example of a project that is aware of the long-term perspective and very consciously deals with 'conflict management' is the ECObox project by Atelier d'architecture autogérée (aaa). The architects used citizen participation as a tool to transform a vacant site in the La Chapelle district of Paris by co-creating a community garden with a multicultural, low-income, and politically under-represented inner-city community. The walls of the garden's perimeter have holes that control which aspects of the space and activities are visually represented to the outside. With this control of visibility, the architects aimed to contribute to the community's feeling of ownership of the space (Morrow 2007). According to Doina Petrescu, co-founder of aaa, making community and making space for community are inherently connected. She criticises mainstream participatory spatial practices with a temporary approach in which, she argues, designers only engage in a project superficially. Petrescu (2007) explains that being a spatial practitioner in a participatory context means participating in and with the community. Furthermore, Petrescu's practice acknowledges the fact that participants' personal gain is often the only form of motivation for their collective engagement, which can result in conflictual situations. Mouffe (2010) also recognizes this paradox between conflict and cooperation. She describes this as 'agonistic struggle', in which 'conflictual consensus' allows people to work together towards a shared goal, even if they are not in constant agreement (Mouffe 2010: 108).

As well as Mouffe's 'agonistic pluralism' (1993; 1996; 2000), there are many other ideas on citizen participation corresponding to diverse political theories, including 'associative democracy' (Hirst 1994) and direct or 'deliberative democracy' (Habermas 1996; Dryzek 2000). Each theory favours a different process of democratisation, presents a different view of social relations, and puts forward different ideas of participatory practices. However, theories that mediate between urban design practice, political notions of democracy and participation are scarce, and often limited in their scope and rigour (Krivy and Kaminer 2013). Through the analysis and exploration of real-life participatory practices in the design of public space, this thesis seeks to contextualise some of these theories in order to assess their ramifications and efficacy and criticise or strengthen some existing theoretical concepts of citizen participation.

1.2.2 The Right to the City

The contemporary discourse on politics and public space has been dominated by recent examples of public protest and occupation of urban spaces by citizens, such as the 2011 Occupy movement or the Arab Spring. Rather than exploring the relationship between politics and public space from a political perspective, this thesis aims to bridge the gap between the ephemerality of common participatory approaches and the desire for lasting change and socially sustainable public spaces through citizen appropriation. The foundations for the idea of citizen ownership and appropriation of public spaces were laid by Henri Lefebvre in his book 'The Right to the City' (1968) in which he maintains that citizens have two central rights: the right to (1) participate in the production of urban space, and to (2) appropriate urban space.

The idea of the 'right to the city' epitomises powerful concepts and values in fighting social and urban exclusion. Henri Lefebvre, who is generally seen as the progenitor of this idea, presents a vision for the city in which citizens reclaim political power from the state, and take ownership of, and self-manage urban spaces. While his call for radical change is often criticised for being overly utopian, this thesis follows Mark Purcell's (2014) practical reading of Lefebvre's ideas on citizen empowerment, which serve as a functional guide and inspiration for socially-engaged design practice.

Lefebvre's theoretical works have been widely adopted in practice by activists, policy-makers and scholars to advocate for the right to the city as part of a broader agenda of human rights, with the goal of promoting greater social justice in cities. Within the United Nations, for example, the phrase 'right to the city' is often replaced by 'inclusion': the desire to include and integrate marginalised and excluded communities into formal governmental and economic structures (UN-HABITAT 2010). Lefebvre, however, did not intend the right to the city to merely become an additional human right within the limited horizon of liberal-democracy. Purcell (2014) argues that he saw it rather as a critique of existing society and a fundamental component in the political struggle to move beyond hegemonic forces of the state and capitalism towards a collective self-governing society (Lefebvre 2009).

One of the central concepts in Lefebvre's political and intellectual project is the idea of *autogestion*, which is usually translated as 'self-management' (Lefebvre 2009:147). For Lefebvre, the right to self-management is grounded within revolutionary social change: as citizens increasingly realise their own power, they become less reliant on institutions of control, such as the state and corporations, which would ultimately wither away.

According to Purcell (2014), Lefebvre sees the right to the city as a spatial understanding of politics. He therefore places urban space in cities at the centre of the revolution as the space where the political struggle is staged. The transformation of society, according to Lefebvre, will depend on the permanent participation of the users of space (i.e. those who actively inhabit space in the course of their daily lives) through collective ownership and management (Lefebvre 1974). He argues that capitalism has resulted in a city that is divided into isolated segments regulated by a hegemonic system of private property, where property rights dominate all other claims to the spaces in the city. Detailed plans for land use have divided functions into distinct zones, and residential segregation has separated users from each other, preventing spaces of encounter and interaction (Lefebvre 1970). Lefebvre (1996) argues that property rights have alienated urban space from inhabitants and that citizens need to reclaim these spaces and reintegrate them into their urban social network. He sees the right to the city as a struggle to de-alienate urban spaces and describes this de-alienation in terms of appropriation: the right to the city involves citizens appropriating spaces in their city.

Lefebvre emphasises the importance of urban spaces for encounter, connection, interaction, difference, learning, play, and novelty. Urban spaces enable citizens to engage with each other in meaningful interaction through which they can overcome their separation, learn about and from each other, and collaborate on the meaning and future of the city (Purcell 2014). The act of appropriation allows citizens to reclaim urban spaces, so they become part of a network of social connections. This thesis recognises the importance of such social networks in facilitating appropriation and self-management in and of public space by citizens to enable socially sustainable urban spaces.

The notion of citizen appropriation of urban space leads to another fundamental element of the right to the city: participation. Lefebvre argues that participation is generally applied inadequately by city governments. Citizens often have merely a nominal and advisory voice in decision-making. He therefore recommends 'real and active participation' through activating and mobilising citizens (Lefebvre 1996:145). Citizen participation should mature from a passive act (i.e. attending and speaking at a public hearing or serving on a citizens' panel) to a living struggle for a city, where citizens become active stewards of public land and come to manage the production of urban spaces themselves. Participation, he continues, therefore serves as an act of awakening: as citizens become activated, they increasingly appropriate and gain control of the city and the production of its space. As this awakening spreads, existing urban professionals such as planners, developers, architects, and government officials become increasingly redundant and ultimately the need for them withers away.

The thesis provides an alternative and more moderate interpretation of such a hegemonic transformation: citizen appropriation of public space, not as ownership or self-management of spaces, but rather as the access to, and use of public space. This requires designers and other urban professionals to reconsider and evolve their practices. The research therefore proposes multiple alternative roles for designers to engender citizen appropriation, including designing conditions that offer better access and stimulate use, and acting as a new kind of facilitator of participatory processes to consolidate community action, new because armed with greater data-acquired knowledge of context.

1.3 A gap in the literature and research opportunities

This final section in the literature review presents the gap the thesis aims to address and frames the opportunities for inquiry that emerge from the literary exploration.

While research on Big Data originated in the 1970s, since 2008 there has been an enormous increase in publications in peer-reviewed literature (Halevi and Moed 2012). In the business and finance world, Big Data has proven successful in its use for stock exchange, banking, and customer behaviour, and market behaviour analysis. Analysing large data sets has also established itself in the life sciences, where Big Data has helped to achieve significant progress in research such as genome sequencing. Over the last decade, Big Data has become fundamental in many scientific fields such as astronomy, oceanography, engineering (Halevi and Moed 2012). The disciplines that have published most research using Big Data are computer science and engineering, with a focus on neural networks, artificial intelligence, computer simulations, and data storage, management, and mining. Horgan (2008) argues that in contrast to most scientific disciplines, engineering often does not necessarily seek to discover a truth. According to Horgan, engineers seek a solution to a problem and accept whatever works, without critically questioning the way they got there. While Horgan's argument on the nature of engineering is questionable, the thesis does recognise that computer engineers primarily focus on the application of Big Data methods, particularly for employing numerical analytics to create predictive models, rather than questioning the scientific value of these methods.

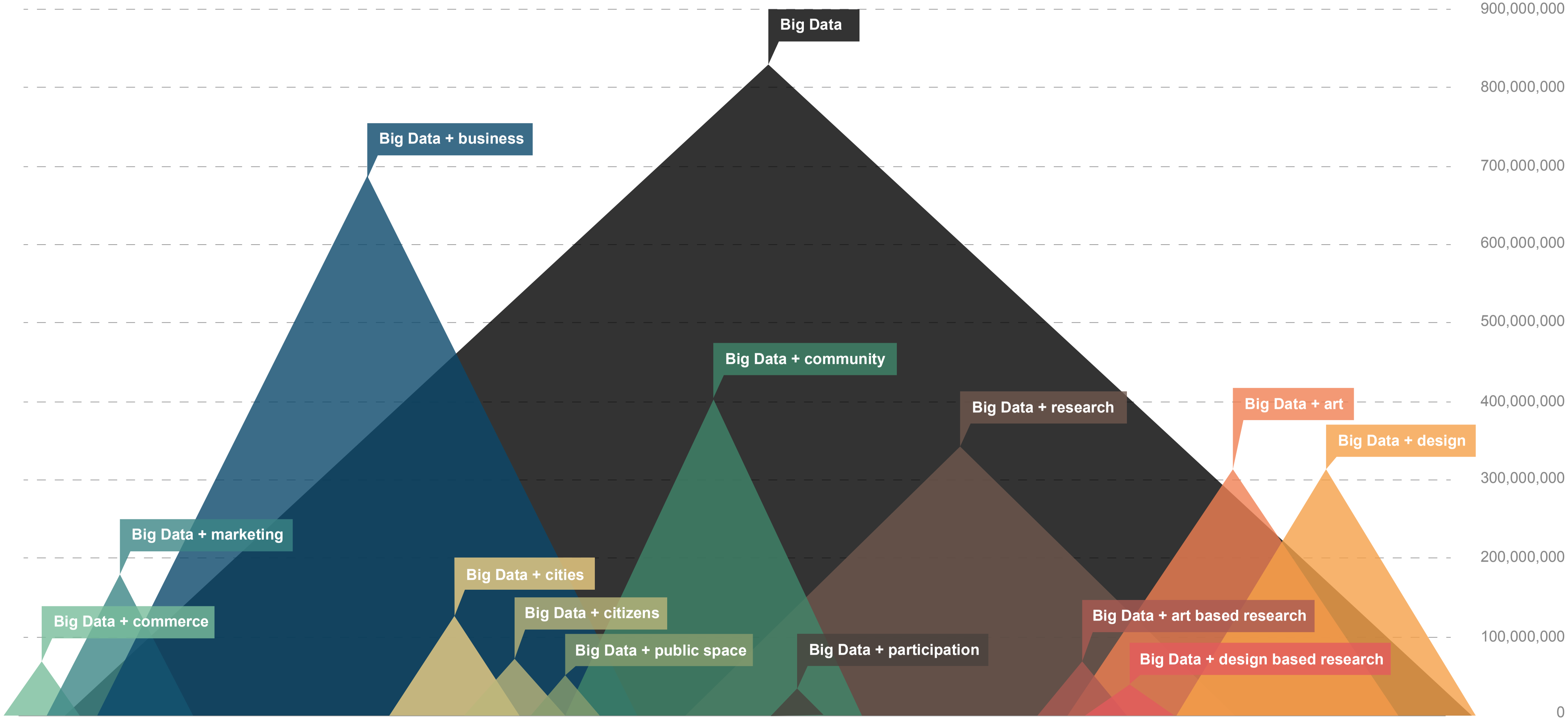
While it is not surprising that the subject of Big Data most commonly occurs in the computer science and engineering fields, there has been a growing interest among other disciplines, including the social sciences, chemistry, environmental sciences, and the arts and humanities (fig. 1.4).

Figure 1.4
Only eleven peer-reviewed papers on Big Data in arts and humanities

The figure demonstrates the number of peer-reviewed papers published on Big Data in different disciplines, revealing the arts and humanities' position at the bottom with only eleven publications (Halevi and Moed 2012). The thesis contributes to the limited knowledge base on Big Data in the arts and humanities by exploring possible new and alternative applications for digital data analysis in socially-engaged design.

In order to gain insights into the wider adoption of Big Data in both in academia as well as practice, I conducted several word-relation studies based on Google search data. I was particularly interested in mapping the definitional landscape of Big Data in different fields and disciplines to expand on its meaning by discovering associations with other words and concepts. The following diagram visualises the number of results for these different Google search commands (fig. 1.5).

No. of hits in Google search: Big Data + ...



Big Data + civic empowerment, Big Data + empowerment and Big Data + civic participation < 2,500,000 hits

Figure 1.5
Visual representation of number of Google search hits for different search commands

In this exploration, I used the following search commands: 'Big Data' + 'business'; 'marketing'; 'commerce'; 'cities'; 'citizens'; 'community'; 'public space'; 'civic empowerment'; 'empowerment'; 'civic participation'; 'participation'; 'research'; 'art'; 'design'; 'art based research'; and 'design-based research'. The diagram demonstrates that the search command for Big Data in business resulted in the highest number of search hits. When looking for Big Data in art and design, the number of search results decreases by half. The lowest amount of results appeared in the search for Big Data and public space, citizen participation, and civic empowerment. The diagram demonstrates that, while there is a lot of information available on Big Data in the business sector, and even for research, art and design in general, there is very little information available on the use of Big Data in or for public space and citizen participation.

To gain more insights into the discourse on Big Data in different fields, I conducted another Google search analysis to discover common word associations. The following diagram visualises the most frequently reoccurring topics and correlating words that emerge in multiple search commands (fig. 1.6).[4] Two words that reappear repeatedly in the diagram are 'analytics' and 'technology.' Other words that reoccur in two or more searches include 'social media', 'customer', 'cloud', 'management', 'education', 'history', 'insights', 'health', 'campaigns', 'platforms', 'innovation', 'understanding', 'science', 'applications', 'design', 'visualisation', and 'network'. These word associations reflect some of the significant relations between concepts within the contemporary discourse on Big Data. In this graph, there is no mention of the public or people; the discourse concentrates on the 'customer' rather than the citizen. Furthermore, other human-centric values, such as data privacy or ethics, do not appear as associated words either. In order to bridge this gap, the thesis aims to introduce and advocate for more human-centric concepts, such as citizen appropriation and empowerment, into the predominantly technocratic discourse on Big Data.

4 For this study, I used the same search commands as in the previous exploration.

Word correlations in Google search

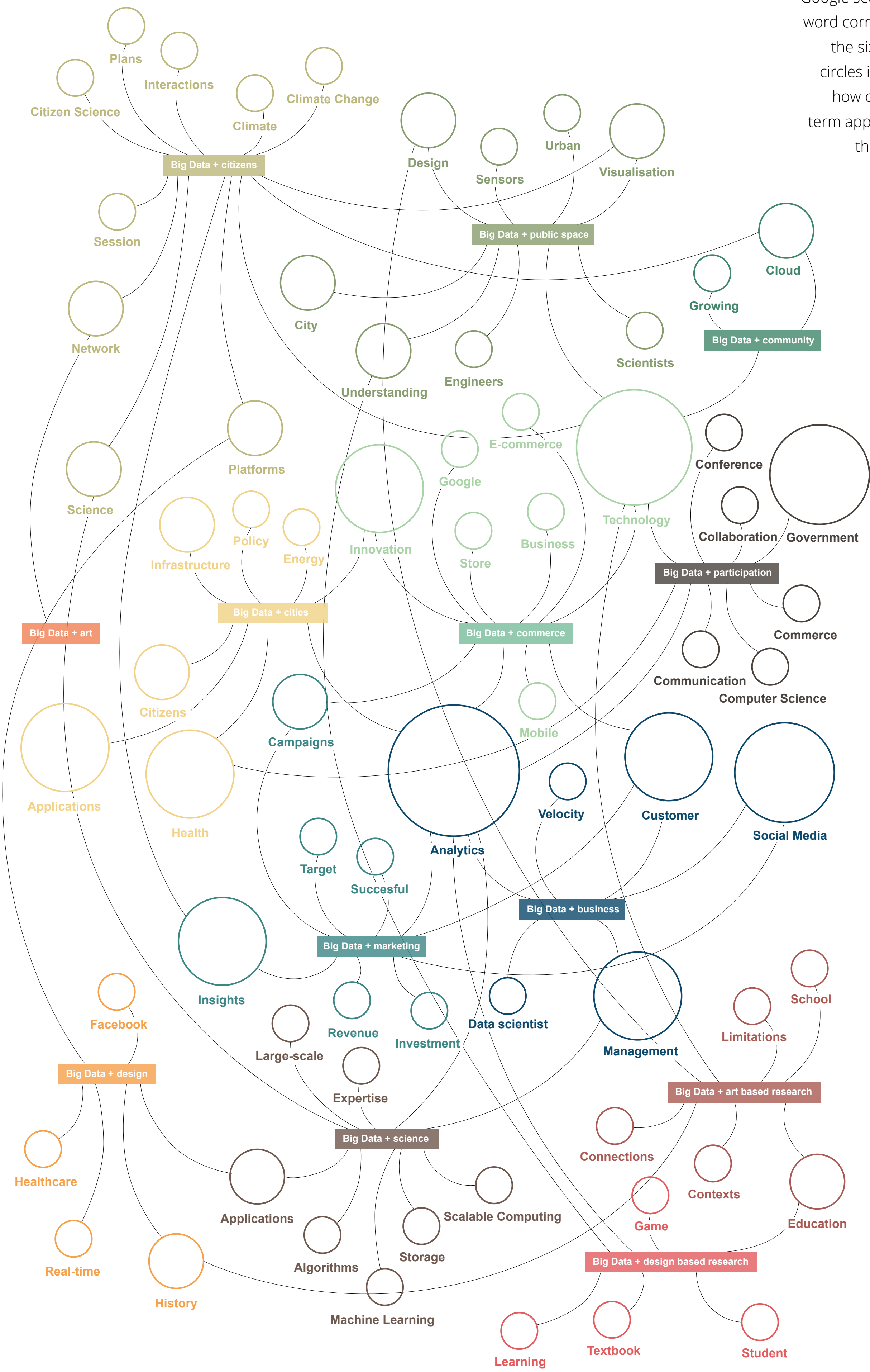


Figure 1.6
Google search hits word correlations: the size of the circles indicates how often the term appeared in the search

1.3.1 Big Data and Data Mining in Architecture and Urban Design Research

One of the significant uses of data mining is to develop accurate predictive models. Within architectural and urban design research, mining spatial data is primarily used to develop *classification models*, such as studies on urban block morphologies (Laskari 2008; Gill et al. 2009), housing typologies (Reffat 2008), neighbourhood typologies (Thomas et al. 2010), typical office building layouts (Hanna 2007), and public open space patterns in urban contexts (Montenegro et al. 2012). They are also used to produce *predictive models*, such as the prediction of spatio-temporal urban growth patterns (Lui and Seto 2008). Some studies explore classification techniques for identifying urban or building typologies, others concentrate on comparative explorations of buildings, such as classifying residential building types based on their energy use, and exploring their correlation with the building age (Alexander et al. 2009). One example of such spatially-oriented data mining research is the study On the Discovery of Urban Typologies (Gill et al. 2009). This research developed a digital model that can read spatial data from a project site via a Geographic Information System (GIS) platform to formulate a suitable programme, develop design options that answer the programme description, and assess which design solutions achieve adequate results. Data mining is used to represent, analyse, and describe digital spatial data from a GIS dataset to discover urban typologies and to inform urban design.

These examples demonstrate a particular focus on spatial objects (e.g. the building, the building block, the building interior) in current data mining explorations in urban design and architectural research. To move beyond existing practices of digital data analysis in spatial design and research, the thesis introduces a human-centred focus and explores the intersection between digital data analysis and citizen participation in spatial design (fig. 1.7). The following chapters explore how digital data analysis could help resolve some of the challenges designers face both in *participatory design* as well as *design for participation* in public spaces (fig. 1.8).

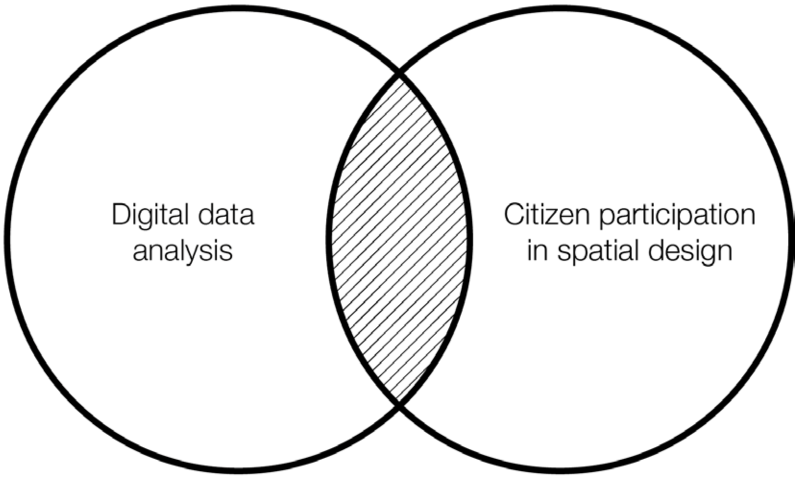


Figure 1.7
Venn diagram of subject area for this thesis; the intersection of *digital data analysis* and *citizen participation in spatial design*

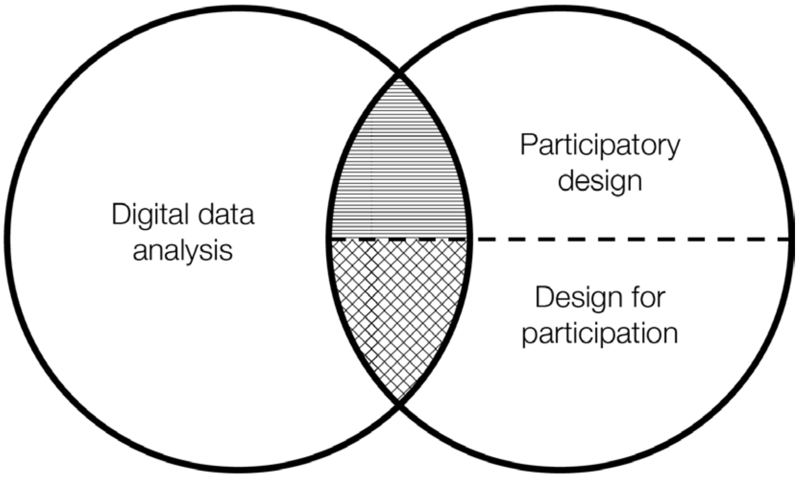


Figure 1.8
Venn diagam demonstrating the research opportunities at the intersections between *digital data analysis* and *participatory design*, and *design for participation*

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Chapter 2 – Methodology

While the thesis research is primarily practice-based, it is greatly informed by theory, which has been discussed in the previous chapter (Literature Review). This chapter outlines the methodological approach and the institutional frameworks that have influenced the research design and determined the selection of research methods.

This research was part of an EU-funded Marie Curie project called TRADERS: 'Training Art and Design Researchers in Participation for Public Space' (tr-aders.eu). TRADERS was comprised of six researchers, all performing two forms of research: doctoral research and project research. Each researcher had a different theme and approach, but all worked within a participatory public space context. The theme of my research within the overall project was *data mining*, and consisted of PhD research, which addressed the role of socio-spatial digital data tools in the design of socially sustainable public spaces, and project research, which explored the use and potential role of socio-spatial digital data for art and design researchers who work in participatory projects that address public spaces. Section 2.1 discusses the impact of the collaborative framework of TRADERS on my research. Section 2.2 discusses the research process, and section 2.3 describes the methodological framework that shaped the research design, and the central research methods that enabled the outcomes of the practice-based project to be used in the PhD.

2.1 TRADERS – an interdisciplinary collaborative framework

The institutional contexts of the Royal College of Art, School of Architecture and the EU TRADERS project have had a significant impact on the research presented in this thesis. TRADERS provided a useful platform to explore the topic of digital data technologies within an art and design context, bringing together opportunities for multidisciplinary collaborative research with a focus on citizen participation in public space. The EU-funded project, which concluded in 2017, was a collaboration between six institutions; LUCA Faculty of the Arts (lead organiser), University of Gothenburg, Chalmers University of Technology, Design Academy Eindhoven, KU Leuven, and the Royal College of Art. The project was centred on six doctoral researchers who closely collaborated with project partners outside academia, both public and private entities, to develop a broad range of projects aimed at developing transferable skills and knowledge. While all researchers worked within a participatory public space context, each doctoral researcher focused on a different thematic approach:

1. **Intervention** – LUCA Faculty of the Arts (Belgium): 'The act or fact of intervening in public spaces can be understood as a participatory act performed to stimulate public involvement in order to create social awareness regarding public issues.'
2. **Play** – University of Gothenburg (Sweden): 'Focusing on design as a means of creating meaning rather than solving problems, this research approach addresses how public space can be re-conceptualized and materialized in perspective of the particular challenges and opportunities provided by children and young adults.'
3. **Multiple performative mapping** – Design Academy Eindhoven (Netherlands): 'Multiple performative mapping refers to developing a multi-layered map: a digital map that not only depicts the conventional spatial patterns in the area, but also the different stakeholders' understanding of the area, how they actually use it, experience it, value it and what they expect from it.'
4. **Modelling in dialogue** – Chalmers University of Technology (Sweden): 'Modelling in Dialogue serves as both a systemic tool for handling data and a

mode to analyse, re-work and re-frame on-site interventions in explorative laboratory contexts. Modelling renders means to visualize and communicate new possibilities and uses both digital and hands-on techniques.'

5. **Data mining** – Royal College of Art (United Kingdom): 'Closely linked to the research themes of 'performative mapping' and 'modelling in dialogue' is the need to be able to gather, handle and interpret many different kinds of data sets. Using advanced software, the RCA will expose the researchers to the conceptual and methodological issues concerning mining of 'Big Data' within the context of the project, with an emphasis on the spatial domain.'
6. **Meta-framework** – KU Leuven (Belgium): 'A sixth theme will entail the development of a meta-framework allowing these research approaches to communicate and collaborate with KU Leuven. This researcher will develop a meta-theoretical framework that will serve as a mirror to reflect on the significance of art, design and action research in the appropriation of public space. This meta-framework should also become a methodological guideline for participatory design and community development.' (www.tr-aders.eu)

While the researchers all explored individually the relationship between their own thematic focus and the general theme of the project, regular meetings and events provided opportunities for exchange and collaborative inquiry into issues concerning citizen participation in public space. The TRADERS collaborative projects problematised and explored a range of concerns that helped to focus my research within the overall project. The project provided a useful structure for collaborative exploratory action and knowledge exchange through a wide range of training programmes and activities, including summer schools, training weeks (each week hosted by a different ESR focusing on their thematic approach), a kick-off meeting, a closing conference, an exhibition, and numerous informal meetings. These activities also contributed to ensuring the communication and dissemination of the project to a wider art and design audience.

Working on a shared focus offered a common ground for collaborations on various projects and publications, and functioned as a framework, complementing the individual research agendas. In order to create coherence between the six individual research projects, the post-industrial town of Genk, Belgium, was selected as the project's collaborative case study. As a town in economic transition, Genk formed a compelling case for the TRADERS researchers to apply, test, and study the project's research themes. The recent closure of the Ford factory in Genk had resulted in high unemployment rates among locals, which forced the researchers to critically reflect on their role, agency, and responsibility in working with vulnerable communities in participatory, and often ephemeral, art and design projects.

The close collaboration with researchers from different disciplinary backgrounds inspired my critical inquiry into the adoption of digital technologies within architectural practices. Being part of a multidisciplinary research group helped me gain first-hand experience on the often troublesome relationship between the art and design disciplines and 'the digital.' Exposure to various critical views from research colleagues challenged me to demonstrate how novel digital data technologies could be relevant and beneficial within art and design research and practice, particularly within the design of public space interventions. Furthermore, the dialogues and exchanges in the collaborative contexts of TRADERS required clear communication and articulation of my research process and intent, and clear project briefs (developed in conversation with project partners), which have helped focus the research. TRADERS enabled the development of a shared research agenda in which I could test my ideas on digital data analysis in the context of citizen participation in public space projects. The projects focussing on 'design interventions' and the research projects conducted in Genk by researchers at LUCA School of the Arts have become an integral part of my research. The 'intervention' approach studies the designer's act of intervening within an established system, community, or space, aimed at instigating social change or creating awareness of certain public issues. My research challenges the often ephemeral results of such projects and proposes a role for digital data analysis to help designers create longer lasting public space interventions.

Beyond providing the overall context in which this research has been developed, TRADERS has offered several opportunities for doctoral training, including the development of organisational and teaching skills. As part of TRADERS, I have been responsible for organising numerous training and dissemination activities, including

PhD seminars, publications, workshops, a training week, and a conference. For one of the TRADERS summer schools in Genk, I hosted a workshop for a group of art and design practitioners and scholars. The workshop addressed the topic of citizen participation in public space and concentrated on a project site in Genk. In this workshop, I introduced the participants to data-driven methods for collecting and analysing (socio-spatial) digital data for a project site. I instructed participants to delay the formulation of a hypothesis or design concept and let data collection and analysis strategies lead their design process. The workshop participants noted that such a data-driven approach counters what most artists and designers are used to, as they often come up with concept proposals at an earlier stage of a project. By postponing the formulation of a hypothesis and the development of a conceptual design, I tested how an empirical data-driven approach could influence the workshop participants' creative process. Through this workshop, and particularly through the dialogues and feedback from the participants, the notion of *timing* emerged as an important concept concerning digital data collection and analysis in design processes; when in the process should data collection and analysis be introduced? And how can this influence a design process? The questions that emerged from this workshop have helped shape one of the main focal points of this thesis. (The notion of *timing* is explored in more detail in Chapter 5). Finally, another significant influence in the development of the research was a six-month secondment at the TRADERS industry partner Commonplace, which is discussed in section 2.3.2.

2.2 Research Process

Next to the institutional frameworks of TRADERS, the Royal College of Art (RCA), and the RCA School of Architecture, the research design is largely influenced by the review of relevant literature and a study of real-life design practices. Furthermore, ongoing dialogue in different settings and within different communities, including fellow doctoral researchers, PhD and MA students, neighbourhood communities, and academics and practitioners with expertise in different disciplines and subject areas have greatly influenced the research. Following Donald Schön's ideas of reflective practice, these activities have informed the first step of the research process: 'problem framing' (1983:40). Schön describes the process of 'problem framing' as the process of framing the context in which the designer or researcher attends to the subject. The review of literature, various knowledge exchange activities (e.g. seminars, workshops, training weeks), and ongoing dialogues with different communities helped me frame the discussion and problem within the context of Big Data and citizen participation in public space. This was followed by a process of 'problem setting,' in which the problems and subjects that the thesis addresses have been identified and determined. Through these two processes, 'problem framing' and 'problem setting', one particularly significant and recurrent problem in participatory design emerged, which became the focal point of the research: public realm design projects that are intended to facilitate sustained citizen participation, yet fail to engage an audience beyond the designers' involvement.

In the thesis, this subject, the social afterlife of a design, is scrutinised through multiple critical and theoretical lenses to identify the limitations and gaps in existing knowledge. Following a critical analysis of the problem, the possibilities of digital data technologies to address it were explored. For this exploration, the research took on a propositional character and presents alternative methods and approaches to fill the identified gaps, i.e. 'problem solving'. This problem solving process consists of different critically constructive activities which have shaped the thesis: *critical reflection*, *critical action research*, and *propositional action research*. The first mode of research, *critical reflection*, took place particularly in the early stages, through the review of literature, the ongoing conversations with various practitioners, fellow scholars, and local community members, and the analysis of various socially-engaged and digitally-informed spatial design practices. A critical reflection on relevant literature and multiple dialogues with peers during various events, including the many TRADERS activities, helped me frame and set the focus of this thesis. The reflective activities have also informed the selection of a methodological framework (section 2.3.1), which, in turn, has helped develop my particular approach to addressing and exploring the problem. Finally, through critically reflecting on existing design practices, I have been able to analyse past activities, identify and learn from their successes and shortcomings, and propose how it could be done differently (Schön 1983). Critical reflection, therefore, has laid the groundwork for the research and formed the foundation of the thesis.

The second activity, *critical action research*, is a research method I adopted at the tech start-up Commonplace. Section 2.3.2 elaborates how adopting a critical approach towards the company's existing digital tools and processes helped identify opportunities for improvement, and at the same time informed the thesis trough practice-based explorations.

The third and final activity, *propositional action research*, describes the actions in this research that go beyond critical analysis and lead to the formulation of a method or tool, an approach, a design proposition, or a general argument. There are two dimensions to propositional action research in this thesis. One runs through the thesis, in which suggestions are made for adopting digital tools in spatial design practice. The second consists of more detailed propositions presented through various demonstrations about the usefulness and deployment of digital tools for socially-engaged spatial design. These propositions have taken shape through three case studies: (1) 'De Andere Markt' (i.e. 'The Other Market' or DAM) – a participatory design project in Genk, Belgium by one of the other TRADERS researchers; (2) public realm design guidance for Whitechapel, London by muf architecture/art (muf); and (3) a public space design for the Afrikaander square in Rotterdam by OKRA landscape architects (OKRA) (fig.2.1). While these projects are all explored through propositional action research, the three case studies all had different outcomes. In the DAM case study, a critical analysis of the design team's actions led to the proposal of an alternative, digitally-mediated *approach* towards participatory design aimed at facilitating citizen appropriation and ownership. The proposed approach demonstrated that digital data analysis could help designers identify active local networks and community members who can safeguard the afterlife of a project beyond the designers' engagement. In the muf case study, the proposition consists of a *method* to analyse visual data from social networking platform Instagram to support the architects' public space design proposal. Finally, in the OKRA case study, the thesis presents a *design proposal*, which emerged from empirical digital data analysis, to revitalise a currently underused neighbourhood public space. The following diagram demonstrates the different instrumental outcomes these three research activities have produced (fig.2.1).

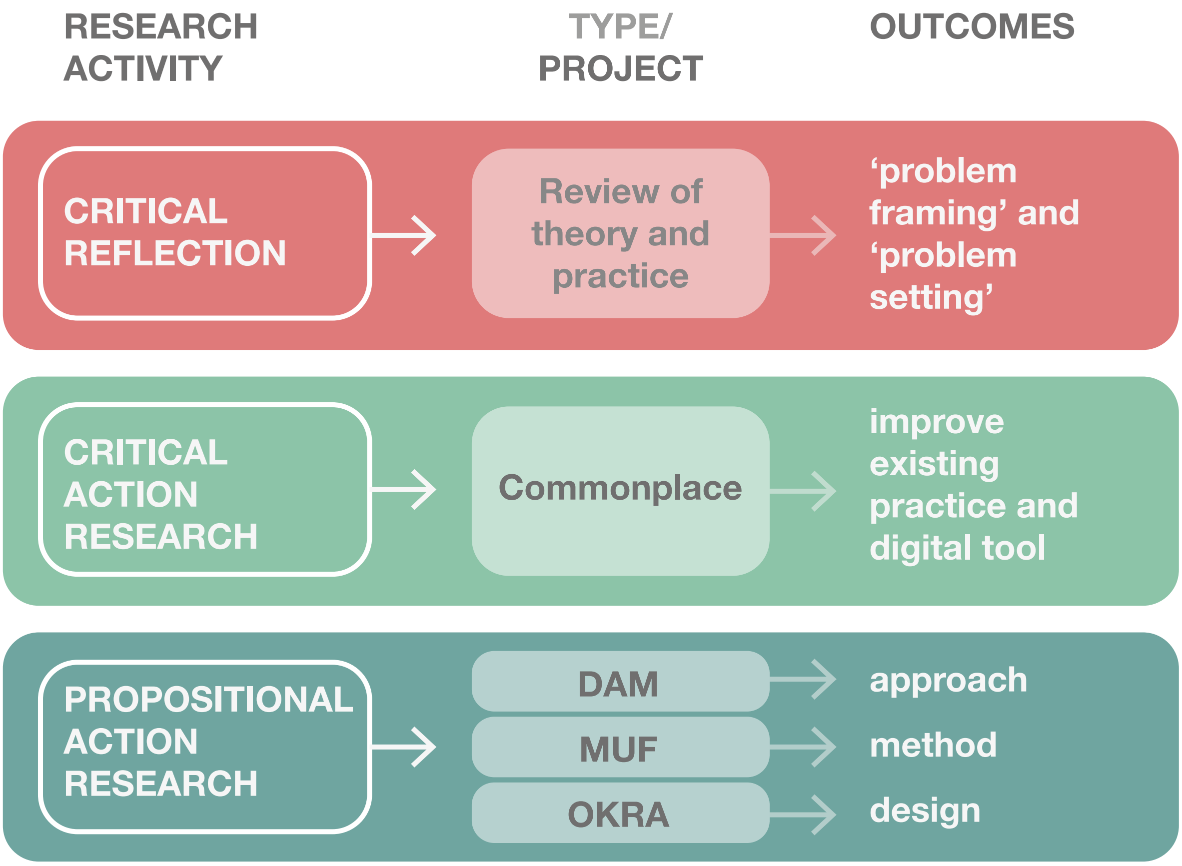

Figure 2.1
Diagram of research process illustrating the three research activities, projects or type of research, and outcomes

The following section elaborates on how these research activities were integrated with different research methods, and how they, together with empirical data collection and analysis, shaped the knowledge production in this thesis.

2.3 Research Methods and Methodology

2.3.1 Grounded Theory – a methodological framework

Knowledge-production in practice-based art and design research often follows an inductive model: in his paper 'What Should We Expect from Research Through Design?' Professor of Design William Gaver argues that 'theory should be allowed to emerge from situated design practice' (2012:942), and Professor of Theory of Research in the Arts, Henk Borgdorff points out that '[as] a rule, artistic research is not hypothesis-led, but discovery-led' (2011:56). The emergence of Big Data has enabled direct access to large amounts of empirical data to inform investigations (Latour 2010). These novel data sources (see chapter 1) offer opportunities for art and design researchers to generate new insights and theories. At the moment, however, methodological options for generating novel theory from such large datasets are limited (Berente and Seidel 2014). This thesis therefore adopted Grounded Theory as a methodological framework to guide the development of a research hypothesis (fig.2.2).

In traditional research, theory is often used to explain data. A hypothesis is articulated, consequences are deduced from this hypothesis and are then tested through empirical observations. In such a deductive approach, theoretical frameworks are used to interpret and make sense of data, and to test existing concepts and relationships (Allan 2003).
In contrast to this traditional model, Grounded Theory (GT) methodology follows an inductive approach where, through extensive data analysis, theory is developed from the ground up (Handfield and Melnyk 1998). Rather than using theory to explain data, theory is expected to be derived from data.

According to the Grounded Theory Institute, all science-based research is 'grounded' in data, yet not all research produces 'grounded theory.' GT seeks to discover and define theoretical concepts and relationships based on a detailed analysis of empirical data (Glaser and Strauss 1967; Strauss and Corbin 1990). In other words, concepts and relationships are derived from data, and theory is formed via empirical generalisations

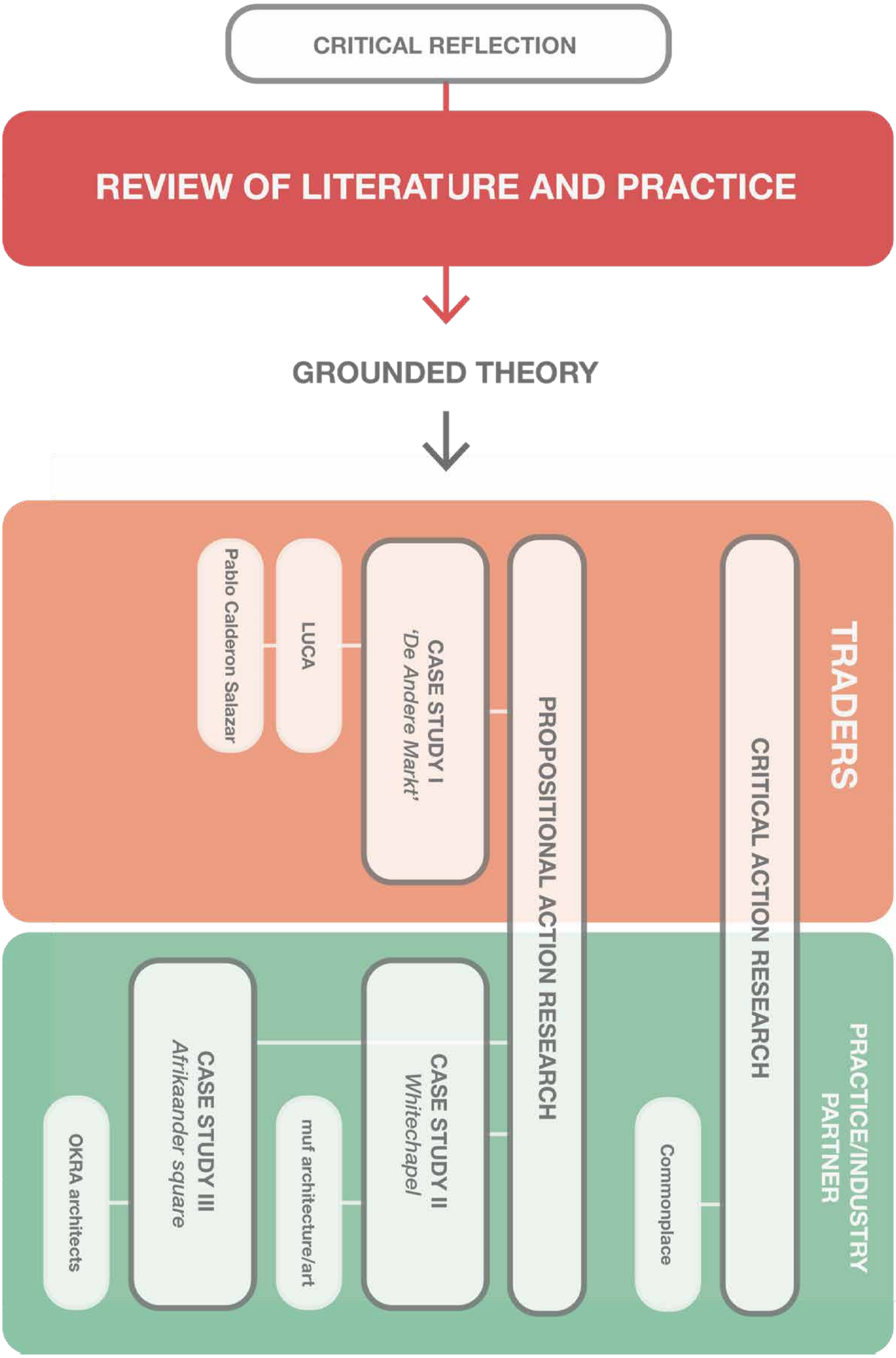

Figure 2.2
Diagram of the methodological and institutional frameworks and research methods

from these concepts. Therefore, the first step in GT is data collection. The collected data is then reviewed to discover repeated ideas, concepts, or patterns, which are tagged with codes. These codes are then grouped into concepts, and the concepts are nested under categories. Finally, these categories form the basis of generating new theory.

Grounded Theory was developed by two sociologists, Glaser and Strauss (1967), in the 1960s as a critique of leading fundamentalist and structuralist theories that were deductive (i.e. applying existing theories to analyse data). With this methodology, the sociologists intended to inspire efforts to develop new theory in a way that was acceptable in the dominant positivistic culture within social sciences at the time. The original goal of Grounded Theory (GT) was twofold: (1) to encourage researchers to generate new theories rather than working on existing ones; and (2) to develop a rigorous methodology to enable empirically-driven theorising (Berente and Seidel 2014). While most researchers apply this methodology for qualitative data analysis (e.g. data from interviews or field notes), Glaser and Strauss (1967) argue that GT is not a solely qualitative method. Rather, it is systematic research in which a set of rigorous research methods and procedures lead to the emergence of conceptual categories and, ultimately, to the systematic generation of theory (ibid.). Grounded Theory can therefore be used with either qualitative or quantitative data. Both can be explored inductively to identify patterns and generate (rather than test) hypotheses and theories (Glaser 2008). However, the methods described for qualitative data analysis (i.e. coding strategies) are quite labour-intensive for analysing quantitative data. Big Data typically means unstructured data that aren't readily available for the type of comparative analysis and ordering recommended for qualitative data (Glaser 2008; Berente and Seidel 2014). The wide variety and large amount of (Big) data therefore require alternative analytical methods that move beyond GT's manual ones.

While GT's existing methods cannot be transferred to digital data analysis directly, there are fundamental lessons to be learned from GT methodology that also hold value for generating theory from large unstructured quantitative datasets. The thesis particularly focuses on the notion of *emergence*, which is a central concept in GT research: 'design, like the concepts, must be allowed to emerge during the research process' (Strauss and

Corbin 1998:33). The thesis tests this approach to data analysis to see if it can produce designs, research methods, concepts, and eventually inform the formulation of a theory.

The impact of the institutional frameworks on the overall research is illustrated through Habermas' notion of 'rational reconstruction' (Habermas 1981; 2001). Habermas argues that particular communities of researchers share a 'lifeworld' and therefore also share a certain amount of intersubjective understanding of the world they study. A key element in this intersubjective understanding is the 'lexicon': a shared vocabulary that reflects the concepts, assumptions, and institutional context of the community. This lexicon influences the theoretical lens through which researchers assess and analyse empirical data. Some of the lexicons this research has been exposed to, and affiliates with, include vocabulary from the Participatory Design (PD) community (power, agency, citizen participation, democracy); social network theory (nodes, links, centrality); computer sciences (data mining, machine learning, Big Data); and architecture (urban form, spatial design, public space). These lexicons are often paired with particular theoretical positions. For example, the PD vocabulary is greatly influenced by post-Marxism and structuralism and closely associated with the work of political theorist Chantal Mouffe and political philosopher Jacques Rancière. In deriving novel theory from empirical data, this research aims to enhance and extend some of the existing lexicons within the different research communities by not confining itself to one lexicon. Instead it crosses the 'lifeworld' boundaries of different communities of knowledge, therefore forming genuinely transdisciplinary research in the field of Big Data.

The first step in the GT process was data collection. From these data, patterns and concepts could be identified.[5] Identified patterns were then tested against new incoming data. The patterns that emerged from the data only made sense by reading them through a particular lexicon (i.e. theoretical lens), such as social network theory (see Space Syntax theory and analysis in Chapter 5.2.2). In turn, the emerging patterns and concepts helped

5 In Big Data analysis, the search for, and identification of, patterns can be run automatically through computer algorithms. However, since the sample of digital data was significantly smaller than in conventional Big Data studies, the data analysis process in this thesis was performed manually.

extend existing lexicons and, ultimately, became the building blocks for devising new theories or enhancing existing ones. Hence, theoretic lenses from various lexicons have helped hypotheses and theory to emerge from empirical data.

The theory that derives from empirical data analysis in GT can be distinguished between substantive theory and formal theory (Glaser and Strauss 1967). Their difference lies in the level of abstraction: substantive theorising concentrates on the relationships between variables that are particular to a specific context, whereas formal theorising concerns developing broader, more general theory (Kearney 2007). Within the grounded paradigm of this research, the outcomes of analysing empirical data have been primarily substantive in nature and focus on the particular context. The thesis, however, does conclude by generalising knowledge gained from these individual studies to articulate several conclusions that function as recommendations for further research.

2.3.2 Critical Action Research – Collaborative Inquiry at Tech Start-Up Commonplace

Action research is a hands-on interactive research method which involves active participation by the researcher, often within an existing organisation or institution, to help improve existing practices and procedures (O'Brien 2001). Part of the EU funding requirements for the TRADERS project included direct transferability of knowledge produced by the doctoral researchers through close collaboration with practice partners. The RCA's project partner was the tech start-up firm Commonplace[6], a London-based business built around an online application that aims to engage citizens in public consultation processes in their neighbourhoods. As part of the TRADERS research project, a six-month secondment at this firm enabled me to conduct in-depth practice-based action research in their firm and on their digital application.

There are different types of action research; some focus on conducting research *for* those taking the action (i.e. the client or organisation), to assist them in improving or refining their actions, while other types concentrate on collaboration *with* the client or organisation to develop a solution based on a mutually diagnosed problem (Bryman and Bell 2011). The latter describes my activities at Commonplace best, which, as mentioned earlier, can be categorised as *critical action research*. In contrast to a *positivist approach*, where action research is used as a method to test predefined hypotheses in real-world environments, or *interpretive action research*, which focuses on exploring the social constructs in organisational structures, *critical action research* critically analyses the processes, activities, and tools within an organisation in order to propose improvements.

With their digital tools, Commonplace aims to tackle inadequate, and often undemocratic public consultation processes in neighbourhood development projects by attracting a wider community to voice their interests. Through a secondment, I was invited to help the start-up improve their strategies, practices, and knowledge of promoting citizen

6 www.commonplace.is

engagement in local decision-making processes through digital technologies. The action research at Commonplace enabled me to contribute both to the practical and immediate concerns of the firm as well as further the goals of my own research agenda through empirical inquiry. On the one hand I critically studied the firm and their digital tool as an outsider, while on the other, I collaborated closely with the firm to develop strategies for advancing their technology in a direction desirable to both parties. To accomplish this dual goal, dynamic collaboration and co-learning were fundamental features of the action research process (Gilmore et al. 1986). Regular meetings with the firm's CEO Mike Saunders in the early stages of the research allowed me to learn about the start-up's ambitions. Later on in the process, after determining the focus and shared objectives for the research, I closely collaborated with Commonplace's User Experience (UX) Designer Fee Schmidt-Soltau to conduct user engagement studies.

Rather than advocating a single method for collecting and analysing data, critical action research allows various research tools to be used in a holistic approach towards problem-solving (O'Brien 2001). Generally, data are collected and analysed to evaluate existing practices. Together with Fee, I explored users' experience of, and engagement with the Commonplace platform through various qualitative and quantitative data collection and analysis methods (including surveys, interviews, and click-stream analysis). I also applied various alternative research methods, including journal writing and digital analysis of Commonplace's data sets. The latter provided particularly useful insights into user engagement, which helped inform strategies for improving the Commonplace tool. Section 2.3.2 elaborates on the digital data analysis methods I used as part of the action research at Commonplace.

During the secondment, I spent a lot of time getting to know the ambitions and realities of the firm's practice as well as the functioning of their digital technology. After defining a mutually beneficial goal for the investigation, I worked on refining the methodological tools and data collection methods to suit the requirements of the situation. As a result, the data-driven studies produced recommendations for modifying the tech firm's digital application to inspire social transformation in community consultation processes in local urban developments. The outcomes of this critical action research were the result of the following activities:

1. **Choosing a focus** - the research process started with a detailed investigation into the firm and their digital tool to identify a topic or focus that would be relevant for both the organisation (increased user engagement) as well as for my research (citizen empowerment);
2. **Formulating research questions** - generating a set of meaningful research questions to guide the inquiry and to communicate the direction of the research to the firm;
3. **Collecting data** - choosing reliable data collection methods which could help justify that the proposed actions are valid. For this research I focused on meta-data produced by the Commonplace app to provide the firm with new insights into user engagement with their tool;
4. **Analysing data** - looking for patterns and relations in the different data sets to gain new insights into the use of the tool and users' (demographic) profiles;
5. **Report results** - communicating the findings of the research with the team to inform a course of action.

To establish a productive collaboration that would result in mutually agreeable outcomes for both parties, I adopted many different roles during various stages in the process, including that of a planner, catalyser, listener, observer, facilitator, and reporter. Typically, in action research the process is concluded by an action. However, undertaking the action, or co-creating an action plan, would have turned the research process into a consultancy, which, in turn, would have required a different, more long-term, commitment. Following the methodological framework of the thesis, my main interest during my time at the firm was to gather insights that emerged from practice. Therefore, rather than staying involved beyond the research process, I concluded the collaboration by recommending improvements for several features of Commonplace's digital tool. In order to safeguard continuity and ongoing action beyond my engagement at the firm, I nurtured close collaboration with employees who could take over responsibility and initiative to continue the process.

Carrying out research in a real-world context within an existing organisation required me to pay close attention to ethical considerations. It was essential to develop the work in a transparent way and to remain open to suggestions by people in the firm (Winter 1996). I strived to be explicit about the nature of the research from the beginning and to be transparent about my personal interests and biases. Furthermore, information generated in the research has been presented to, and accessible by, all members of the firm throughout the process. Decisions on the direction of the research and outcomes were made collectively to reflect the firm's ambitions. Both the participants in the firm and I aimed to establish a collaborative process that would maximise the opportunities for all involved. Finally, analysing data produced by the Commonplace application, particularly the privacy-sensitive data on user profiles, demanded a responsible and confidential approach.

2.3.3 Case Study Research

In-depth empirical inquiries in three major case studies provided opportunities for identifying limitations to participation in real-life practice and for incorporating digital data technologies in practical contexts. While these case studies deal with different circumstances and are embedded in different socio-spatial, economic, and political contexts, all three deal with obstacles and complications designers face in producing socially sustainable public space designs, or design interventions.

The case study method offers useful tactics and strategies to study complex social phenomena in contemporary real-life contexts through various data collection and analysis methods. It involves an in-depth and detailed examination of a case in its own right while taking into account the contextual conditions the case is embedded in. In case study research, the researcher acts as an outsider and often has no or little control over events. Information is gathered by discrete observation or the examination of records (Yin 2009). Such inquiries typically rely on multiple research methods and can include multiple sources of quantitative and qualitative data from interviews, surveys, or observations aimed at catching the complexity of a case. While each case study is unique, there are several generalisations and transferable lessons that emerged from these diverse studies, such as the usefulness of digital tools in delivering more socially sustainable outputs, particularly when they are applied in an early stage of a design process. While the sample of case studies is small, the variety of study demonstrates that digital tools can be beneficial in many situations and contexts.

The case studies consist of exploratory descriptive research as well as detailed analytical investigation to critically assess, evaluate, and scrutinise a situation. This approach is strongly influenced by my background in design, where inquiries are often problem-oriented. In the case study explorations, the focus on problems helped me to familiarise myself with a case by exploring what challenges existed and how the designers dealt with them. These observations formed empirical input into developing and formulating the propositional components of the research.

Case study research can be time-consuming and requires access to sufficient amounts of information. Therefore, a prerequisite in the selection of the case studies was their potential for maximising what could be learned. Which cases were most likely to enable an in-depth understanding and lead to more significant insights into the general problem (i.e. the unintended ephemerality of public realm design projects)? Furthermore, selecting cases that were hospitable to inquiry was another fundamental criterion, so that availability and accessibility of data have significantly influenced the selection.

The first case study is the 'De Andere Markt' (i.e. 'The Other Market') living lab in Genk, Belgium, initiated by one of the other TRADERS doctoral researchers. The direct connection to the project through TRADERS provided access to all project data, which enabled me to conduct a valuable in-depth empirical inquiry. The detailed exploration of this case contributed to developing greater insights into the role and attitude of designers in long-term participatory projects in the public realm. The second case study was a result of a consultancy I conducted for muf architecture/art. The architects invited me to undertake a digital data analysis for their ongoing public realm project in Whitechapel, London. The firm provided me with access to their project data and through an interview with one of the architects I was able to collect more in-depth information on the particular context of this case. Furthermore, as I was developing a study that would benefit their project, the office was generous in providing me with inside knowledge into particular processes and procedures, which would have been difficult to get via other, external channels or data sources. The third case study 'Afrikaander square' is a project I have been working on for a more extended period, and for which I have collected an extensive database over the years, including interviews, morphological studies, and photographic material, which formed the foundation for this inquiry. The availability of these data allowed me to focus the research on (digital) quantitative analytical methods to expand the qualitative findings and descriptive nature of pre-existing work into a fully developed proposition.

2.3.4 Digital Data Analysis

The different types of data in the research required different methods of analysis. While some data were analysed through existing and established methods, such as network analysis and space syntax (see case studies 'De Andere Markt' in Chapter 4.3 and 'Afrikaander square' in Chapter 5.2), other data sources required the development of alternative methods. For the muf case study in chapter 5, for example, I developed a new method for analysing Instagram data.

The studies in this thesis all work with digital data. However, they don't necessarily qualify as Big Data studies. Examples of Big Data explorations in spatial research demonstrate that 'Big' does not always equal better (see Chapter 3.2), which is particularly true for the architecture and urban design disciplines. Rather than beginning with a question by urban planning, design or architecture professionals, research on the possibilities of Big Data for spatial design has primarily been determined by the source of data. Chua and Vande Moere's (2013) study on the Luchtbal neighbourhood in Antwerp, for example, was determined by the possibilities of Twitter data and resulted in visualisations of Twitter users' commuting patterns from and to the city centre. MIT SENSEable City Laboratory's studies on real-time data in Rome illustrated the density of people in different places in the city at different times of day, and visualised people's movement patterns by mapping walking directions of cell phone users in different neighbourhoods (see Chapter 3.2.1). So far, these studies have failed to generate any new or useful insights into how the city operates, or on human behaviours in the city, in any significant way. Instead, they tend to merely reproduce existing knowledge on people's movement patterns through cities.

This thesis recognises that, at the moment, there is still a large gap between Big Data analytics, which exist mainly in the realm of computer science and engineering, and the urban and architectural design disciplines. Within the smart city context, Big Data is used for its potential to optimise urban processes, systems, and infrastructures on a city-scale. When working on a neighbourhood scale, however, understanding the particularities of a situation (i.e. the local socio-spatial context) is often more important than a general perspective of the city's systems and processes. This thesis argues that in neighbourhood-scaled projects, a Big Data approach is often less beneficial to architects than a customised, small-data approach, which uses targeted data for the specific commission and can provide a more detailed analysis of a local context. The approach to data presented in this thesis concentrates on project sites and local communities, rather than large-scale systems and infrastructures. Therefore, rather than letting the size of data determine the study, these explorations started from the needs of practitioners in real-life smaller scale projects.

To understand how analysing socio-spatial digital data could be useful for architects, the case studies needed to be contextualised and tested. By working closely with practitioners such as muf architecture/art, and testing different ideas about the possibilities of digital data for spatial design, I could elicit what the architects wanted, what they needed, and how data could help them. The muf case study, for example, demonstrated an easy, manual approach to analysing Instagram data – a data source that the architects had not taken into consideration before. While there are numerous studies that present new methods for analysing social media data (Ying et al. 2010; Cranshaw et al. 2010; Wang et al. 2014; Zheng 2011), they are often developed by computer scientists and contain quite complicated code, which makes them difficult to be reproduced by non-specialists, including urban designers and architects. Architects at muf, as well as professionals at other socially-engaged practices, therefore often assume they need external expertise to incorporate social media data analysis in their projects. At the same time, these architectural offices often lack the funds to bring in such expertise. The studies in this thesis aimed to demonstrate how architects could conduct simple digital data explorations by themselves. The Instagram demonstration was received positively by the architects at muf, who incorporated it in their Whitechapel project (Chapter 5.1). This demonstration also aimed to encourage the architects to explore and experiment with alternative ways of analysing and working with social media data in their future projects.

In the research at Commonplace (Chapter 4.4.2), I explored data sets that are generated by, and produced about, the use and users of the Commonplace application. To advance the TRADERS' thematic focus, I was particularly interested in adopting a 'data mining' approach to analysing the firm's data sets. Hence, the following data mining actions were applied in this study:

- **Data Preparation**: cleaning and preparing the data set in order to weed out incomplete and impossible data combinations (e.g.: Gender: Male, Pregnant: Yes). Typically, in data mining explorations, large data sets are collected via an automated method (e.g. a programmed code that pulls data from an Internet site). Such aggregated data often contain erroneous values that need to be discarded prior to analysing the data, which is particularly crucial for optimising processing power of computer-automated analysis performed by algorithms.

- **Data Reduction:** the general objective in data mining is to find ways to unlock and make sense of the information embedded in large data sets. One step towards uncovering this is by accumulating and aggregating the total information into manageable, and often smaller, categories of information to make the data exploration more comprehensible. For example, a data set of individual ratings per subject could be reduced to descriptive statistics: X% gave an A rating, Y% gave a B rating, i.e. focusing on a group rather than each individual in a data set.

- **Drill-Down** Analysis: this action breaks down the data set into several variables that are of interest (e.g. gender, age). These variables can be organised into tables, histograms, and other graphic summaries. Subsequently, one can "drill-down" into the result in order to expose and explore the data in each variable individually (e.g. focus on males from age range 30-39). Again new summaries can be computed for these data, which could suggest breaking it down into other variables (e.g. geographic location, income), in order to find particular patterns or correlations (StatSoft 2013).

The Commonplace study included analysing data produced directly by their digital tool, and analysing data from Mixpanel[7], a user analytics tool that helped explore online user behaviour on Commonplace's digital platform.

Generally, there are two types of community consultation projects Commonplace offers on their platform. The firm refers to these as Needs Analysis (NA) and Design Feedback (DF) projects. NA projects are open consultation projects where users are presented a map of an area, typically part of a neighbourhood, and can choose a location in that area to place a comment about any concern or topic. DF projects are more detailed, and present the user with spatial design proposals for an area. Users are specifically invited to give detailed feedback on these design proposals. In studying the Commonplace data sets, I explored which data could be retrieved from the platform and how these data could be compared for different Commonplace projects to identify patterns in user behaviours and engagement. The availability and characteristics of the data largely determined the design of these explorations. The studies compared NA and DF projects to identify differences in user activity, looking for instance at the number of comments placed, the time spent on the platform, and the frequency and number of revisits to the platform. These provided insights into users' preferences, and more generally, into user engagement through digital consultation tools.

Some of the Commonplace data sets also included records of users who opted to stay in the loop on the progress and outcomes of the consultation, and users who didn't. In one of the studies, we compared the number of users who provided their contact information in relation to the total amount of respondents in NA and DF projects, which provided some insights into users' desire for on-going engagement corresponding to the different project types (see Chapter 4.4.2.1).

The Mixpanel data allowed us to explore online user behaviours on the digital platform through methods such as clickstream analysis. We used Mixpanel data to study the path

7 mixpanel.com

visitors take through the website or application, to learn where visitors navigate to and where visitors drop out, but also to learn when and how often people revisit the platform (see Chapter 4.4.2.1).

Finally, in one of the studies, I explored user profiles, including users' age, gender, ethnicity, and other demographic data that is collected through the app. The study explored whether these data could help uncover a relationship between user demographics and participation in digital consultation tools. Furthermore, the study aimed to provide insights and opportunities for further causal investigation to understand people's motives for participating in decision-making in their local environments. The details and conclusions of this study are set out in Chapter 3.4.

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Chapter 3 – Limitations of current data-driven approaches

This chapter aims to answer one of the earlier formulated research questions:
What are the limitations of data-driven approaches currently adopted by designers in the design of the public realm?

The Royal Institute of British Architects (RIBA), in collaboration with multidisciplinary design and engineering firm Arup, published a report, 'Designing with data: Shaping our future cities' (2013), in which recommendations are made for design firms and urban planners to adopt data gathering in their practices. Their report highlights four different territories where designers and planners can incorporate digital data gathering to improve their everyday practices:

1. DESIGNING FOR CITIZENS
Using data to better match user needs

2. EXPERIMENTATION
Enhanced testing and modelling through using data

3. CITY ANALYTICS
Analysing big data to improve policy implementation and planning

4. TRANSPARENCY
Reducing search and processing time through sharing data (RIBA 2013:5)

As this thesis concentrates specifically on designers rather than urban policy makers and planners, it will focus on the RIBA's first two recommendations: data for 'designing for citizens' and data for 'experimentation' (i.e. modelling). This chapter reviews the proposals in this report as a starting point to explore how designers use digital data today. The RIBA's recommendations will be analysed in order to critically examine present-day practices and expose possible existing pitfalls and deficiencies. This exploration will serve as the foundation for the following two chapters, which propose alternative methods and approaches to designing with data.

Digital technologies are not new to the architectural profession. Computer-aided design (CAD) tools have been adopted widespread in architecture and urban design offices in the late 1990s and early 2000s. Furthermore, one of the uses for digital data currently employed in many architecture and urban design practices worldwide – and quite influential within the architectural academy - is parametric design, in which sets of rules and algorithms shape the design process and outcomes. Parametric modelling is a computer-aided design approach that allows designers to create building plans, public space designs and more, by taking predefined parameters and particular criteria as inputs to generate designs (RIBA 2013). This technique is used in various CAD software programs for various purposes, such as Building Performance Modelling (BPM), where the environmental performance of a design can be tested, Agent Based Modelling (ABM), where the interaction between the environment and users can be modelled, and Building Information Models (BIM), a platform that helps optimise communication and information-sharing between architects and other stakeholders. These software programs have gained widespread recognition within architecture over the past decade, and have become embedded in many architectural firms. Parametric modelling technologies all focus primarily on the built object, and can be used to test the structural, environmental, material and economic outputs of a design. While there is a vast amount of digital data on users available today, captured through all kinds of digital devices connected to the Web[8], its potential as empirical input for the social dimension within architectural design, and particularly within design for the public realm, remains underexplored.

8 Ninety percent of all of the data in the world has been created in the last two years alone. Social media channels are one of the sources where large amounts of data are produced by users on a daily basis. 4.3 billion messages are posted on Facebook every day, and 5.75 billion posts are liked. Each day there are 656 million tweets uploaded on Twitter, and roughly 67 million posts uploaded on Instagram. Furthermore, there are roughly 1.3 million new social media users each day (https://blog.microfocus.com/how-much-data-is-created-on-the-internet-each-day/, accessed 12 December 2017).

Some socially-oriented architecture practices, such as muf architecture/art, have a long tradition of incorporating analogue user data, captured through observations, to inform their designs (Rangel 2017). However, where in-situ observations, surveys or semi-structured interviews can be time and labour consuming, new digital data sources that are available to us today, i.e., from social media platforms such as Facebook, Twitter, and Instagram, enable designers to find similar information faster and in more efficient ways (Chua and Vande Moere 2013). Instead of using structured and static demographic and economic activity data (e.g. from national censuses), designers now have access to large amounts of unstructured dynamic data on the public (Serras et al. 2014). However, at the moment there are very few architecture practices that are taking advantage of this rich source of data. At the same time, there are various other digital tools architects and other spatial designers do engage with, such as BIM and other kinds of parametric modelling. Could this absorption of CAD technologies not function as a template for incorporating other kinds of software and digital data in architectural practices that focus on the social aspect of design? (See Conclusion)

This chapter explores which digital data technologies have been adopted by architects and how they are currently used. It also examines available digital data technologies architects could use to help them incorporate the social aspect in their design process. This exploration is organised into the following four sections:

3.1 How digital modelling tools are used by architects today;
3.2 Digital data to help designers meet user needs;
3.3 Digital tools for citizen participation;
3.4 Digital tools for community consultation;

Section 3.1 explores how architecture and urban design firms have adopted digital technologies in their practices, such as CAD, BIM, and various types of parametric modelling. This section argues that the same way these firms have absorbed and incorporated design software, they could integrate digital data technologies that are user-centred. Section 3.2 introduces such a user-oriented approach to digital data and demonstrates how social media data can be used as a method for designers to better understand the user or public - i.e., those that are affected by design. Section 3.3 explores various digital tools that are used to promote citizen participation in the design and development of the built environment, and questions how they are used, by whom, and to what effect. In section 3.4 one particular citizen participation technology is explored in detail. This section presents the results of an extensive field study where the civic application Commonplace has been investigated. Finally, the discussion on the digital in this chapter and continuing in the following chapters, with an exception of section 3.1 where digital modelling tools are discussed, will refer to socio-spatial digital data (SSDD).

3.1 How digital modelling tools are used by architects today

One of the suggestions for the use of digital data in design put forward by the RIBA report is 'data for experimentation and modelling' (RIBA 2013:5). Tools such as Autodesk's Revit[9] enable designers to experiment with data to optimise the performance of buildings and urban systems. Experimenting with – and testing – designs before starting the construction process would allow for a more efficient design and development process and could save designers and planners time, and potentially money. This section explores how designers have absorbed different digital modelling technologies in their practices and argues that this could function as a template for adopting other digital techniques that focus on the user.

3.1.1 Parametric modelling

In parametric modelling, parameters and rules are expressed at the outset and aim to define relationships between different design elements. One of the well-known software programs for parametric modelling that is used in a large number of architecture firms is Revit[10]. This computer program allows designers and contractors to model buildings and alter parameters in one part of the building to then automatically see how the rest of the construction is affected.

Parametric modelling can be used to cover different aspects of a design process, and can be used for different purposes. It can be used to generate form, or to improve the performance of a building design (i.e. environmental performance as in Building Performance Modelling) or the building process (i.e. organisation and communication

9 Autodesk Revit is building information modelling software for designers and engineers, which allows them to design a building, its structure, and its components in 3D. The software also enables users to add comments to the model, and access building information from the building model's database.

10 A 2014 study by ArchDaily shows that 71 percent of the top fifty architecture firms in the world require job applicants to have experience with Revit. The more traditional design software, AutoCAD, follows closely behind at 50 percent (Quirk 2014).

as in Building Information Models). This section offers a brief overview of these digital modelling techniques and discusses how these technologies have been adopted by architecture practices in their design process at the moment.

The goal of a parametric model is to optimise the design output against a number of existing design constraints by helping architects test how their designs perform under various conditions of the urban built environment before the actual construction of a building (Woodbury 2010). In Building Performance Modelling (BPM) these design constraints consist of measures of sustainability and can help designers test the energy performance of their buildings at an early stage to develop an environmentally sustainable end product.[11] BPM enables designers to model the internal environment of a building and place this building into a simulation of a real-world environment, where the performance of various architectural elements can be assessed, and different energy-saving methods can be tested (Monteiro and Martins 2013). It enables designers to run automated simulations to determine and optimise the energy performance of their design, and has, therefore, become a standard tool in designing low carbon buildings.

Another digital modelling method adopted by some architects is agent-based modelling. Agent-based models (ABM), also known as multi-agent systems (MAS), agent-based simulations (ABS), or individual based modelling (IBM), are small-scale models that simulate individuals, their interactions with each other, and their interactions with the environment. These models aim to assess individual's effects on the system as a whole and re-create or predict complex phenomena (Chen 2012). An individual, or agent, is a programmed entity within the model that is situated in a programmed environment, where it can take independent action, i.e. the agent can perform individually, follow instructions and make decisions independent of others (independent of other agents

11 There are different software programs on the market that can be used for BPM. One of the most accessible and user-friendly software programs is Autodesk's ECOTECT, which is compatible with the most commonly used modelling software Revit. ECOTECT provides a wide range of simulations to analyse the environmental impact, such as thermal, lighting and acoustic analyses.

or without the interference of the programmer).[12] The programmed environment also contains rules on how agents move around in them and interact with other agents (Chen 2012). By creating realistic environments and generating rules that emerge from observing patterns of human behaviour, ABM enables a simulation of real-world systems to a high level of accuracy (Moss and Edmonds 2005).

ABM's ability of modelling individuals and their interactions has evoked the interest of many socially-related studies. This modelling technique could offer new insights into how individuals behave in environments and of how interactions between individuals can affect urban systems on a larger scale. As such, ABM has found its most common use in research into the spatial realm through urban and geospatial studies. The advances in geographic information systems (GIS) have also resulted in a greater acknowledgement of ABM as an effective tool for spatial models that help us comprehend complex (social) phenomena in cities (Batty 2005). One of the earliest examples of such an ABM, developed by Schelling (1971), aimed to understand and disclose racial segregation in American cities. Agent-based models can be used to model environments at different scales – a part of a city, a neighbourhood, a public space, a building, or even the interior of a particular space within a building.[13]

ABM enables designers to conduct a more quantitative, theoretical and automated approach to analysis and prediction than other behavioural research methods, which are usually qualitative (Schank 2010). However, even though this approach allows the modeller to incorporate users, they are as 'designed' as the environment they are made to act within. Only if agent-based modelling is used with scientific rigour, i.e. by using

12 Agents in ABM can make assessments of their situation and make decisions based on these assessments (Bonabeau 2002). An agent also contains a certain degree of social ability, which means it can interact with other agents and function as part of a community. These two aspects are what set ABM apart from other forms of modelling software.

13 Schumacher (2013) has developed an agent-based model where both the designed space as well as its users are represented. These individuals walk through the spatial model and, by connecting rules (move slow or fast, towards or away from others) to surface materials (hard surface, carpet, and so on), agents are programmed to be responsive to designed environmental cues. The model then conducts measurements by counting the frequency of encounters of agents, the encounter durations, group formations, the variety of interaction partners, and so on. Schumacher aims to use these measurements to design a space that can maximise the intensity of communication between users.

empirical data on human behaviour to generate agents' behavioural rules and considering demographic, economic, environmental and material constraints to model the environment, one can generate a more accurate and bottom-up model of reality that can be used to reflect realistic and probabilistic behaviours of humans and complex dynamics in the built environment.

Another parametric modelling tool that focuses on performance optimisation is Building Information Modelling (BIM). Rather than focusing on the optimisation of the design object, however, this software aims to optimise the performance of the design and development process. At its core, BIM is a tool for system-based thinking and operates as a communication and information-sharing platform, which focuses more on project management than design (Architizer 2017). BIM provides a digital representation of a building that captures all of its physical and functional components and has gained widespread recognition, both within architecture as well as engineering, as it facilitates the coordination of, and interaction between, all stakeholders and building professionals involved throughout the various stages of a project. The software offers a platform where architects, clients, engineers, suppliers, project managers, environmental managers, builders and so on can share information, mutually identify problems and develop solutions in cooperation (Architizer 2017; Martin 2017). This new approach in building design and development is bringing about a great deal of change in the industry.[14] The following section will take a closer look at how architecture practices employ digital technologies at the moment, and whether they are currently used for the social aspect of their designs.

14 According to the American Institute of Architects, half of all architectural practices use BIM. BIM software enables more transparency in the design and development process. Therefore, from April 2016 onwards, the UK government has made it mandatory in public-sector projects to use the technology in order to document the building process (Cheshire 2017).

3.1.2 How architecture practices have adopted digital technologies

Some firms use digital tools at various scales and have incorporated them into different stages in their design process. Foster + Partners is a leading example of a firm that has embedded digital technologies into the DNA of their practice. The firm even has an in-house Specialist Modelling Group (SMG) existing of employees that have expertise in complex geometry, environmental simulation, parametric design, computer programming and rapid prototyping.[15] However, even while the firm uses digital modelling tools to help generate form, it is different from the work of Greg Lynn or Patrick Schumacher, where parametric modelling for architectural form-finding is an end in itself, rather than a means to satisfy a precise brief.

Firms such as Foster + Partners are at the forefront of technological developments applied for structural, environmental and economic ends. However, there aren't many examples of practices that use digital technologies for the social aspect of design. Each year the *Architect's Journal* publishes a list of the 100 largest firms, by the number of UK architects working at the firm. Since 2012, Foster + Partners has been at the top of this list. The top 15 of this AJ100 ranking include BDP, Zaha Hadid Architects, Purcell, Grimshaw, and more. All of these firms use digital technologies in their design processes to some extent, ranging from two-dimensional CAD software to parametric modelling. Do they, however, also use digital technologies for social ends, for instance in their community planning projects? According to the RIBA's 'find-an-architect' search engine, six of these offices offer community planning and participation as a service. The six firms include BDP, Sheppard Robson, Allies and Morrison, Scott Brownrigg, Hawkins/Brown and Feilden Clegg Bradly Studios. From their respective websites, only five of them advertise their community planning or participatory projects. These five firms all indicate that they both use novel digital techniques, such as environmental modelling, and participatory

15 The SMG consults design teams on digital techniques and the development of custom CAD tools. Integrating this specialised group of experts has enabled an advanced 3D modelling capability to the practice, which allows the architects to build complex geometric forms that were not feasible to realise twenty years ago. Some of the projects developed with the help of the SMG include the Swiss Re Headquarters, the Sage Gateshead Music Centre, London City Hall and the Bejing International Airport.

strategies in their practice, however, these two never seem to overlap in their projects. The projects either focus on the built object and the digital tools used to achieve the outcome (often regarding the environmental aspects of the building), or they focus on the community aspect and show no sign of incorporating any digital tools to help bring about social outcomes. The only office on this list that has combined the two is BDP, number two on the AJ100 list. On their webpage, BDP communicates that their urbanism team has used various techniques, including digital ones, to reach a wider audience in their community planning projects. The tool that they used for this public engagement is Commonplace, an online platform that was used to facilitate a conversation with, and engage a broad range of community members. BDP suggests that this tool allowed them to reach community members that would otherwise not have engaged through traditional consultation methods. Later on in this chapter, we will take a closer look at this digital consultation tool to investigate whether it is indeed a successful digital strategy in democratising neighbourhood design and development processes.

Another firm that focuses on incorporating digital technologies in a human-centred design approach is Atkins, the number 7 on the AJ100 list. Atkins won the 2017 AJ100 Best Use of Technology award for their interactive tool 'Wellbriefing'. The digital engagement tool tests worker happiness by recording the needs and wishes of the building's users through surveys. Their digital survey is classified into nine physical and perceptual categories: movement, light, temperature, air quality, sound, connections, interaction, flexibility, and ownership. The outcomes of this survey are then used as input to generate a design brief and to evaluate whether generated design concepts comply with human-centric goals.

Atkins has used technology to create an interactive digital survey tool that collects data on the elements in a design/building that influence the building user's relationship with their environment. These data are used to develop indicators of users' wellbeing, which influence the building layout, the choice of building materials, and so on. With this interactive tool, Atkins aims to design spaces that are uplifting and inspire their dwellers. According to the firm's architects, spaces should be light and airy and facilitate and stimulate social interaction. Their digital tool aims to support a human-centred design approach by engaging end-users in the (digital) engagement process. Ultimately, the firm argues, their wellbeing data will enable architects to make empirically-based human-centred design decisions and will enable clients to make better-informed decisions on developing user-friendly buildings. Atkins describes their human-centred designs as 'design that reduces stress and promotes healthier living, enables people to concentrate better, interact more effectively and work more efficiently' (atkins-hcd.com).

Rather than focusing on the social aspect of human-centred design, Atkins uses a language of economics to attract clients. Human-centred design, they argue, will help increase workers' well-being and, as a result, increase productivity, and ultimately lead to increased profit. While such a top-down approach to optimising the performance of human resources through design might be useful in attracting clients interested in company design, this thesis rather focuses on deploying digital technologies to support social ends from the bottom-up, i.e., to promote user engagement in, and appropriation of the local public realm and to democratise decision-making processes on the local built environment. Furthermore, rather than advocating for designers to create their own digital tools to generate user data, such as Atkins' bespoke digital tool to collect survey data, this thesis explores how designers could use existing digital data on users that are already accessible and available (i.e. through social network services such as Facebook or Twitter). Instead of developing new digital technologies to generate data on users, designers could tap into existing data and knowledge on users that can help them create their human-centred or socially-engaged designs.

While all of the modelling technologies discussed in this section can be valuable tools within a design process, they all focus on a particular aspect of the overall process. The risk of such software tools is that, while they are partial, they can be interpreted as all-encompassing by the people that use them. Designers who base their designs exclusively on modelling technologies risk reducing the design process to something that fits the computational process; features that cannot be described to a computer will be left out. Furthermore, while most CAD software developments aim to support aspects of the design process that are concerned with the design object, there are many other qualitative features within a design that these programs do not cover, such as the social aspects of a design. Qualitative features that fall outside the scope of existing software technologies are therefore at risk of not being represented as equally important, data-rich aspects in technology-driven design processes. If such techniques are used in parallel to other design techniques that do address the user, they can be useful tools for designers. The testing of a building's environmental performance in BPM, for instance, could be extended with other parameters on the user-friendliness of buildings, such as data from the Atkins' Wellbriefing tool, so that other vital features within architecture, such as the user, can become embedded within an environmentally-determined design. So far, the social dimension is often missing in discussions about experimentation with the digital in architecture. Designers might not yet see the relevance of incorporating digital user data, since, different from CAD techniques, it is not perceived as directly pertaining to the act of designing. Or designers might believe there isn't the same quality or amount of data available on the user(s). While exceedingly large amounts of data are recorded on humans on a daily basis, through various everyday technologies such as mobile phone networks, social media networks, credit card systems, and so on, architects are not fully taking advantage of this vast source of user data yet.

The widespread adoption of CAD tools in architecture and urban design offices could function as a precedent for the discipline to adopt other kinds of software that would enable designers to explore the social dimensions through empirical data. Foster (2011), for example, explains that their practice has always acknowledged the benefits of new technology, such as digital modelling or rapid prototyping. He stresses, however, that computers are just another tool, and that technology is a means, not an end, and that the ends are always social. The same way architects have adopted tools from engineering in their practices, such as CAD and other digital modelling technologies, they could integrate digital technologies that address these social ends. At the moment, firms that adopt participatory approaches and aim to create socially-engaged projects, such as Hawkins\Brown, Allies and Morrison, and Feilden Clegg Bradley Studio's, often limit themselves to analogue techniques to facilitate social outcomes. On the other hand, firms that do use digital technologies for human-centred design, such as Atkins, seem to focus on optimisation strategies of human performance in the interest of clients and advocate maximised economic gains, rather than promoting social ends. Finally, the use of data for computer-aided modelling forms only a fraction of the myriad of approaches to digital data that are available to designers today. This section exposed which elements of a design process, particularly within a socially-engaged practice, currently fall outside the scope of these software programs. This thesis aims to fill this identified gap, by demonstrating how digital data on the public could be of use to designers. The following sections will explore what kind of user data is produced by existing digital technologies, such as social networking platforms, that could help designers incorporate the social end to a similar empirical degree as they have incorporated environmental or economic aspects within their design processes.

3.2 Digital data to help designers meet user needs

Along with data for experimentation and modelling, the RIBA proposes that data can also be used to help designers better match user needs. Our data today is captured through all kinds of digital devices connected to the Web. Such devices often contain integrated global positioning system (GPS) receivers, which log location-specific data and can help identify the location of objects, places, and people. Various urban sensors, such as parking sensors, wireless networks, mobile phones with integrated GPS trackers, and Oyster cards containing RFID[16] chips that leave digital traces of users' public transport routes, record our whereabouts. At the same time, social media networks form another large source of location-based data. Numerous social media platforms have incorporated a GPS function, which allows people to link their physical location to their uploaded data. A well-known example of such an online social network is Twitter, a micro-blogging platform for text-based messages in which people can share news and events, or have conversations, in real-time. Twitter users generate a vast amount of location-based data every day.[17] Empirical studies show that people particularly use the 140-character long Twitter messages to report on their activities or to express their thoughts, sentiments, and experiences of places (Java et al. 2007). Such tweets primarily exist of text content, but they also contain meta-data, such as geographic locations and timestamps. Data from location-based tweets can, therefore, be used to visualise patterns of cities' infrastructure networks and human geography (Chua and Vande Moere 2013). The availability of this new type of data has also resulted in various studies on sentiment mapping of people in the public sphere at certain times of the day or around specific events.[18]

16 Radio-frequency identification

17 Twitter has 328 million monthly active users and generates 500 million messages each day (Aslam 2017).

18 A wide variety of tools have been developed to conduct such a Twitter-based sentiment analysis, such as tweetfeel.com, tweettone.com, themoodmap.co.uk or twittersentiment.appspot.com.

Geographic data has now become a regular feature in many social media services (e.g. Facebook, Instagram, and Foursquare). Since such data can be useful in conducting urban studies, spatial designers, artists, and researchers are exploring user data to create various visualisations. Examples include maps that illustrate the most frequently used transport infrastructures[19], the different languages used in cities[20], or the whereabouts of tourists vis-a-vis locals[21]. At the same time, new digital platforms also allow designers to communicate with, and consult, more people in a wider variety of ways.

The RIBA report (2013) outlines three ways in which designers can use data to better understand the needs of the public in order to generate spaces that better answer to user needs. The report proposes that user data can be used for:

- Understanding how spaces and neighbourhoods are used at different times of day, by different types of people, and in response to different events and understanding complex relationships between different variables, such as how people respond to traffic, weather, or public events;
- Helping people make sense of spaces, by feeding back information to them while they are in those spaces;
- Understanding who users are and what they want: learning about what people are doing in places and what they are saying about spaces, as well as being able to have conversations with more users about what they want from spaces (RIBA 2013:6).

This section will take a closer look at these suggestions and examine how digital data are currently used to study urban contexts and how these methods could be of use to socially-engaged designers.

19 An example of such a study was conducted by Citylab (www.citylab.com/commute/2012/02/map-day-how-people-travel-around-city/1131/)

20 Twitter Tongues is an example of such a study (twitter.mappinglondon.co.uk)

21 Data artist Eric Fischer created several maps of various cities in which data from the photo-sharing platform Flickr are used to differentiate and visualise the locations of tourists and locals (brilliantmaps.com/tourists-vs-locals/, accessed 5 May 2015)

3.2.1. Data for understanding human behaviour in the built environment

Whether by choice or not, humans today are more and more entangled in socio-technical systems through everyday technologies such as mobile phone networks, social media networks, credit card systems, and so on. All of these systems produce 'digital exhaust' on our daily actions and transactions, which have become valued means in studying individuals' behaviours, and society at large, at low or no cost.[22] While exceedingly large amounts of data are recorded on a daily basis, the format of such data sets is often generated with no specific structure or research question in mind. This unconventional size and shape of data have therefore called for new and advanced methods of analysis. These new methods have enabled researchers to explore issues that were difficult to investigate before through qualitative methods, such as human sentiments, perceptions or social networks of large populations (Offenhuber and Ratti 2014). Moreover, through collecting and analysing data on people's movement patterns, transportation systems, and communication networks, as they occur, cities can now be observed in real-time. Such real-time observations can be useful for architects, and urban designers to both generate an understanding of existing urban systems as well as forecast, and design for, the future of urban environments. Data on how people use (public) spaces and urban systems could generate new insights on cities and could also potentially help designers create spaces that can better accommodate user needs (RIBA 2013). This section deconstructs several examples of existing user data studies to explore whether they have been able to generate new insights and to question how these could potentially inform socially-engaged design practice.

Twitter data analysis to reveal user patterns

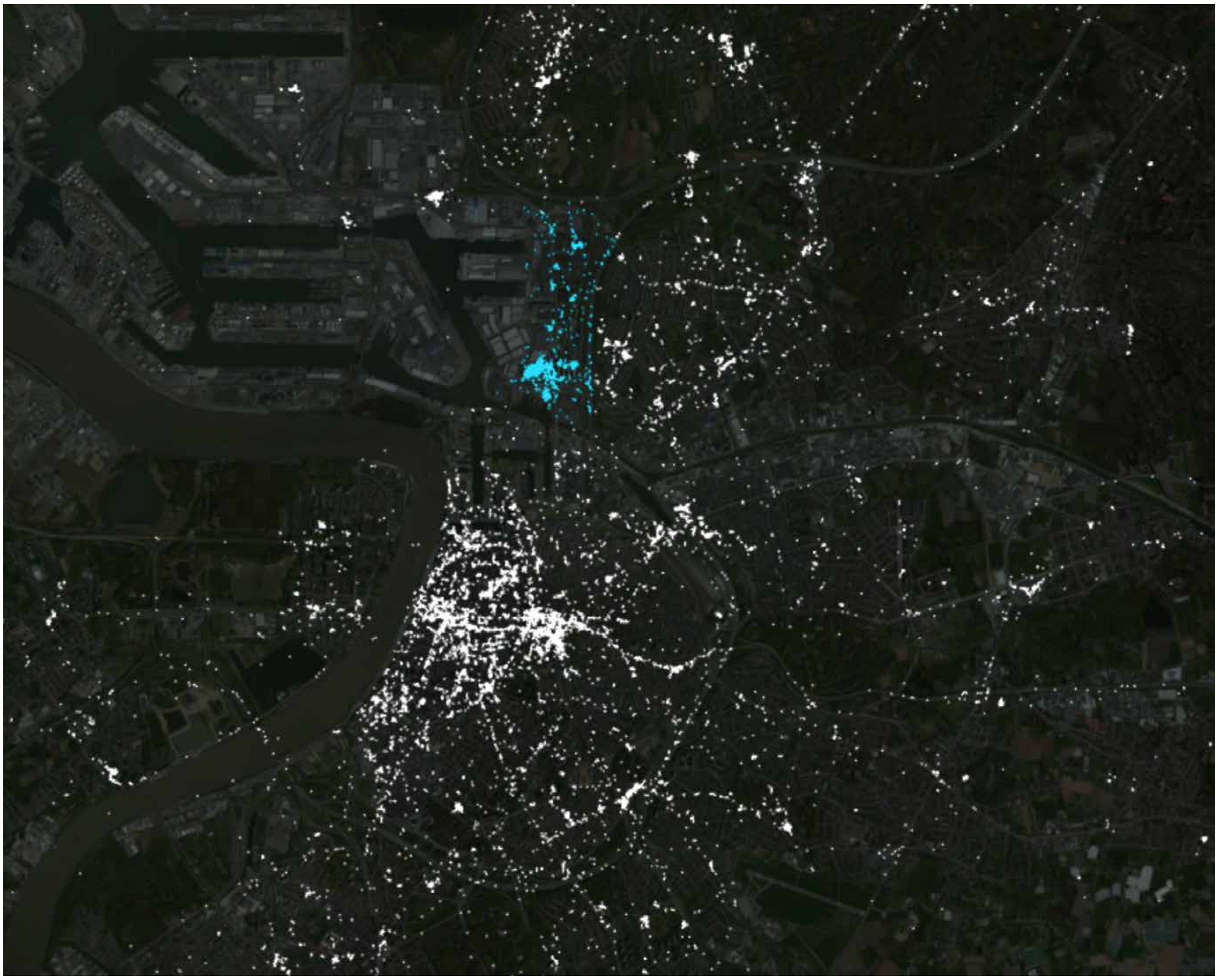
Data on human movement can help spatial designers better understand and anticipate user patterns in the built environment. The following example demonstrates how a study

22 Over the last ten years, the population's ubiquitous connectivity and the growing availability of digital data have resulted in a quantitative turn in the social sciences, often characterised as 'computational social science' (Lazer et al. 2009).

of geo-located social media data from Twitter aims to help designers analyse such human flows.

In a study of Twitter data, Chua and Vande Moere (2013) investigate daily routines of users to gain insights on how people navigate the city of Antwerp, Belgium, and particularly the neighbourhood Luchtbal. By looking at timestamps in the Twitter dataset, the researchers were able to conduct space-time observations and identify user movements at different times of the day (fig. 3.1). Assembling various user routines resulted in a pattern that discloses a rhythm of transient collective movements of people,

Figure 3.1
Map of Twitter feed – Close up view of the location-based tweets in Antwerp. Only 2067 (2.68 %) of the total tweets collected are located in Luchtbal (these points are marked in blue)



which are affected by time and reveal a network of connected spaces. The researchers discovered that there was a considerable disparity in day and night tweet frequency in the studied area. A closer analysis of this discrepancy revealed a noticeable routine of a home-work/school commute of the neighbourhood inhabitants. Furthermore, within this routine, one specific site around a bus stop emerged as a critical location for many users, which could imply that public transportation is the primary mode of travel among the studied sample.

This study aimed to demonstrate how Twitter data could be used to study human movements and behaviours within an urban environment. Such geo-located social media data could function as an alternative to designer's existing techniques of analysing people's commuting patterns, i.e. through census data, and could result in a different image of mobility flows in urban regions (Chua et al. 2014). This thesis, however, questions whether a study on mobility patterns is the best use for digital data from a social media platform, such as Twitter. Does it add any new insights into our understanding of an urban fabric? Also, does it generate any valuable information for designers working in a public space context? The Twitter study visualises the most frequently used infrastructure networks of a studied sample and shows the places Twitter users travel to, yet there are several shortcomings in this approach. First, the study used only two percent of the total amount of collected tweets, which were collected over a three-month period. However, this is similar to an analogue technique of user surveys, which would also only include a small sample of a population. Second, this study is only based on Twitter users and therefore does not equally represent the local community.[23] A final concern is this study's lack of success in discovering new insights on human movements and activities in the city of Antwerp (and neighbourhood of Luchtbal). The researchers conclude that there is a clear commuting pattern visible from the Luchtbal neighbourhood to Antwerp's city centre. With this conclusion, the study merely validates existing observations on commuting behaviours in urban regions. The

23 Studies have shown that there is an ethnical imbalance among Twitter users, and they are predominantly male and aged between 18-49 years (Mislove et al. 2011; Duggan 2015).

lack of mixed use (e.g. business, schools, and commerce) and overrepresentation of housing in this neighbourhood already indicate significant commute patterns between the neighbourhood and the city centre, as is the case with many homogenous suburban neighbourhoods.

Real-Time Rome

Real Time Rome is a project by the SENSEable City Laboratory of MIT, an interdisciplinary lab that studies the impact of technologies on cities. This particular project, which was their contribution to the Venice Biennale of 2006, explores how real-time technologies could help create a better understanding of cities, and speculates about how this could help designers improve urban design (Offenhuber and Ratti 2014:11).

For this project, the lab collected location-based data from cell phones, buses and taxis in Rome to create an understanding of the city's dynamics in real-time and to demonstrate how such data could help citizens make more informed decisions about their movement through the city (senseable.mit.edu). The project resulted in a number of visualisations on different scales (from city to neighbourhood), which, for instance, illustrate the density of people at different times of day, or map the walking directions of cell phone users in a neighbourhood. Real-time data gathered from various wireless technologies were used to demonstrate the interrelation between the urban population, physical spaces and urban infrastructures. The exhibition existed of seven screens showing animations based on real-time data for the city of Rome. One visualisation, for example, shows traffic congestion in the city, while in another the real-time location of buses and taxis are animated. Another screen shows how pedestrians and cars move around in the city and yet another visualises which attractions are most popular among tourists. All these animations take data from various real-time networks and translate them to visualisations that aim to help the audience recognise patterns of daily life, and would ultimately help designers gain new insights on human behaviour in the city.

By mapping these data for the city of Rome, the project aimed to expose the rhythm of a city in real-time and potentially create a deeper understanding of how modern cities operate. A closer examination of these examples raises an obvious question: Are these visualisations successful in generating new insights on city dwellers' behaviour in Rome? Also, could they, therefore, be of use to designers? One of the screens shows the mobile phone use of Romans during different major events, such as a Madonna concert that took place in the Olympic Stadium on August 6th, 2016. The animation illustrates how the usage frequency of cellular phones converges towards the stadium and peaks during the concert. After the concert, the use decreases and disperses through the city. Another screen shows the 'pulse' of the city, where the intensity of mobile phone usage at different times of day are visualised. On this map, a concentration and convergence are noticeable in the city's central areas at daytime, while, again, the use diminishes and disperses throughout the city overnight. These movements and behaviours of people in the city of Rome are not particularly surprising or unexpected, which raises questions on the relevance of these studies for designers. While such visualisations are compelling experiments in demonstrating new ways of tinkering with novel data sources, these particular examples fail to produce any new knowledge that could help create a deeper understanding of user needs or the functioning of cities.

Critique

While location data-oriented studies, such as the Antwerp and Rome examples, can be instrumental in experimenting with the possibilities of newly available digital user-oriented data, they fail to generate any critical insights into human behaviours in urban environments that could be of use to designers. Before conducting such studies, and rather than letting the data determine the investigation, it would be a good idea for designers first to question whether such a study has the potential to uncover any new insights that can be of use to the design of urban environments. So far, social media data studies on human behaviours in the urban realm fail to conduct critical explorations and end up merely validating designers' existing knowledge and observations.

Carlo Ratti, of MIT's SENSEable city lab, believes that data visualisations, such as those for Rome, can help diminish inefficiencies in present daily urban systems, and potentially pave the way for more sustainable systems in the future. By visualising real-time data, he hopes city dwellers can make more informed decisions about their daily routes and movements through their surroundings and will therefore ultimately gain more control over their environments. By feeding back real-time data to the public, people can, for instance, make more informed decisions about their commute and avoid traffic congestion, he argues. With this, Ratti (2006) believes, real-time feedback loops have the potential to ultimately change urban design. The next section explores whether such real-time data can actually influence people's decision making and help them make sense of their urban environments and whether it could, therefore, become a valuable tool for designers.

3.2.2. Data to help people make sense of their environments

Real-time data can be used not only to observe human behaviour but also to actively influence and potentially change human behaviour in the built environment. Digital technologies allow companies such as Google to augment and assist people's experiences of cities through tools such as Google Maps. At the same time, over the last decade, real-time technologies used in system management and optimisation have emerged in the urban realm, where information on conditions of urban infrastructures and resources are made available to the general public in real-time. Information on traffic, environmental quality (e.g. air and noise pollution) and even the public's emotions are now monitored and visualised as they occur, and presented on various media such as online city dashboards[24] (Golder and Macy 2011). Real-time technologies also enable designers to tinker with new ways of mediating the virtual with the physical world. It is argued that such technologies hold the potential to empower citizens by enabling them to choose for a more efficient and peaceful movement through the city (Vanky 2014). Instead of behaving according to habit or routine, the availability of real-time data enables people to adjust their behaviour according to the present situation of their surroundings. A person could, for instance, decide on their departure time based on real-time information about traffic or weather conditions to have a smooth and more comfortable commute. Designers could also take advantage of real-time data to influence people's behaviour and potentially improve the quality of the built environment, and of people's experiences in it. Designers could, for instance, use real-time environmental data (such as air pollution or CO2 emissions) or social-media data (i.e. data on the whereabouts of a person's social network) to influence people's commuting behaviours, walking routes or means of transportation.

Cities are increasingly setting up real-time data feeds (e.g., for public transportation systems), and Intel companies such as Cisco and IBM are developing more and more

24 One example is London's CityDashboard, a website created by the CASA research lab at University College London in 2012, which aggregates spatial data of the city and presents this in readable formats on a dashboard and a map (citydashboard.org/london/).

products for cities to monitor, control and optimise their urban systems.[25] While such technologies are increasingly emerging in our everyday lives, there is little to no research into the experiences and usage at the customer/user end. Thus, although the size and variety of available data are vastly expanding, there are hardly any studies on the relevance of this information. Does it hold the potential to transform citizens' behaviour and use of urban infrastructures? Moreover, could it, therefore, be an interesting tool for designers? While some cases do monitor quantitative data, such as the number of users, the quality, and type of use often remain overlooked (Vanky 2014).

Real-time transit data in Singapore

A study on the use of real-time urban data in Singapore focuses on describing precisely these missing qualitative features. In this study, researchers have tracked the public's use and perceptions of real-time information and analysed whether they influenced their decision-making on the use of the city's urban infrastructures.

Singapore is a unique case for studying embedded urban technologies.[26] Due to the restrictions on physical growth (the city is located on an island), a lot of technological investments have been put toward real-time monitoring and management of the island's urban infrastructure. As a result of these technological developments, along with the city's economic performance, Singapore has emerged as a so-called 'smart city'. The tech-forward climate of the city has also resulted in a tech-savvy population[27], where conventional restrictions towards embracing technology are less of a concern, and which turns this city into a suitable case study location for investigating the public's perception of real-time information. Also, as smart technologies continue to advance and expand, Singapore might prove to be a glimpse into the urban futures of cities worldwide.

25 Other industries, such as energy companies, have also started to deploy smart technologies (i.e. smart meters), for instance, to monitor their customers' energy use in real-time.

26 After gaining independence in 1965, large domestic economic investments in the city-state's IT development have elevated it from a developing country into a globally operating economic hub.

27 Through surveys, Vanky (2014) found that many Singaporeans were already familiar with real-time information. Moreover, data from the Singapore Department of Statistics (2012) showed the mobile phone subscription rates were 145.24 per 100 individuals, and seventy percent of the population had access to the Internet.

By conducting surveys and observations, researchers were able to gather data on how individuals looked for, and acted upon, real-time information available online and on transit stations. In their studied sample[28], they found that more than two-thirds would seek real-time information regarding their daily transportation plans. While most people in the survey indicated that they would change their travel plans according to this data to save time or reach their destination faster, the study shows that most individuals would not revise their travel routine based on the available real-time information. Only 1.6 percent would change their choice of travel mode based on insights gained by real-time data, and only 6.3 percent would reduce the wait time of their commute. While people did declare their intentions to reduce commute and wait times, the findings of the observation showed that individuals would hardly ever change their mode of travel based on real-time information. Most individuals indicated that they only considered the real-time data at a later stage in their decision-making after their plans were already made. Another significant finding that emerged in this study is the trust in the accuracy of data: recurring inaccurate data could lead to antagonism. Real-time data can sometimes appear to be unreliable, for instance when waiting times increase or massively fluctuate due to unstable transport conditions. In the Singapore study, researchers found that many individuals would consult both real-time data as well as printed bus schedules, and would never rely on the real-time data alone to inform their journey (Vanky 2014).

Critique

The development of real-time urban technologies, such as those in Singapore, often follows the mantra of 'if you build it, they will come'. Especially tech developers are under the impression that the increasing availability of real-time data will inevitably lead to more use, and eventually to behavioural change in the public (Willams et al. 2008).

28 The researchers selected Government employees as the studied population – 3,221 employees took part in the surveys.

However, research into the user experience of such technologies demonstrates that people's adoption of real-time data does not occur naturally, even within a tech-forward society. Individual's deep-rooted habitual and intuitive behaviours, accompanied by a lack of trust in the accuracy of data, make for an uneasy acceptance of real-time technologies. At the same time, smart city solutions and services industry are expected to grow from 40.1 billion dollars in 2017 to 97.9 billion dollars in less than ten years in the global market (Navigant Research 2017). With a lack of awareness of the experiences at the user end, it is difficult to learn whether such smart city investments and ventures will have any impact on citizen's everyday lives, or hold the potential to improve people's experiences of their urban environments. Before implementing real-time technologies, it would be sensible first to understand if and how data can enable citizens to live more efficiently, and whether there is even a desire amongst the public to do so. At the moment, real-time technologies are developed from a market-driven ideology of system optimisation and efficiency. Designers that aim to engage with such technologies need to question whether they want to reinforce such principles and challenge whether these are desirable values for people to aspire in their daily lives. Are real-time technologies designed to improve the life of citizens or merely to optimise the performance of urban systems? Moreover, are we even still talking about citizens, or are people purely seen as consumers of city services? While it could be valuable for designers to acknowledge and understand the possibilities real-time technologies have for enriching people's experience of public spaces, there is still little knowledge on whether such technologies can actually improve the quality of urban spaces and influence people's experiences.[29]

29 There is also a practical concern about the format in which such real-time information should be presented to the public. How can information be visualised efficiently in a readable and intelligible format, and through which medium? At the moment these data are presented on urban screens or people's devices, such as smartphones and tablets. Tech companies, such as Google and Microsoft, are exploring appropriate human-computer interfaces to mediate between the human body, the digital realm and physical spaces (RIBA 2013). Google Glass was an example of a pair of augmented reality glasses that proved to be an unsuccessful venture. While there are still questions on whether experiencing public spaces as digitally augmented is favourable, current developments have not matured to a degree yet that allows the general public to experience spaces in such a digital-physical manner.

3.2.3. Understanding who users are and what they want

While real-time data on various services (such as public transportation) can be useful to citizens, real-time data on users, on the other hand, allow service providers (such as bus companies) to learn about people's experiences of their services. Such real-time feedback enables companies to optimise their services for its users. User feedback also allows designers to learn about people's experiences in the spaces they design. New technologies, such as digital consultation tools, offer designers new ways of including the public in various design phases to inquire about their needs or even to co-design solutions. Such consultation tools enable a more efficient feedback mechanism. Several architects and urban designers believe that new online consultation tools enable a better understanding of the public's needs since traditional techniques often only reach those community members who are able and interested in attending public consultation meetings (Kingston et al. 1999; RIBA 2013; mySociety 2015). The following section (3.3) explores whether such digital tools have the potential to democratise decision-making processes and examines how such tools could be of use to socially engaged designers.

Critique

This section explored how digital data could support more human-oriented design approaches and help designers better understand the relationship between humans and their (urban) environments, by examining how data is currently used to create an understanding of how different people use spaces at different times of day and in response to different events, and by exploring how (real-time) data is used to help people make sense of spaces.

The studies of Antwerp and Rome demonstrate new methods of experimenting with user data. They, however, also expose several pitfalls in data-driven explorations. These studies exemplify how data explorations can become directed and determined by the content, shape, and availability of particular datasets. In other words, the data source (e.g. Twitter) determines what can and cannot be studied, and therefore influences the relevance of the outcomes. The Antwerp and Rome examples both generate limited insights that merely ratify designers' and urban planners' existing knowledge on human behaviours in the urban realm.

While large amounts of data on users can certainly be valuable in public space research and design, a more critical reflection is needed on what kind of data is used and for what purposes. Currently (real-time) data on how people use public space consist either of data collected by mobile phone tracking and sensors (e.g. parking sensors, congestion charge zones, and Oyster cards) informing us of how and when people move through the city, or by social media data, informing us of what people say (and feel) about a place. Not everyone participates in social media (or has access to online tools), which raises a question of how representative digital user data are. Furthermore, since other user data is about large flows of people (for example data on people's movement through the city), one might question whether these data on general movement flows merely justify a management-driven ideology on urban systems that advocates performance optimisation and encourages a technocratic approach to urban planning and design. Finally, these types of data cover only two aspects of the vast data landscape that is available. Architects would do well to take a critical position and question whether the data they use to inform their practices serve the quality and values of the public realm. Do these data show whether a public space is truly public, can they tell who's included or excluded, and can they show how communities take ownership of these spaces?

This section also explored whether data can actively influence individuals' behaviours in the city. While investments in real-time technologies are increasing, the Singapore case study demonstrates that the availability of real-time information does not automatically lead to behavioural change. Furthermore, real-time information technologies aim to enable citizens to live more efficiently, productively and reduce time-waste. However, the question is whether such level of efficiency is desirable for individual citizens and collective civic life. Intel companies such as IBM, Cisco and Siemens offer city governments smart technologies for control and efficiency and don't concern themselves with civic values and human-centred qualities such as social inclusion, citizen participation or urban serendipity. The kind of urban environments and nature of civic life that are advocated by real-time technology developers, therefore, need to be scrutinised. While cities will need to operate more efficiently to deal with increasing pressures on their existing urban systems (due to, for instance, population growth or climate change), city governments also need to be aware of safeguarding the qualitative aspects of civic life that liberate citizens from control and homogeneity. Journey planning tools, for example, are developed to help users travel the shortest distance at the fastest speed. However, there are other criteria that could help improve people's experiences of urban environments, and ultimately improve their quality of life, which aren't considered at the moment, such as the least polluted route or most scenic one (Camacho et al. 2012; Foth 2016; Paulos et al. 2009). Some designers are aware of this technocratic shift in urban developments and alert the public on the effects of ubiquitous digital technologies on public life through digital design interventions. Such interventions, for instance, advocate for a return of urban serendipity (such as *Serendipitor*[30] or *Likeways*[31]). Chapter 4 takes a closer look at how designers are trying to create greater awareness on city governments' techno-scientific determinism and explores how digital data is used in their critical designs practices. Finally, the final conclusion of this thesis will discuss how the use of these forms of digital real-time and user data could influence the role of the architect.

30 Serendipitor, a navigation application developed by Mark Shepard, is a tool that proposes alternative routes to the standard fastest route from the point of origin to a destination (serendipitor.net).

31 Likeways is an application that aims to lead its users off the beaten path and onto side streets, where people may discover new places, such as café's or galleries (citylab.com).

3.3 Digital tools for citizen participation

This section explores how the emergence of particular digital technologies has influenced public participation in architectural and urban design and development processes, and questions how this emergence can be of use to designers that aim to empower citizens by engaging them in neighbourhood public space developments. Neighbourhood communities are key players when it comes to knowledge about the local built environment. Their knowledge forms a rich source of information that can help architects and urban designers conduct qualitative analyses of local contexts and generate plans that cater to the needs of those that inhabit the spaces. Furthermore, through several changes in legislation, such as the 2011 Localism Act in the UK, urban planners, and property developers are obliged to involve members of the local community in planning decisions that affect their everyday lives (Bugs et al. 2010).

The ideologically driven desire to diminish the role of the state, and therefore its costs, through increased citizen engagement (e.g. 'Big Society' in the UK or the 'Participation Society' in the Netherlands), along with the rise of digital technologies have resulted in the emergence of civic technologies that are being developed at a steady rate all over the world. Many local authorities in the UK collaborate with third-party companies to create digital applications that aim to make their services easier to use for citizens, and ultimately help optimise and cut costs of their service delivery (Woollacott 2017). New digital consultation tools allow city councils, property developers and designers to collect and analyse local feedback through online platforms, and are argued to make it easier to consult the public on what they want. Such techniques enable more efficient co-design processes in generating planning proposals and offer tools that help citizens in holding their governments to account (mySociety 2015). It would also generate a better understanding of the public and their needs (mySociety 2015; RIBA 2013; Erickson 2010; Brabham 2009). Digital tools for consultation would allow for feedback from a broader sample of the public since traditional consultation meetings tend to only attract a particular set of people that are able and interested in attending (RIBA 2013; Fredericks and Cochrane 2015; mySociety 2015; Pratt 2012). However, not everyone participates or has access to such online tools. Moreover, even those that do have access to the tools might not be more inclined to participate in consultation processes, even if the technology simplifies such an engagement. This section examines various examples of civic applications that have been developed to mediate different aspects of public life in the built environment between (local) councils, private actors and the public, to explore if and how such tools could be of use to socially-engaged designers. Two examples of civic applications are examined in more detail to question whether these technologies are able to engage more citizens and democratise participatory processes in the design, development, and management of the built environment.

The section differentiates between three types of digital technologies that have emerged over the last decade to foster citizen engagement in local governance and urban developments. The first category optimises city services and engage citizens in monitoring and sustaining their (local) environments. The second group comprises digital applications that are developed to tackle traditional consultation processes in the design and development of the built environment. These platforms aim to engage and empower traditionally marginalised members of society by opening up the consultation process to a broader public. The third type exists in online gaming applications. Such 'digital serious games' strive to engage citizens in decision-making processes through gameplay. This section examines several examples within these three categories and questions how they function, whether they succeed in democratising citizen engagement, and how they could be of use for architects and urban designers who want to empower citizens in their practices.

3.3.1 Civic applications to optimise city services

Civic applications (or 'civic apps') are software applications that aim to encourage citizens to participate in the development of public services, and with that, enhance civic engagement and ultimately increase citizens' social capital. Due to the diminishing role of the state, city governments are welcoming such technological solutions to promote civic participation through various software applications. Opening up their governmental data sets has been the first step in providing opportunities for tech-savvy entrepreneurs to develop data-driven ways of making government's communication and services more accessible to citizens. Outside the scope of business and government, digital movements that are closely related to urban life are emerging. Activists, technologists, and citizens concerned with everyday problems in the city often lead these bottom-up technological advances, for instance through hackathons where people involved in software development tackle problems in the city with technological solutions or through non-profit organisations that develop virtual platforms for public goods. Some examples include apps for strengthening local communities, for supporting entrepreneurship or for protecting nature in local public spaces. Different applications can have different functions: some apps offer public information; some enable public reporting, while others advocate volunteerism or use citizens as sensors. In general, two types of apps have emerged over the last decade. The first type aims to complement existing government services by making them more accessible and transparent. The second type aims to stimulate citizens to collaborate with their local governments through various activities, such as monitoring the city's fire hydrants (Pratt 2012).

Adopt-a-Hydrant is a project by the non-profit organization Code for America that developed an app to engage people in taking responsibility of public goods. During harsh winters in Boston (USA) fire hydrants would be buried in snow, causing dangerous delays for fire fighters. It would be costly and time consuming to have City of Boston employees check and clear the thousands of fire hydrants during and after these winter storms. The Adopt-a-Hydrant application offers a solution by allowing local community to help their government. The map-based web application shows its users where the hydrants are located and allows individuals, small businesses and community organizations to volunteer by 'adopting' a specific hydrant and with that taking responsibility to shovel it out after heavy snowfall (adoptahydrant.org).

Civic apps are different from traditional government websites aimed at informing citizens since they are built around the interaction between the user and the app, which is necessary for the tool to work. The origin of civic applications lies in the development of public participatory geographic information systems (PPGIS) in the 1990s (Poplin 2013). This technology aimed to enable citizens to make more informed decisions about their environment (Carver 2001; Kingston et al. 1999; Pickles 1995; Schroeder 1996). Early PPGIS developments failed to enable significant interactions between online users and GIS maps since their user functionality proved to be too complicated for a majority of the online public (Steinmann et al. 2004). New technological developments, such as Web 2.0, crowd-sourcing and social networks, and everyday use of online tools such as Google Maps, have opened up new possibilities for map-based digital platforms aimed at promoting public participation (Poplin 2013). As a result, an increasing number of civic apps have been developed over the last years to support citizen participation in the development of the built environment.

Such digital civic platforms aim to improve public services by promoting transparency and accountability, and by allowing citizens to collaborate in local governments' decision-making processes in order to develop or sustain their environments. These services also help local governments understand the concerns of their citizens through crowdsourcing information (Pak et al. 2017; Seltzer and Mahmoudi 2013). Crowdsourcing enables decision-makers to address issues of urban governance in alternative ways. Such matters are often large-scale, highly complex and challenging to resolve from the top-down through an expert-driven approach. Crowdsourcing can enable solutions to emerge from collective inputs of engaged citizens (Surowiecki 2005; Brabham 2009). It also allows for a less costly and more accurate way of monitoring the urban environment, since crowdsourcing generates a neighbourhood database from experiences of citizens who use the space (Brabham 2009). This bottom-up approach enables citizens with profound knowledge of their neighbourhood to actively engage in improving the quality of their environments (Erickson 2010). Through crowdsourcing, digital civic platforms have allowed both citizens and institutions to identify and map problems, propose and discuss solutions and invoke action (De Waal and De Lange 2013). This section examines three examples of such digital civic technologies and analyses one particular application in more detail, to explore whether such a tool can offer new opportunities for designers to create more participatory projects or outcomes.

Street Bump

Street Bump is an initiative by the Mayor's Office for New Urban Mechanics, which exists of a network of civic innovation offices in Boston, USA. The digital application aims to engage residents in monitoring the quality of their neighbourhood streets (fig. 3.2). By activating the mobile app while driving through the neighbourhood, the driver's smartphone will record "bumps" in the road through an embedded accelerometer. This data, together with the GPS location of the device, is then sent to the city's database. Analysing this data reveals which bumps are identified as known obstacles (e.g. speed bumps) or as problems that need to be fixed (e.g. potholes). Crowdsourced data from this app enables local authorities to monitor their road infrastructure in real-time, identify and resolve problems, and plan long-term investments on road quality improvements.

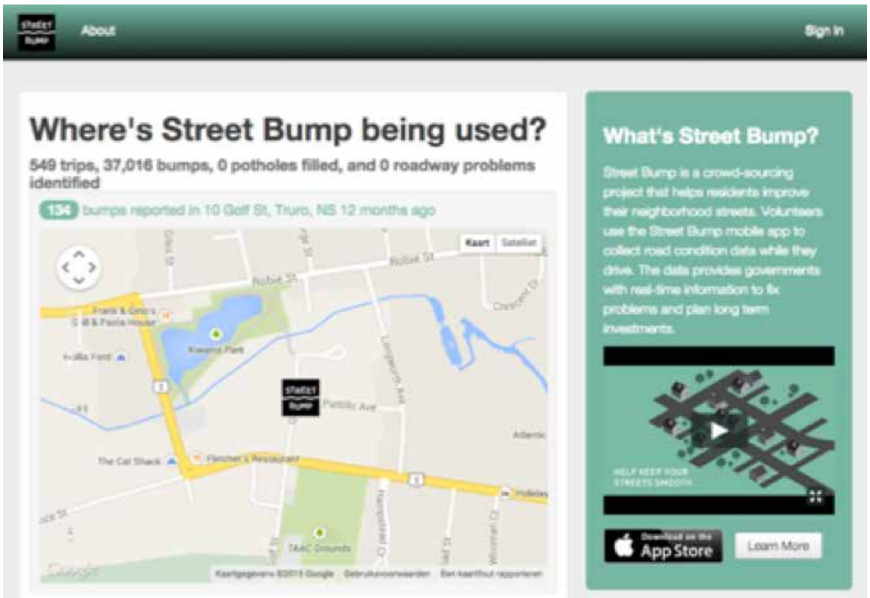


Figure 3.2
Screenshot of the user interface of the Street Bump web platform (streetbump.org)

Citizen Connect

Citizen Connect is another project by the New Urban Mechanics network, which aims to offer residents an easy tool to report public realm maintenance issues. Users can submit photos and locations of problems they encounter (e.g. graffiti) via the app, which is then automatically sent to the responsible service department (fig. 3.3). The app enables residents to act as the eyes and ears on city streets and ultimately aims to empower citizens in contributing to the improvement of their neighbourhoods in the City of Boston.

There are many more examples of online civic crowdsourcing platforms that have been deployed over the last decade to support urban planning, design and governance processes. Examples include OpenPlans, a digital mapping tool that offers a vast plethora of community engagement projects for the urban realm (such as improving bicycle network infrastructures) in various cities in the United States, or Ushahidi, a platform that allows citizens to report events (such as elections) or incidents (such as traffic congestions) in Nairobi, Kenya. These tools often exist of a publicly accessible map that presents reported issues and which citizens can use to monitor the performance of their local governments. The following project is a well-known example of a similar

Figure 3.3
Screenshot of user interface of web platform Citizen Connect (newurbanmechanics.org)

crowdsourced reporting application. It is one of the earliest examples of a digital civic platform and one of the first projects that tested the potentials of civic crowdsourcing (Pak et al. 2017).

FixMyStreet

FixMyStreet (FMS) is a civic application that exists of an online platform, which allows people to report and view local concerns in their environment and report problems to their local government. By placing a contribution on a map of their neighbourhood, users can communicate their concerns to their local council. If the local authorities decide to take care of a raised issue, they can use the digital platform to inform citizens that the problem is being, or has been, resolved (fig. 3.4). By offering citizens a more natural way of reporting problems in their community, the app aims to enable a more efficient and more responsive method of communication between citizens and (local) governments. Citizens use the FMS platform to report items that are broken, damaged or dumped (i.e. through requests for cleaning graffiti or dog fouling or fixing potholes or street lights). The app promotes citizen engagement in sustaining neighbourhoods by providing them

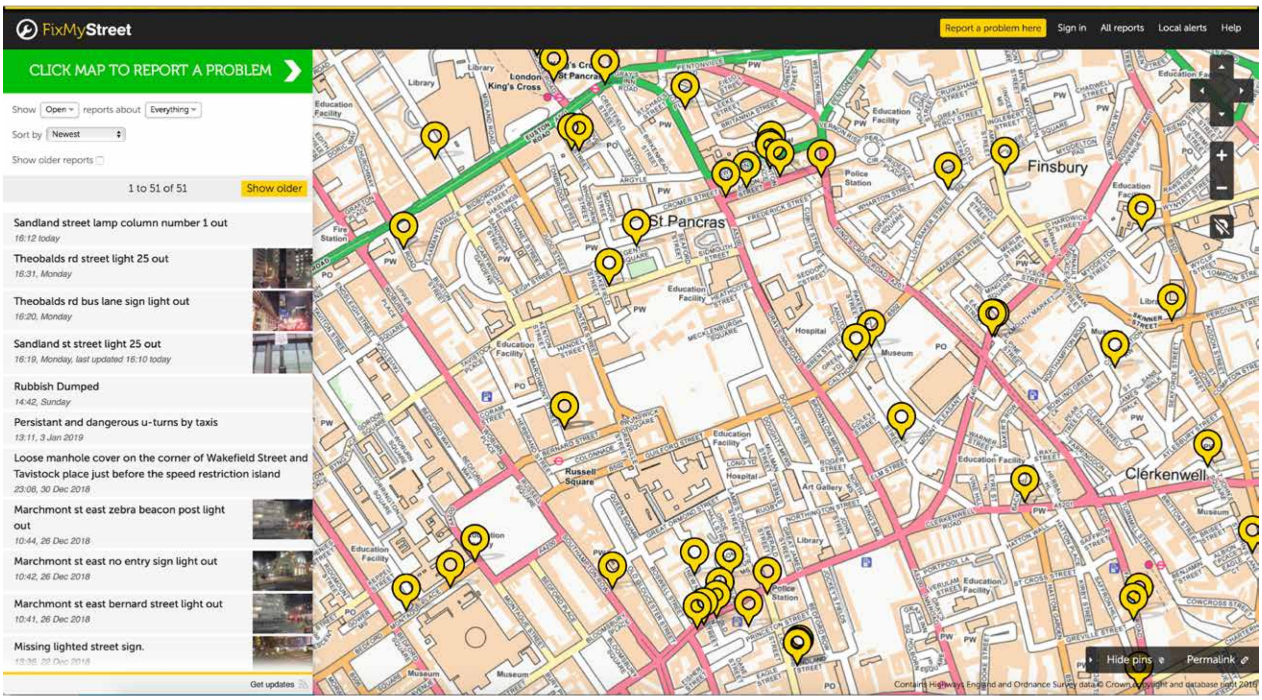


Figure 3.4
A screenshot of the online interface of the Fix My Street platform for UK-based users (www.fixmystreet.com)

with a channel for reporting defects in their environments. This digital civic participation platform has now been adopted by many cities in countries worldwide, including Uganda, Uruguay, Malaysia, France, Sweden, Spain, Ireland, and more (mySociety 2015).

Similar applications are emerging in different parts of the world, and have become increasingly popular amongst city councils over the last decade. Examples include Verbeterdebuurt in the Netherlands, SeeClickFix or PublicStuff in the United States or Snap, Send Solve in New Zealand (Atzmanstorfer and Blaschke 2013; crowdgov 2016). Rather than being designed to last, the driving force behind such developments is fast supply (Pratt 2012). This rapid process of development leaves little room for reflection, which would help software developers, designers, and local governments learn what the actual effects of such civic apps are on citizen empowerment. Are they able to establish more democratic decision-making on the built environment?

Civic applications can be useful instruments for empowering citizens and democratising bureaucratic operations, yet they have been criticised for marginalising specific populations (Martínez et al. 2009; Brabham 2009). Since the Internet is ubiquitous, it is believed that digital civic applications will naturally reduce barriers for citizens to engage in decision-making processes (Baykurt 2012). However, digital applications often require a certain level of skills and a certain degree of digital literacy. Accessibility and use of digital applications can, therefore, be challenging for some members of society (Haklay 2013). By scrutinising the FixMyStreet app, the following paragraphs will investigate socio-demographic inequality in the use of such civic platforms.

FixMyStreet is one of the numerous civic applications developed by the UK-based international non-profit mySociety. Their platforms aim to facilitate citizen empowerment by offering tools that citizens can use to bring about change in their environments. This social enterprise is one of the few civic technology organisations in the world that undertakes research to test the impact of their developments (mySociety 2015). In their 2015 report, mySociety questions who the actual users of their developed technologies are, and what their motivations are, in order to understand the effect their digital technologies have on citizen empowerment. By conducting surveys, the researchers explore who the users of their technology are. From these studies, they found that 48 percent of the users are over the age of 55, and 22.6 percent between the ages of 46-55, which means that more than 70 percent of FMS users are over the age of 45 (mySociety 2015). For their GovTrack application in the United States, a similar civic technology developed by mySociety, they found comparable numbers (fig. 3.5). Their study also uncovered that users of the FMS application in the UK are predominantly male (fig. 3.6).

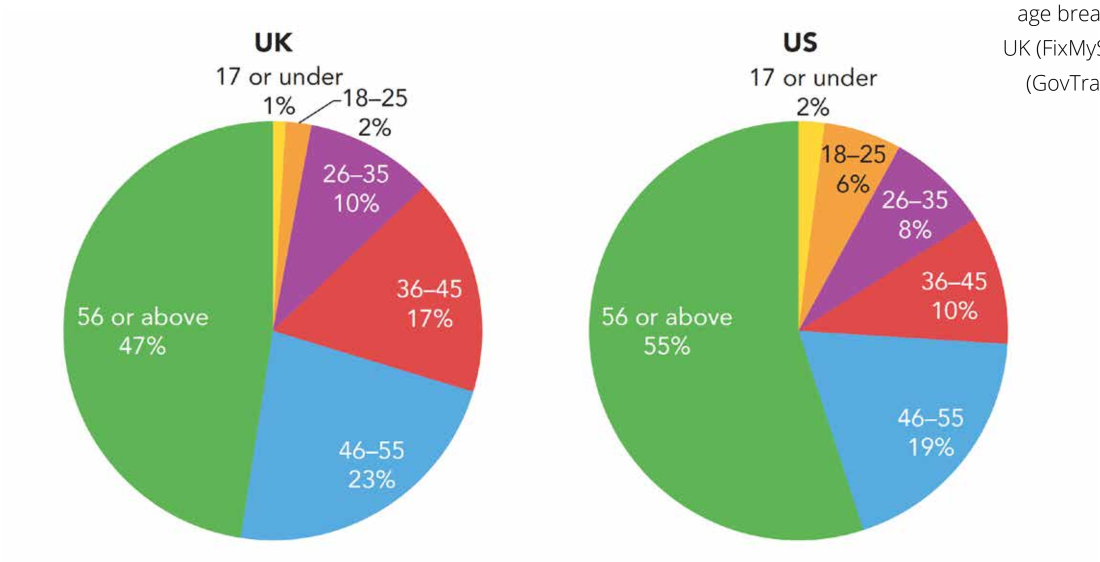


Figure 3.5
Comparative charts for age breakdown for the UK (FixMyStreet) and US (GovTrack) (mySociety 2015:8)

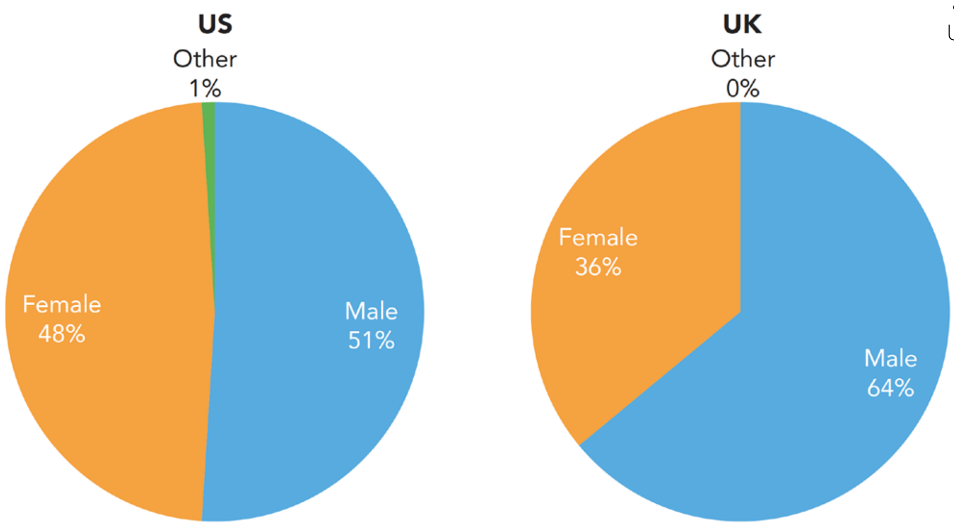
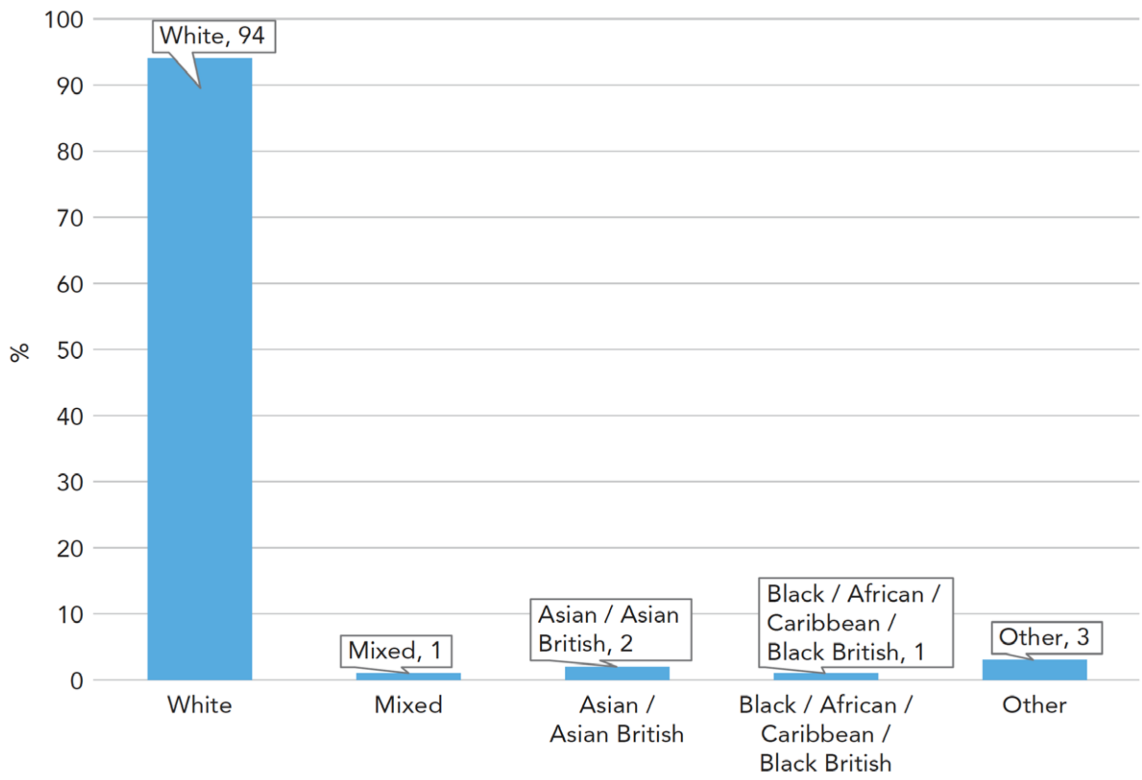


Figure 3.6
Comparative charts for gender breakdown in US and UK (mySociety 2015:9)

If civic technologies are genuinely employed as a 'democratising tool for all', they should aim to mirror the population and provide proportionality to the discussion. Different communities, with diverse ethnic backgrounds, can potentially have different experiences as citizens. Civic technologies should, therefore, enable individuals of various ethnic groups to be able to participate equally (mySociety 2015). The FMS study shows that 94 percent of the app users in the UK were ethnically white, which is slightly higher than the national population of 91 percent, and which allows for 6 percent of users from other ethnicities. Also, while almost 7 percent of the national population identifies as Asian or Asian British, they only account for 1.5 percent of all FMS users (fig. 3.7).

Figure 3.7
Ethnicity breakdown for FixMyStreet users in the UK (mySociety 2015:12)



A final important factor for equal participation in the use of civic platforms is accessibility and user-friendliness. It is essential that citizens who may not have any existing knowledge of politics or public administration are able to use the technology. Civic applications aim to eradicate traditional barriers to public engagement and information accessibility and seek to include those outside the political and educated classes in decision-making processes in their environments. Individuals with higher levels of education are expected to participate in civic activities more naturally and have fewer problems with digesting information on (local) politics (mySociety 2015). Therefore, if user data on education indicate that a large number of users hold a degree level or higher, it might suggest that users with a lower level of education may have difficulties understanding and using the platforms. The FMS study shows that from the users in the UK 57 percent holds a first degree or higher, while according to the 2011 census this group only represents 27.2 percent of the UK population (fig. 3.8). The study

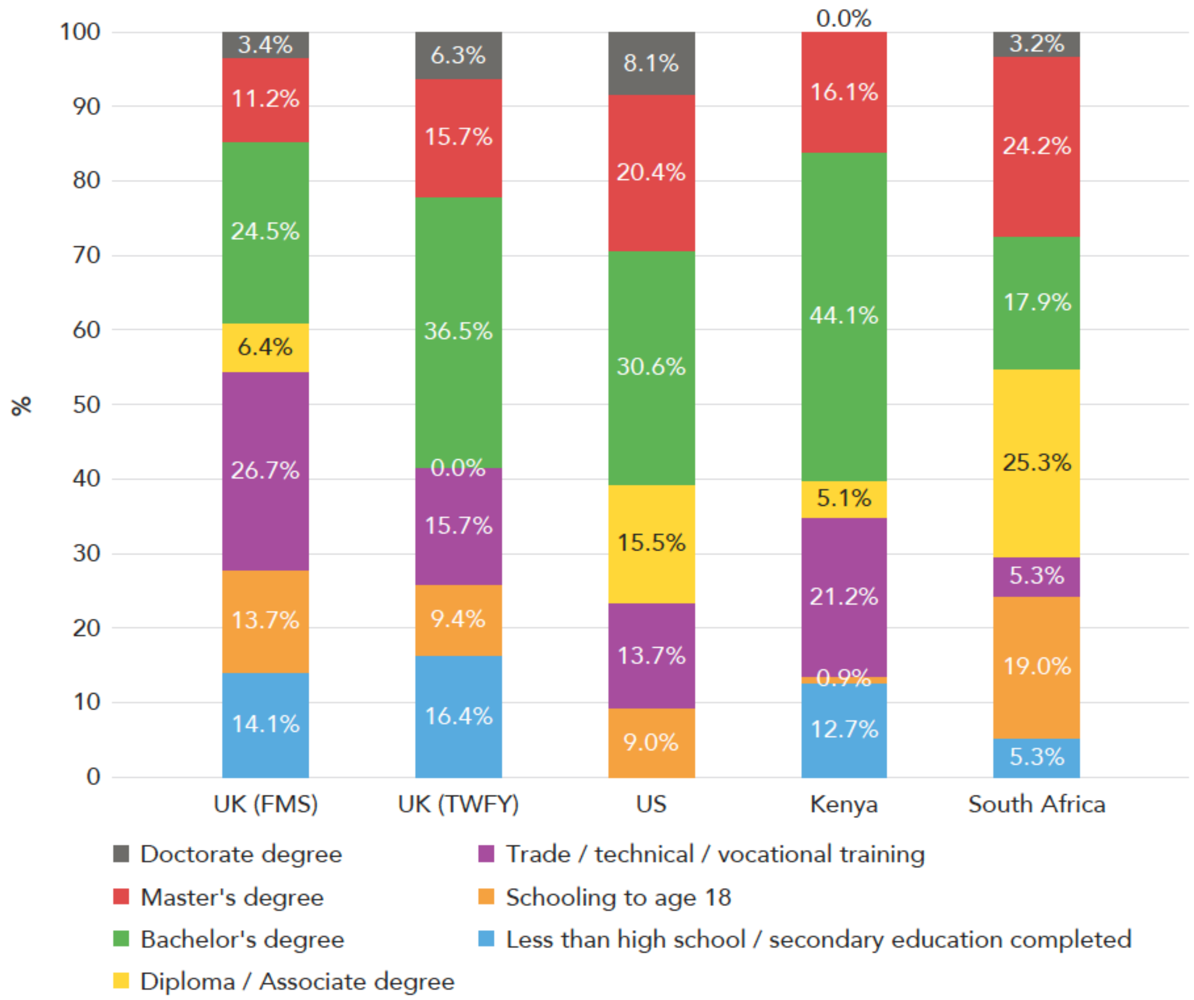


Figure 3.8 Educational achievement of users (mySociety 2015:13)

also indicates that 14.1 percent of the FMS users in the UK did not complete secondary education qualifications, while this group accounts for 22.7 percent of the national population.

The survey exposes a definite bias towards older, educated and (often) affluent white males amongst FMS users in the UK (mySociety 2015). These users are considered to already have a certain degree of personal and political capacity and power in both the on- and offline realms. While civic technologies such as FixMyStreet enable such individuals to engage with local government more efficiently, they fail to increase civic engagement beyond this demographic. User data on the FMS app indicates that the availability of technology alone does not open up participation to a broader public and does not automatically lead to the democratisation of decision-making processes. Individuals who don't hold personal or political efficacy within traditional formats remain excluded from decision-making procedures, either by choice (e.g. opting out of digital engagement) or because they are unaware that such platforms exist and are used by their local councils.

Another study of the use of the FixMyStreet application in Brussels, Belgium complements these findings. In this study, researchers compared FMS user logs to Brussels' city statistics and social media data from Twitter to investigate user inequality on the civic application. Data analysis revealed significant differences in participation rates and demonstrates that the citizen participation platform FMS in Brussels marginalises community members with lower incomes and those from certain ethnic minorities (Sub-Saharans and North Africans) (fig.3.9) (Pak et al. 2017).

The two studies of the UK and Belgium correspond with other reports of various mySociety apps that have identified an overrepresentation of users of a white ethnicity (Escher 2011; Baykurt 2012; Gibson et al. 2014). They also align with studies that identify biases towards educated, high-income and politically engaged populations in citizen participation demographics (Helsper 2008). This user imbalance might be due to a failure of providing a user interface that is simple to use or offering a variety of languages for different community members. Also, the complexity of interaction in these apps might put off individuals with limited technical aptitude (Offenhuber 2015). While web-based civic participation platforms are believed to be democratising tools that enable more involvement from members of the entire community, the studies in this section demonstrate that currently there is a high level of socio-demographic inequality in citizen participation on such platforms.

Many city councils, software developers, urban planners, and designers believe that civic apps can reduce traditional barriers to citizen participation for the currently less-engaged members of society by enabling more efficient, transparent and accessible democratic processes (mySociety 2015). While civic applications hold great potential to promote and facilitate citizen participation to a broader public, empirical studies show that they have so far been unable to foster socio-demographic equality of participation or resolve the digital divide (Pak et al. 2017; mySociety 2015; Norris 2001). Members of society who have little or no access to the Internet automatically become excluded from participating in online platforms. Even if they do have access, the level of digital literacy required to interact with the platform or application can form another barrier for participating. Ethnic minorities, in particular, may have difficulties comprehending the language of instructions, and the visuals on the user interface may be difficult to navigate for those that lack technical know-how (Baykurt 2012). The repercussions of this unequal representation are discussed in more detail in section 3.4.

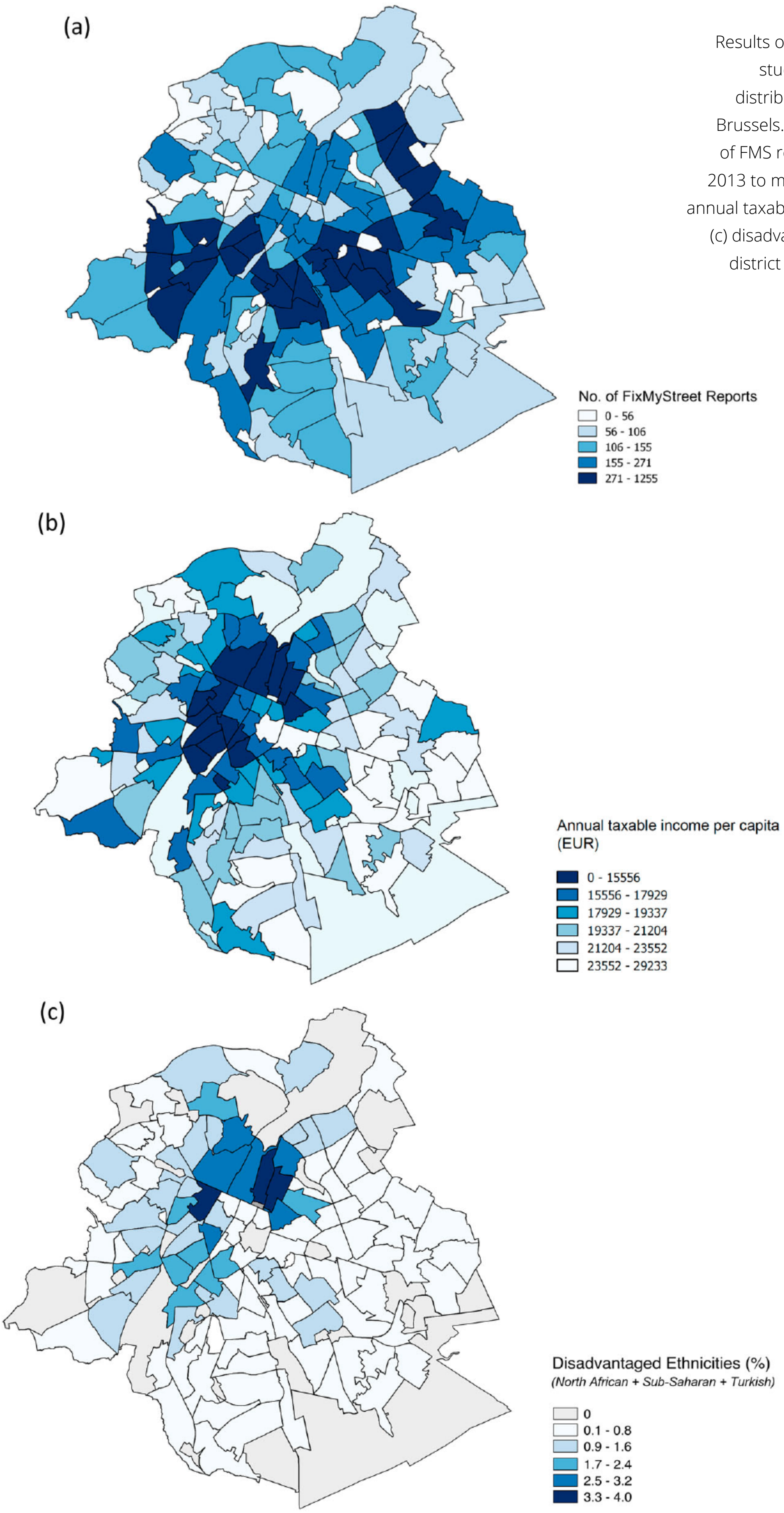


Figure 3.9

Results of the Pak et al. (2017) study on the geographic distribution of FMS users in Brussels. (a) The total number of FMS reports (mid-February 2013 to mid-June 2015); (b) the annual taxable income per capita; (c) disadvantaged ethnicities at district levels in the Brussels Capital Region

3.3.2 Digital tools for community consultation in urban planning

Along with the availability of new technologies, shifts within the political landscape and the establishment of new legislation have resulted in a growing number of tools developed for public consultation in urban development processes. There has been an ongoing discussion amongst city councils, property developers, designers and members of the community about their shared dissatisfaction with traditional consultation processes and their impact on the planning process. Many consultation processes have been criticised for their lack of adequately representing a variety of demographics. Moreover, citizens who do engage often feel that their voices are not heard. Also, in many cases, community engagement is merely undertaken as a legislative requirement to inform communities on development processes in their local environment (Fredericks and Cochrane 2015). New legislation aims to tackle these issues, such as the 2011 Localism Act in the UK, which was introduced to empower local communities in decision-making on the development of their local environments.

The 2011 Localism Act aimed to make the development process more open and inclusive, which also had its repercussions for private property developers and housing associations. To safeguard community engagement in neighbourhood developments, the Act requires developers to consult local communities before submitting their planning application to the local council. Not only do developers need to take into account any responses they have received before finalising the proposal, but they must also justify how they have consulted the local community, what the received comments were, and how these were taken into account (Department of Communities and Local Government 2015). The new legislation requires local authorities to evaluate consultation processes thoroughly and obligates developers to carefully collect, store and present data on their consultation strategies and outcomes to get planning approval. Many software developers have seized this opportunity to develop digital tools for community consultation that they can offer to clients (such as property developers) for simple and efficient data aggregation, analysis and visualisation. The following paragraphs demonstrate several examples of such new companies that offer to take care of the community consultation through digital platforms.

Stickyworld

Stickyworld is a digital platform developed by a London-based start-up that allows users to create online 'rooms' (such as maps) to host participation by colleagues, clients, end users or local citizens. The tool offers a platform where all stakeholders can get into one 'room' to share ideas and suggestions on projects (fig. 3.10). Stickyworld aims to enable more natural communication and engagement between all stakeholders involved in a project.

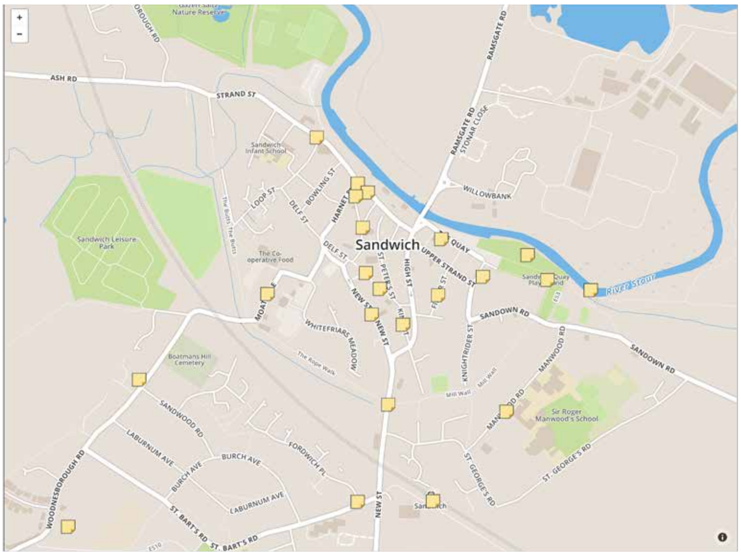


Figure 3.10 Screenshots of the user interface of Stickyworld.com

Open Debate

Open Debate is a UK-based consultation management service that offers information to citizens about local developments (fig. 3.11). Maps and plans are open to be viewed by anyone and users can register to receive updates on the developments. The platform also

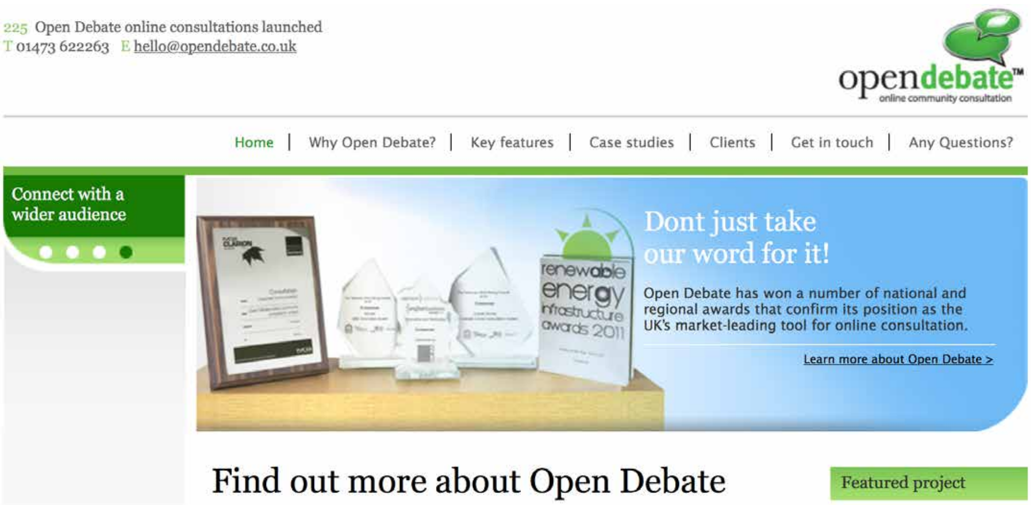


Figure 3.11 Screenshot of Open Debate homepage (opendebate.co.uk)

allows users to submit questions or comments about the plans. Open Debate takes care of the community consultation for its clients and sends periodic reports to keep their clients updated. The website contains features such as online questionnaires, discussion forums, comment forms, interactive plans and maps, and participants' Facebook and Twitter profiles. Since the tool uses personal profiles of participants, there are some privacy considerations, which can be a threshold for some individuals to participate.

Digital platforms for community engagement have the potential to foster local conversations between developers, community members, and local councils. In comparison to traditional community engagement events, digital technologies are argued to reach a broader public and attract a more varied demographic. Rather than attending community engagement events in a set location at a set time, individuals can now view and react on information on planning proposals in their own time at any given place (Fredericks and Cochrane 2015). Such platforms could potentially revitalise citizen engagement, reinforce transparency, and broaden the public debate (mySociety 2015). However, as is the case with most civic applications, there is little evidence to demonstrate the actual impact digital consultation tools have on citizen empowerment. While ubiquitous connectivity enabled by the Internet has the potential to democratise decision-making processes through increased accessibility, functionality and a certain degree of anonymity, research into the actual use of digital consultation tools is needed to understand what, and how significant, the impact of such tools are. To explore the effects of a digital consultation tool on civic empowerment, and to question what value such technologies can have for socially-engaged designers, the following section will carefully examine and deconstruct one particular consultation tool.

3.3.3 Gaming applications

Next to digital consultation tools, game application developers have also started to explore new (digital) methods to open up design and development processes to the broader public. Several building professionals use existing popular gaming applications that allow users to plan an imaginary city (such as *Sim City*) to influence their digital testing and modelling tools for the built environment. Games such as *SuperCity* or *The Grepolis* enable players to develop imaginative cities for entertainment purposes (Poplin 2013). Motivational elements of gameplay, such as competition, collaboration, reward, and fun, are believed to appeal to the general public and have the potential to attract individuals to urban governance processes. In the field of urban planning and design, online 'serious games' are being developed to engage citizens in playful participation in decision-making processes in their environments (Poplin 2011).

One example of such gaming software for collaborative city planning is *Betaville*, an online open source platform that allows users to propose ideas on what they would like to realise in their cities. Betaville is a multiplayer environment for real cities, where ideas and proposals for new works of public art, architecture, urban design, and development can be shared, deliberated, tweaked and advanced by both professionals and interested members of the public (RIBA 2013; Betaville.net). Betaville's user interface consists of a 3D model of a local context in which players can upload their 3D design proposals and a discussion forum that allows users to engage in conversations about each other's plans.

Participatory gaming software, such as Betaville, Block-by-Block or PlastiCity, allow city councils, property developers and citizens to participate equally, alongside urban planners and designers, in generating proposals for new urban developments in their neighbourhood (Rogers 2010). Rather than being confined to the format of ephemeral consultation tools, such as public hearings, the online gaming platform enables participatory design processes to be collaborative, dynamic and ongoing. Learning about urban planning in their environment through digital serious games can be a playful, entertaining and engaging experience for citizens. Also, facing and resolving challenges within a game environment that represents real-world (community) issues, could potentially motivate citizens to become more interested and engaged in local governance and neighbourhood design proposals (Poplin 2012, 2014).

For over twenty years, researchers and software developers have been exploring how new civic technologies and digital tools for communication could be designed and developed to support citizen participation in urban governance processes. So far, however, studies on the performance of such civic technologies have not resulted in any observations that indicate an increase in public participation due to the implementation of digital technologies (Poplin 2014). Several researchers have identified possible causes for this lack of public involvement. Gordon et al. (2011) argue that spatial and urban concepts have a certain degree of complexity that can be difficult to understand for the lay public, particularly if they need to make decisions based on verbal descriptions or even a set of images. Moreover, participating in urban development processes can be considered to be time- and energy consuming. Other researchers argue that a majority of the public chooses to be 'rational' and ignore public participation processes (Krek 2005; Buchanan and Gordon 1962; Gunning 2002). 'Ignorance about an issue is said to be rational when the cost of educating oneself about the issue sufficiently to make an informed decision can outweigh any potential benefit one could reasonably expect to gain from that decision, and so it would be irrational to waste time doing so', Krek (2005:1) explains.

According to this perspective, new digital tools and advanced technological developments will not inevitably lead to greater public participation, if they are not able to solve the issue of citizens' 'rational ignorance' first. By adding a game element to digital applications, software developers aim to add incentives and motivational factors that could entice users to participate in decision-making processes on the development of the built environment. By interacting with the game, users can contribute their observations, knowledge, and ambitions for their neighbourhood or planned developments in their environment. Digital gaming applications would, therefore, allow citizens to learn about their environment in a playful and entertaining way. However, there is no proof yet that adding game elements to participatory planning processes can increase citizen participation in urban planning (Poplin 2014). More research is needed to find out who the users of such gaming applications are, and whether they form a representative sample of local communities. Until then, designers that use such tools for citizen engagement in their design processes need to be aware of their shortcomings.

Critique

Traditional citizen engagement methods in local governance, such as attending town meetings or public hearings and participating in focus groups, are often criticised for being time-consuming, unidirectional and exclusionary (Pratt 2012; mySociety 2015; Fredericks and Cochrane 2015). Moreover, the lack of an active feedback mechanism reinforces citizens' perception that their local government does not take their input into account in decision-making processes. Digital civic applications aim to offer platforms where citizen concerns and government responses converge, and both parties can take part in ongoing conversations. While such digital platforms provide new opportunities for two-way communication, technological improvements alone will not result in an automatic increase of citizen engagement in participatory processes (Poplin 2012; Gilman 2014). It is crucial to think beyond the tool and research how such innovations could affect participatory processes. Due to the current lack of such research, civic apps are often deployed and accepted uncritically by local councils in their decision-making processes on the built environment.

3.4 Commonplace – *a field study*

Commonplace is a social enterprise that has developed a digital application to engage citizens in local developments in their neighbourhood. This tech start-up has developed an online app for community consultation, which collects qualitative data from local citizens and provides this data to their clients: public and private property developers, housing associations, local councils and self-organised citizens in Neighbourhood Forums. With their digital platform, Commonplace tries to tackle traditional approaches to community consultation, where methods such as public hearings, community forums, and town meetings often reach only a small sample of the community. Digital technologies such as the Commonplace tool enable citizens to engage in a consultation process without the obligation to be physically present at set hours in a set location. By enabling a more flexible engagement in community consultation processes, Commonplace promises their clients a broader reach: 'Engage many more individuals and groups of people, including the young, the digitally savvy and the time-poor, plus other hard-to-reach audiences.' (commonplace.is, Home page)

The Commonplace app offers an online platform where citizens can share comments about their neighbourhood or communicate their feedback on design proposals for their local environment. Clients that use this tool receive regular updates on the consultation process through an online dashboard presenting them with a summary of the number of comments posted, the number of visitors to the platform, a list of all users' comments and a demographic profile of users that registered to the platform. Commonplace clients can present these data as empirical evidence of their consultation process to the local authorities. With their digital tool, which received the 2017 best stakeholder engagement award from Planning Magazine[32], Commonplace aims to change traditionally agonistic planning processes:

32 https://www.commonplace.is/blog/the-future-of-engagement, accessed 5 August 2018

> By making local participation easy, we reach wider audiences and provide real-time dashboards to see 'the heartbeat' of an area. We encourage companies to adopt these approaches, and to be more open for collaboration – because it benefits them too. After all, even big building development companies strive to meet less opposition and become more agile in responding to people's needs. (commonplace.is)

Through a six-month secondment period at Commonplace, I was able to conduct in-depth research into the data produced by their digital application to explore several questions, such as: What kind of data is produced by such a platform, and can these be of use when exploring issues of civic empowerment in the design of the public realm? Do such apps really reach a wider audience and enable more democratic processes, and are they, therefore, able to empower marginalised communities?

The platform

Users who wish to place a comment first have to sign up by filling out their name, email address, and password. By creating an account, users are presented with some questions on their age, gender, ethnicity, ownership status (own or rent), and so on. The user can choose whether they like to provide this data to Commonplace. Commonplace does not offer this information to their clients directly but uses it anonymously to provide their clients with a general profile of users in their projects (e.g. x percentage of users are between the age of 30-40).

The comments that people place are posted on a map of the neighbourhood, which can be accessed by any online visitor. This aspect of transparency would make it difficult for property developers to circumvent the community consultation input and ignore ideas, suggestions and wishes of the community in their plans without having empirical proof or good reasons for it. Such a level of transparency can put off some developers, while others use the Commonplace tool explicitly for this feature, to promote and showcase their openness and engagement.

The comment page on the Commonplace platform allows individuals to upload general comments on the neighbourhood, or specific input on the proposed development. The platform, however, does not enable communication between users. There aren't any features that allow users to react on each other's comments, which would enable a conversation amongst participants. Users can place comments anywhere within the study area defined on the online map, and there is no restriction the topics that users can comment on. There are however word tags that users can select to address certain predefined issues. Commonplace clients decide on the selection of word tags, which enables them to steer the conversation to a certain degree. Furthermore, there is no word count limit for user comments. Some users write long pieces of texts in the comment section, which can make the comment analysis a time-consuming task. The word tags therefore aim to offer a more quantitative view of people's concerns (eg. X amount of people selected the following tags, which could indicate that some topics are more pressing or deserve more attention). The format of the comment section allows clients to distil the issues that they want to approach, and which fit best within their own development plans and visions, while ignoring other issues.

In a project in Peckham Rye, for instance, a large number of users commented about the lack of a public toilet. There was, however, no word tag users could select to address this issue. One would only learn about this issue by going through all of the people's comments, which makes it easier to be overlooked by the developers. The word tags in general are quite generic, and include tags such as: community diversity, public space, trees or lighting. The tags don't say a lot about the issue with these items; is there a lack of public space? Is there too much of it? Does it lack quality? Is it exclusive? Do people like the trees? Are there too few or too many? In some cases, there are no additional comments from users to elaborate on the issue, therefore clients could attach meanings to them as they see fit. Users can, however, choose whether their comment is about something positive (which results in a green point on the map), neutral (resulting in an orange point) or negative (a red point), yet in many projects most comments are indicated as neutral (fig. 3.12). Finally, users can also indicate their satisfaction of a place through a positivity scale. The use of this scale, however, is not entirely clear; does it refer to the overall perception of a place, or is it about the word tag or the specific comment?

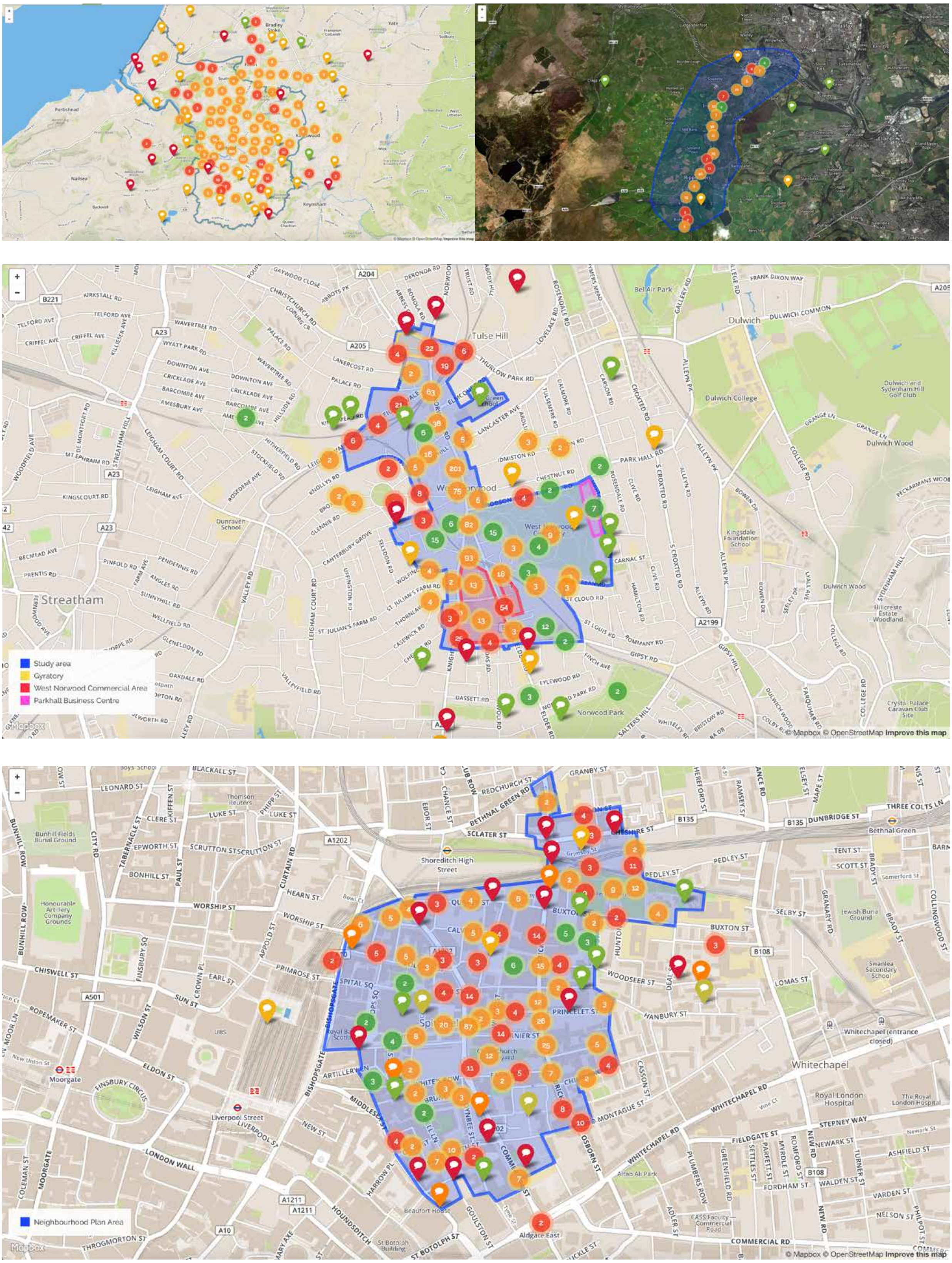


Figure 3.12

Screenshots of different user interfaces of commonplace.is

Research

Civic applications are a rich source of data on public engagement in neighbourhood developments. At the moment, however, these civic apps are primarily used to collect and analyse data for the particular, and often singular, use they are designed for (i.e. gathering input from citizens on their local environment). If we can learn anything from the success of Big Data in the business sector it would be that data is not just valuable for the direct purpose it is used for (such as comments on Facebook or Twitter, or photos on Instagram). It is often the meta-data that is produced through user engagement with the platform that has proven to be useful to businesses (such as time stamps, geographic locations, and so on). Similar to social network platforms, or Internet sites in general, civic applications produce data on how people use the tool, such as when people visit, if they revisit, how they interact with the tool, and in some cases, such as Commonplace, they even collect demographic data on the users (e.g. age, gender, and so on).

During my secondment at Commonplace, I explored how the meta-data generated through user interaction with the platform could be analysed and could potentially provide useful insights for the social enterprise, their clients, but also, for socially-engaged designers. Through various studies I explored whether the data from a civic application could be useful for designers to learn and speculate about public participation, such as peoples' personal motives to engage in decision-making on design and development projects. My studies included analysing the amount of time people would spend on the platform, the amount of comments placed per user, how often users revisited the platform, and which pages within the platform they would (re)visit. By comparing these various data, I explored whether there were any correlations between the different aspects that could tell us anything about people's online behaviour, which could help the tech start-up optimise their tool, and, at the same time, potentially help designers create a better understanding on citizen engagement in neighbourhood developments.

In one particular study, I matched Commonplace's datasets against census data on neighbourhood residents to study whether community members involved in the consultation process through the digital application were a representative sample of the local neighbourhood. In this study, I compared numbers on age, ethnicity, and ownership in the Commonplace datasets to the ONS open datasets on local demographics (fig. 3.13). Comparing these data for six Commonplace projects resulted in the following conclusions:

- Residents between the ages of 50-59 (in five of the six projects) and 40-49 (in four of the six projects) were overrepresented in the community consultation process.
- Residents between the ages of 20-24 (in five of the six projects) and 25-29 (in four of the six projects) were underrepresented in the consultation.
- Residents of a white ethnic background (in three of the four projects) were overrepresented in the consultation.
- Residents of Asian ethnicity (in all four projects) and of a Black ethnicity (in three of the four projects) were underrepresented in the consultation.

Furthermore, homeowners were overrepresented in all three projects, while renters were underrepresented in the overall consultation. This imbalance could be a result of the transient nature of a rental population, which are often less invested or have less stake in a neighbourhood. Homeowners generally live in a neighbourhood for a longer period and are therefore more invested, which makes them more likely to participate in consultation processes. However, due to an increasing lack of affordable housing, there could be more long-term renters in some neighbourhoods, which makes their contribution equally important as input from homeowners in a neighbourhood development process. Finally, the shape, condition, and quality of the local built environment, including its public spaces, can have a significant impact on the value of a homeowner's property, which forms another incentive for this group to participate in neighbourhood consultation processes.

The Commonplace study is in line with previous examples of civic apps and demonstrates that there is an overrepresentation of community members over the age of 40 of a white ethnic background. Civic technology promoters often believe that younger people will use the technology more, and with higher proficiency, than older populations (mySociety 2015). The studies in this chapter, however, demonstrate that the opposite is true: older individuals have embraced these technologies to a much greater extent (Pak et al. 2017; mySociety 2015). The Commonplace study also demonstrates that providing a digital tool for community consultation will not automatically resolve issues of representation in democratic processes. The discussion at the end of this section will take a closer look at the repercussions of such an imbalanced representation in civic app users, and will expose the possible negative externalities such technologies could have on the development of urban environments.

The following diagrams present the findings of the representation study for each of the examined Commonplace projects (fig. 3.13).

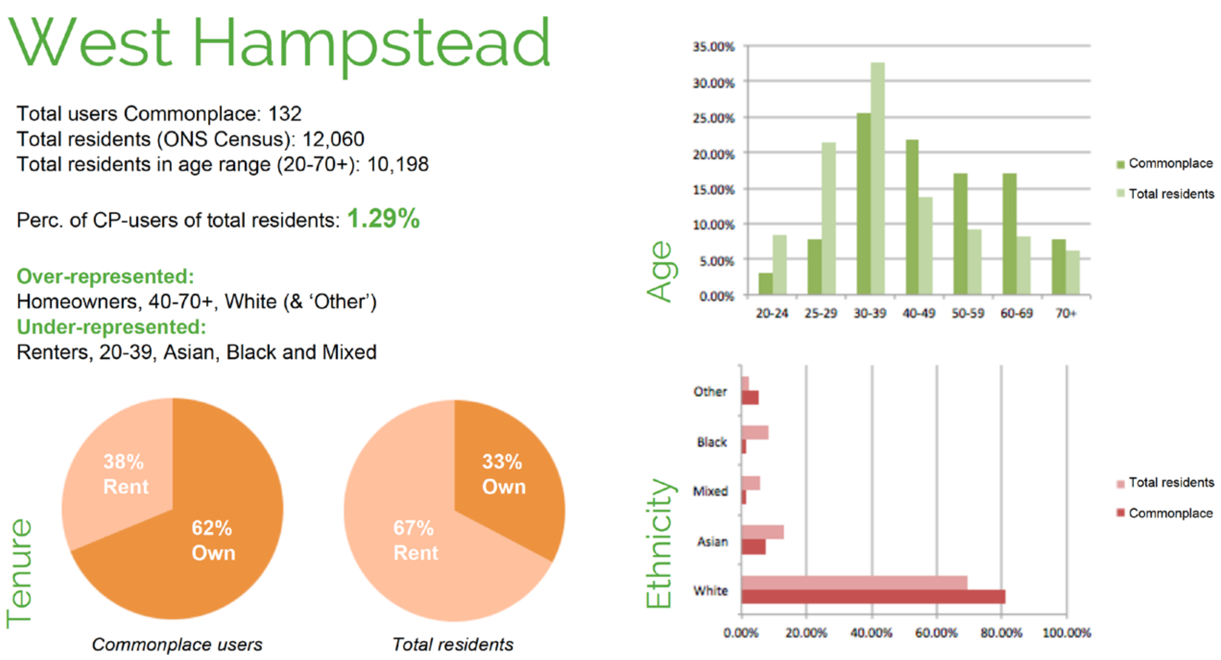


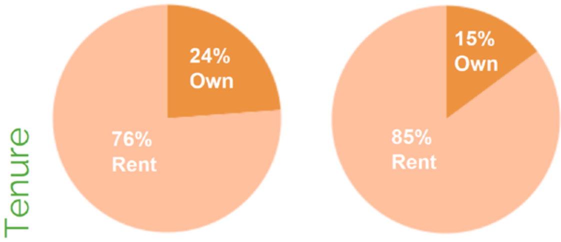
Figure 3.13
Findings of Commonplace engagement studies

Devons Road

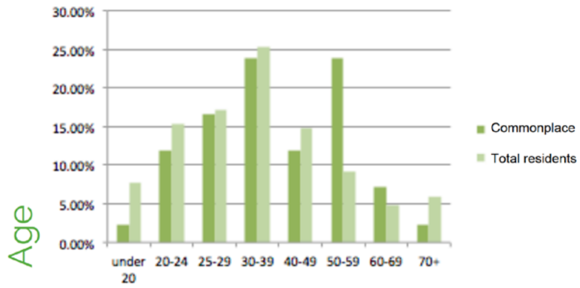
Total users Commonplace: 43
Total residents (ONS Census): 14,480
Total residents in age range (20-70+): 10,609

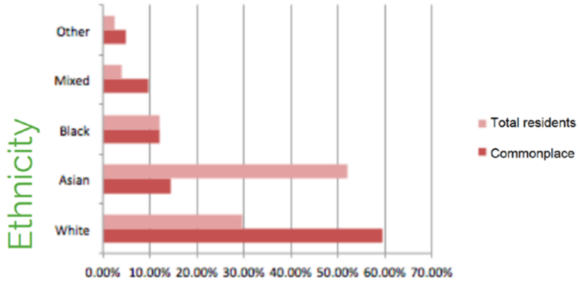
Perc. of CP-users of total residents: **0.41%**

Over-represented:
Homeowners, 50-69, White (, 'Other' & Mixed)
Under-represented:
Renters, under 20-24 & 40-49 & 70+, Asian



Commonplace users *Total residents*



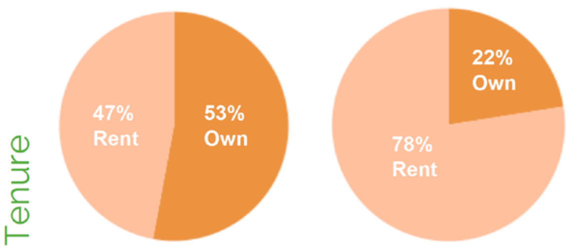


East Shoreditch

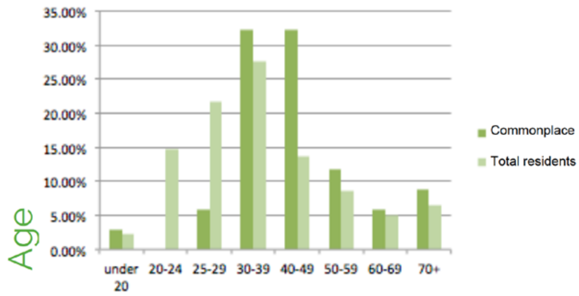
Total users Commonplace: 38
Total residents (ONS Census): 13,206
Total residents in age range (20-70+): 10,709

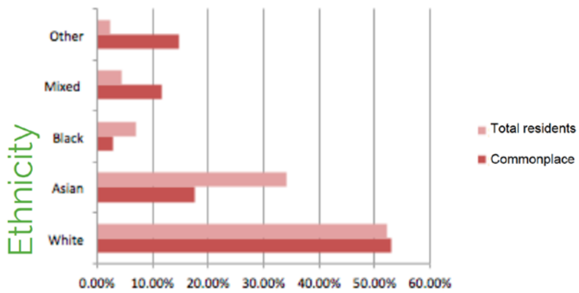
Perc. of CP-users of total residents: **0.35%**

Over-represented:
Homeowners, 30-59 & 70+, 'Other' & Mixed
Under-represented:
Renters, 20-29, Asian & Black



Commonplace users *Total residents*



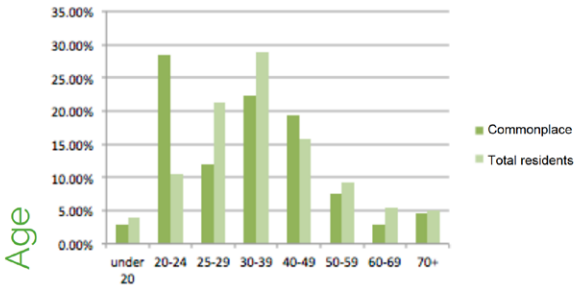


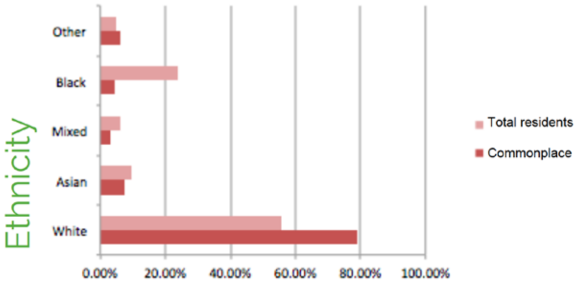
Dalston

Total users Commonplace: 67
Total residents (ONS Census): 14,727
Total residents in age range (20-70+): 12,303

Perc. of CP-users of total residents: **0.54%**

Over-represented:
20-24 & 40-49, White (and 'Other')
Under-represented:
25-39 & 60-69, Black, Asian and Mixed

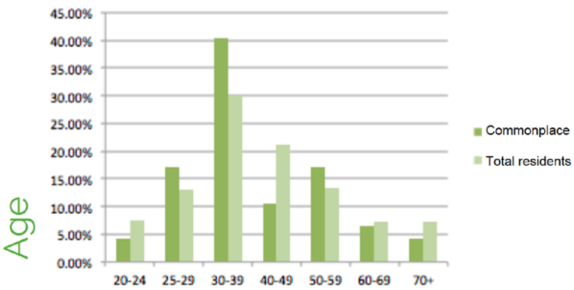




Peckham Rye

Total users Commonplace: 89
Total Cp users lthat are residents here: 47
Total residents (ONS Census): 13,518
Total residents in age range (20-70+): 10,293
Perc. of CP-users of total residents: **0.46%**

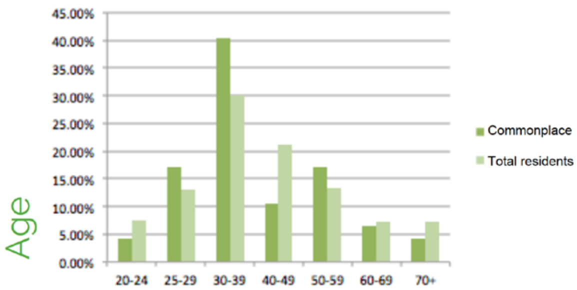
Over-represented:
25-39 & 50-59
Under-represented:
20-24, 40-49 & 70+



London Bridge

Total users Commonplace: 121
Total Cp users lthat are residents here: 49
Total residents (ONS Census): 14,390
Total residents in age range (20-70+): 12,179
Perc. of CP-users of total residents: **0.40%**

Over-represented:
40-59
Under-represented:
20-39 & 70+



My analysis of the Commonplace data demonstrates which community members are currently over- and underrepresented in public consultation processes. The analysis also offers empirical evidence of a democratic deficit in community consultation: evidence that shows that there are clearly some groups that are excluded from existing decision-making processes. The start-up firm is now developing a beta-version of the app in which this problem will be addressed in the dashboards they offer their clients. This way their clients will be able to get real-time feedback on the consultation process, which enables them to alter their promotion and communication strategies during the consultation period. Ideally this will allow them to reach a wider and more representative demographic.

As with most data-driven technologies, the development of digital tools from social enterprises such as Commonplace is primarily directed by capitalist forces: the firm needs to be profitable in order to survive, therefore the software developments are primarily focused on serving the market- i.e. the paying clients. Through my secondment I was able to promote an alternative course in the application's development to enable more democratic outcomes. By steering the output of the existing technology in a slightly different direction, the social enterprise now aims at restoring equilibrium in the development of their tool to serve both the community as well as the market. Two year after my secondment at Commonplace, the start-up has altered several features of their engagement tool and added a few new features as well. They have removed the positivity scale, and instead have developed a different feature to collect qualitative data on people's emotions. Users now have the option to indicate how they feel by selecting one of five different emoticons (fig. 3.14).

They have also made the word tags more specific, for instance, rather than a tag indicating 'air quality' users can now choose between the tag 'will improve air quality' or 'will worsen air quality'. Also, if the given tags fail to accurately represent their feelings, users now have the option to articulate their own word tag in a comment box. In most project interfaces there are two more open comments boxes in which users can indicate what they are commenting on and what other issues and improvement opportunities they would like to address. Different projects can also include additional site-specific questions; such as questions on vacant spaces in a project in Wembley (fig. 3.15). Finally, users are now also offered the option of agreeing with, and sharing other people's comments, which, although limited, offers some kind of engagement between users (fig. 3.16).

Figure 3.14
Screenshot of user interface Commonplace.is for the 'Connecting Leeds' project

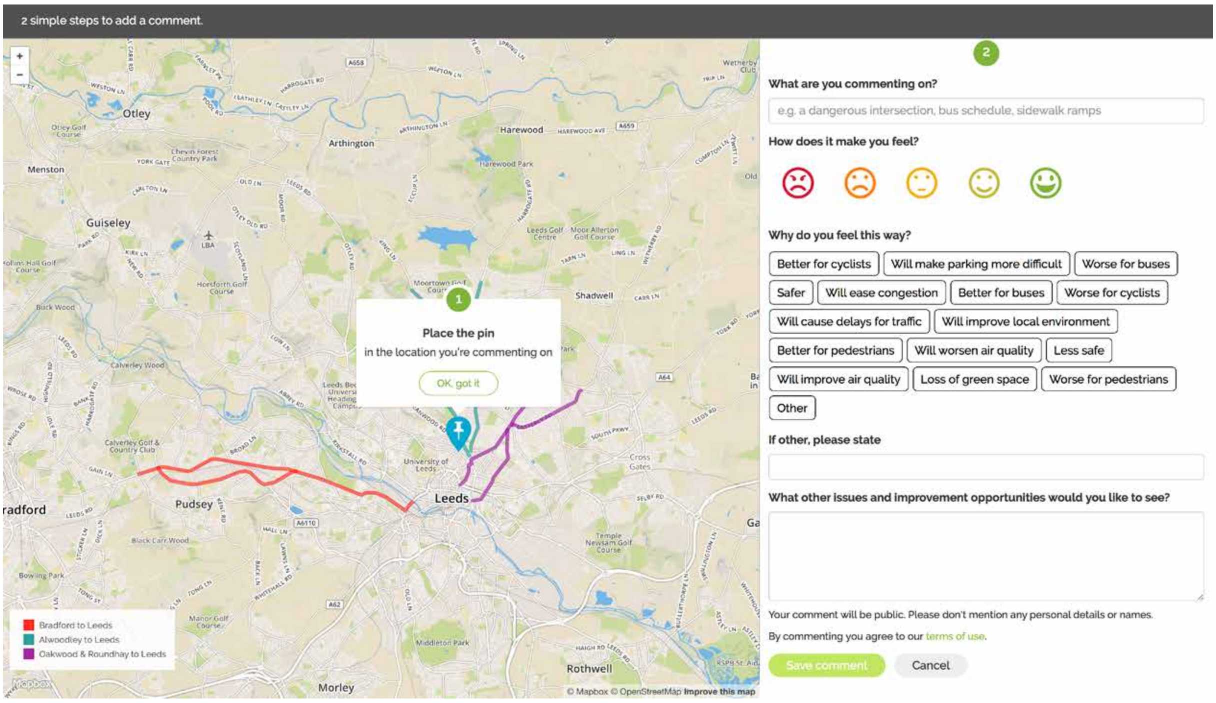


Figure 3.15
Screenshot of user interface Commonplace.is for the 'Wembley' project

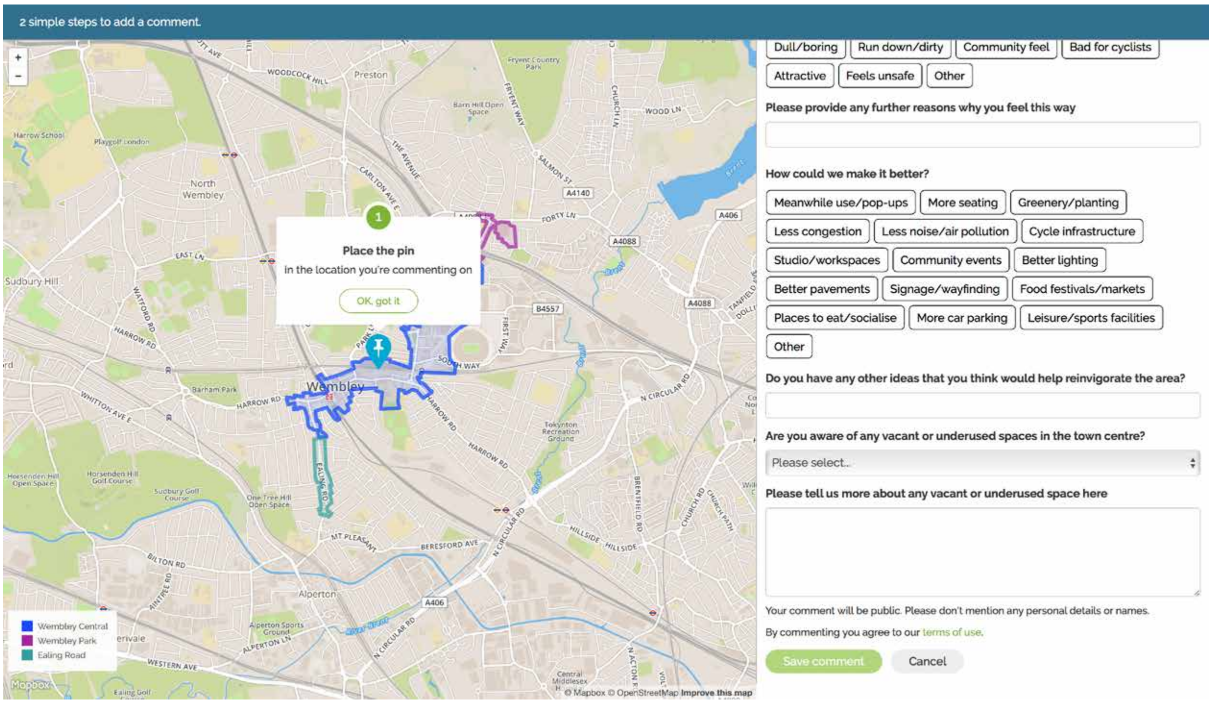
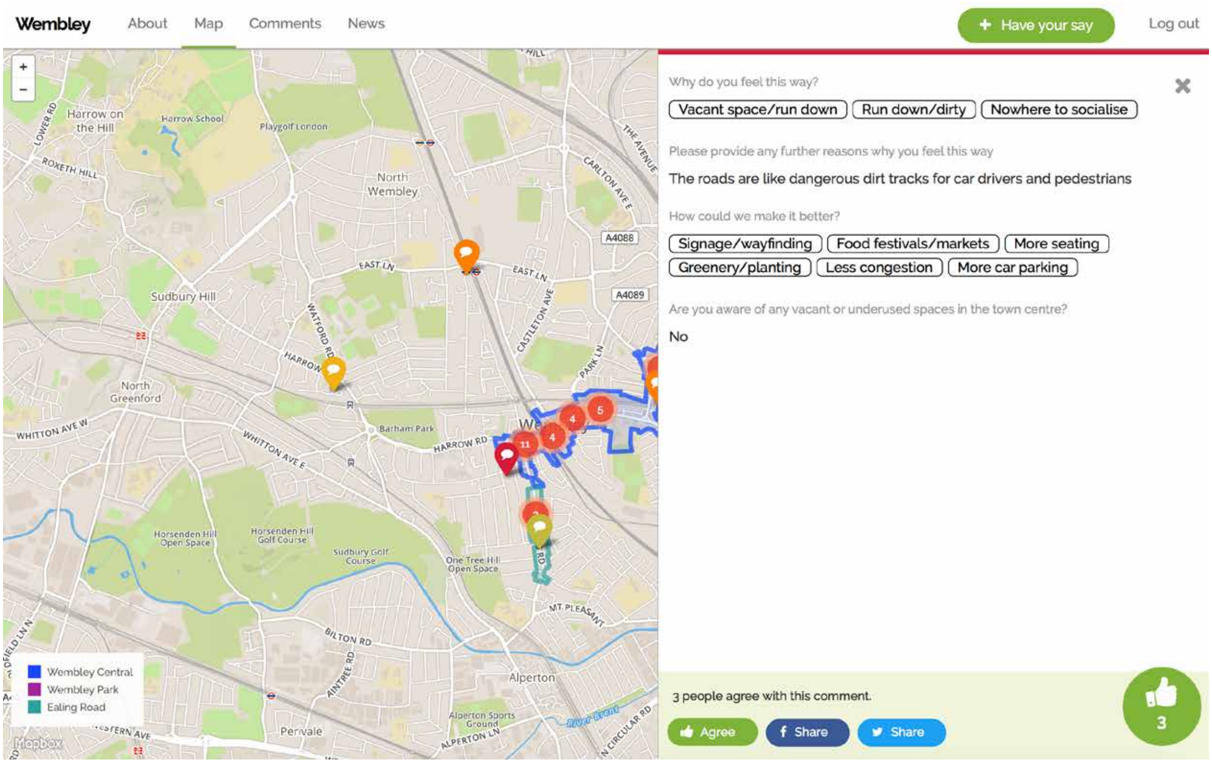


Figure 3.16
Screenshot of user interface Commonplace.is for the 'Wembley' project



Critique

Over the last decade, civic apps have become noted for their potential to mobilise new segments of society in order to achieve more representative insights into the public's concerns and desires. These apps aim to lower the threshold to participation for those that have not engaged in (local) governance before (Pratt 2012). The studies on civic applications presented in this chapter, however, have shown that such tools have so far not been successful in reaching a broader socio-demographic sample than traditional public engagement tools. Furthermore, an imbalance of civic app users could skew local policies and interventions in favour of this group (mySociety 2015). In the FixMyStreet application, for example, the majority of users are older, affluent white males, that use the app to report problems such as potholes, broken street lights, and litter. The homogeneity of users of this app could potentially result in monopolising local authority's resources. Since affluent individuals generally live in affluent areas, and a large number of reports on the app emerge from this area, domestic issues in other, under-reported, areas potentially remain unresolved (mySociety 2015). This lack of maintenance can initiate a downward spiral, where potholes that are unreported and stay unfixed get bigger, defective streetlights increase petty crime and unreported litter, or dog-fouling leaves an adverse effect on the neighbourhood's 'kerb appeal'. Such factors of maintenance also play an important role in safeguarding a neighbourhood's value, and ultimately its property prices.

The user imbalance in apps such as FixMyStreet and Commonplace can have negative consequences for disadvantaged areas in cities and can potentially reinforce inequality between different socio-demographic groups in various urban areas. The current dominance of affluent users will possibly be enhanced through the disproportionate use of public authority resources for maintenance of their neighbourhoods, while less affluent, and often more diverse communities are increasingly marginalised through their under-representation on such civic applications. Consequently, long-term effects of such an imbalance in the maintenance of affluent areas vis-a-vis ethnically diverse, and as the Brussels study reveals, often deprived areas, may ultimately visibly increase socio-demographic inequalities in cities (Pak et al. 2017; mySociety 2015).

Analysis of the Commonplace and FixMyStreet data reveal that civic technologies aimed at democratising local governance and urban planning have yet to succeed in engaging a more representative sample of the local community. Architects and urban designers that use such civic apps to generate participatory design proposals should, therefore, be aware of their limitations. While such tools can be useful in informing designers on the opinions of locals and can enable more qualitative and detailed conversations about design proposals with a selective few, designers would do well to pursue other engagement tools that aim to reach excluded community members. A design based on the outcomes of an unrepresentative digital consultation process might serve a particular, privileged, group, yet it might not be in the public interest (De Waal and Dignum 2017). Designers could use the outcomes of engagement studies, such as the Commonplace and FixMyStreet examples, to learn which community members are currently represented and which ones are not, i.e., which voices are not heard. Analysing data from civic apps could reveal which community members are more actively engaged in the development of their local environment and which members are excluded from current decision making processes. Chapter 4 will continue this investigation by exploring how socially-engaged designers could take advantage of these civic technologies and use data from these apps to safeguard the social sustainability – the 'afterlife' -of designs for local public spaces.

Conclusion

Firms such Foster + Partners and Zaha Hadid Architects innovate by incorporating the latest digital technologies in their design processes. On the other hand, there are practices, such as muf art/architecture, which define themselves as socially oriented but limit their engagement with the digital realm to design tools such as AutoCAD. Very few architecture firms are taking advantage of the vast amount of digital data on users that is available today from various mobile phone and web platforms, such as social networking services, to inform their design process. Some practitioners might think the learning curve for analysing digital data is too steep, while other firms might not immediately see the benefit of incorporating digital user data in their design process, since, different from CAD tools, these technologies would not directly pertain to the act of designing.

While architects at muf regularly conduct behavioural studies on users through long-term observations of people in public spaces, and while they do recognise that digital data on users could help them expand their knowledge on user behaviours, they have yet to discover how to engage with digital data sources (Rangel 2017). By exploring which digital tools and techniques are available for designers to incorporate the user, this chapter demonstrated how designers could benefit from such existing digital data sources and, at the same time, demystify the notion that working with digital data would require a high level of expertise from designers. Chapter 5 will present a case study where Instagram data is analysed for a public realm project by muf art/architecture in order to demonstrate how social media data could help inform their design process.

Some practices, such as Atkins, are already engaging with digital data on users to incorporate the social aspect in their design process. However, rather than advocating for designers to develop their own bespoke tools for digital data collection, this chapter demonstrated that there are many digital sources of user data out there that are easily accessible and available, which architects and other socially-engaged designers could make use of.

The social media data studies in this chapter illustrated how some designers and researchers have used digital user data to study the socio-spatial urban realm. So far, however, these social media data studies on human behaviours in the urban realm have failed to produce any new insights and often end up merely validating designers' existing knowledge and observations. By exposing the shortcomings within these studies, this chapter argued that alternative approaches to exploring social digital data are needed for it to become a valuable source of information for architects and other socially-engaged designers.

Finally, this chapter examined several civic applications that have been developed over the past years to empower citizens in decision-making processes in their local built environment. The following chapter will take a closer look at how analysing (meta-)data from such civic applications could potentially benefit socially-engaged designers.

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Chapter 4 – Data to facilitate the participatory process

Rather than proposing a one-size-fits-all approach to socio-spatial digital data for designers, this thesis recognises the broad spectrum of architectural design practices and focuses on one particular group of practitioners: designers who aim to create participatory public realm projects that have an active afterlife beyond their own engagement. While such projects often do succeed in engaging a public during the design intervention, practitioners often fail to facilitate long-term engagement and citizen appropriation to safeguard their project's afterlife. First the shortcomings of such projects and their reasons are studied, which are followed by the introduction of two approaches that could answer the existing problems identified from these real-world examples. The case studies that are discussed have all adopted digital technologies in their projects in some form. Examining how these technologies were used, and to what ends, will help explore how socially-engaged designers are currently using digital technologies in their projects and whether these technologies could potentially help them enable sustained social engagement. Furthermore, in this exploration there is a focus on self-initiated projects by designers and (art and) design teams, generally with funding from the public sector, such as the Engineering and Physical Sciences Research Council[33], which funded the *Feral Robotics* project discussed in this chapter.

There are various sources of public funding available to designers to help them realise public realm projects: from governmental bodies (national, regional, local, or intergovernmental), from research councils, creative industries funds, arts funding, and so on. A relatively new source of funding that has become increasingly popular for public projects over the past years is crowdfunding. According to design magazine

33 EPSRC is the main UK government agency for funding research and training in engineering and the physical sciences, investing more than £800 million a year in a broad range of subjects - from mathematics to materials science, and from information technology to structural engineering (https://epsrc.ukri.org/about/, accessed 2 April 2018)

Dezeen[34], crowdfunding represents an excellent opportunity for architects to get public funding for their projects (Fairs 2015). The London-based architecture office Studio Octopi, for instance, created a Kickstarter campaign in April 2014 for their Thames Baths Lido project – a design to create a swimming pool in the river Thames[35]. Within thirty days they raised approximately £142k from 1,273 backers. While the project still needs much more funding to be realised, the crowdfunding campaign helped the architects get their idea off the ground, illustrate the project's feasibility, and demonstrate the public support behind it (Fairs 2015). Daan Roosegaarde is another designer who raised public funding for his Smog Free Tower project in Rotterdam, The Netherlands through a Kickstarter campaign. Roosegaarde argues that by engaging the public, backers become ambassadors who support and promote a project (Fairs 2015). Crowdfunding also offers an opportunity to build a community around a project, he explains. Crowdfunded projects are therefore more likely to be appropriated by local communities since financial investment in a project helps establish a sense of ownership. Although crowdfunded public space projects form another interesting field of study, this chapter concentrates on civic engagement in public realm design projects that do not rely upon citizen's monetary investment.

The projects that are discussed in this chapter all aim at improving or revitalising the public realm in order to change a problematic social or environmental condition within a particular context and aim for a local community to take over the project in order to sustain its life. By analysing several existing examples of such design practices, this chapter asks:

- How do socially engaged designers currently use digital tools in their public realm projects aimed at long-term citizen engagement?
- How could analysing socio-spatial digital data help designers generate public realm projects that are more likely to become appropriated and sustained by local communities?

34 https://www.dezeen.com/2015/09/03/crowdfunding-trend-changing-game-public-architecture-projects-thames-deckway-baths-lowline-kickstarter/ , accessed 23 April 2018.

35 https://www.kickstarter.com/projects/thamesbaths/thames-baths-a-new-beautiful-lido-for-the-river-th , accessed 27 April 2018.

Currently, many design projects that engage with digital technologies use them for ephemeral art or design interventions.[36] These examples demonstrate that digital technologies can be useful tools to engage a public in a dynamic and short-term activity. Although novel digital technologies can be powerful instruments for disruptive design interventions, their use for long-term, sustained, systematic change remains underexplored. In contrast to other design disciplines, such as service or product design, 'users' in design for the public realm are often not clearly defined. Exploring data from social media platforms could help designers discover existing active local communities in physical public spaces and help them generate insights into the network(s) they are part of. Approaching and involving these local user groups is key to sustaining engagement beyond the active involvement of a designer, for it enables designers to build upon existing social structures rather than introduce new ones. Socio-spatial digital data (SSDD) can inform designers about the social layer of a local context before they enter the design stage and even before they enter the participatory process. This chapter proposes an approach for analysing SSDD to discover potential user groups who can act as local agents in appropriating and prolonging the life of the design project, and with that demonstrates how digital technologies could help designers facilitate the participatory process.

Within the participatory design community, Living Labs (LLs) have become a widely adopted methodology for facilitating long-term citizen engagement and appropriation in participatory design projects. The format of a Living Lab, which originates from MIT, has gained widespread recognition over the last decade amongst socially-engaged designers who aim to engage the public in their social innovation projects. At the moment, there are more than 400 Labs worldwide as members of the European Network of Living Labs (ENOLL). Although there is not a single definition of Living Labs, they are often described as long-term ecosystems that involve real users in real contexts and aim to facilitate an environment for experimentation in order to achieve social innovation (Hillgren 2013; Følstad 2008). Rather than carrying out research in

36 Examples include SMS Slingshot by design collective VR/Urban (http://www.vrurban.org/smslingshot.html), and Public Face by artist Julian von Bismarck (http://juliusvonbismarck.com/bank/index.php?/projects/public-face-ii/)

closed design studios or within the academy, Living Labs aim to open the research and innovation process up to the general public through various participatory approaches. Also, rather than advocating the use of particular methods, Living Labs often combine and customise various user-centred and co-design methods as they see fit. While the focus is on users (or citizens), Living Labs also aim to involve relevant stakeholders, so that the Lab can bring together top-down and bottom-up actors, including members of the public and private sectors, academia, and the general public, and facilitate real-world implementation, institutionalisation, and up-scaling of the concepts that emerge in the Labs (Hillgren 2013). Some of the fundamental concepts involved include continuity, openness, realism and user/citizen empowerment (Cottam 2012). Ultimately, Living Labs aim to consolidate bottom-up grassroots initiatives by connecting local communities to established top-down stakeholders in order to create real impact and ongoing action (Hillgren 2013).

At Malmö University, Sweden,[37] Living Lab explorations include long-term engagement with different agents, such as civil servants, NGOs, businesses, and citizens, in order to co-design and co-produce new practices, services, or products. One of their projects was a Living Lab established in the multi-ethnic neighbourhood Rosengård in Malmö in collaboration with the Herrgårds Women Association (HWA). HWA was established more than ten years ago by a group of five immigrant women from different ethnic backgrounds. While most of these women lack higher education and have limited skills in the Swedish language, they hold numerous valuable qualities which could benefit upward social mobility for the neighbourhood. HWA has an extensive social network in the neighbourhood and has strong connections with various local communities. Together with HWA, the Living Lab team explored how this organisation could become a more useful community resource for both the neighbourhood and city. The Living Lab experiments included exploring how HWA could offer a new form of catering service, or how HWA could help support newly arrived refugee orphans. From a service design

37 The Malmö Living Labs have been experimenting with participatory design within various contexts in the city of Malmö since 2007 (http://medea.mah.se/malmo-living-labs/)

perspective, the Living Lab experiments were a fruitful exercise in discovering how HWA could provide new kinds of services which either did not exist or did not exist to a sufficient capacity (Hillgren, Seravalli and Emilson 2011). However, the design and design research team experienced difficulties in implementing and upscaling these ideas. The project's results were, therefore, short-lived, and the Living Lab failed to deliver socially sustained outcomes and facilitate long-term social impact (Hillgren 2013).

Rather than focusing on a fixed design output, in Living Labs such as the Malmö example, designers focus instead on constituting and supporting a public around an issue in order to co-design various outputs (Le Dantec and DiSalvo 2013). Within the participatory design community, this activity is often referred to as 'infrastructuring' (Björgvinsson et al. 2010; Ehn 2008; Le Dantec 2012; Star and Bowker 2002). Within service design, this term has been adopted to refer to social arrangements or the socio-technical mechanisms needed to create a public (Karasti and Syrjanen 2004; Le Dantec and DiSalvo 2013). Within the participatory design community, the notion of infrastructuring is used to question the concept of innovation, which has resulted in a shift from accepting innovation as purely technocratic notion towards one that includes social innovation: innovation that unfolds out of the action of establishing a new public and is born from social interactions (Björgvinsson et al. 2010; Le Dantec and DiSalvo 2013). Infrastructuring would enable members of the public to identify and address matters in existing contexts to co-develop a response that could help shape a different, desirable future context. Infrastructuring champions argue that designers can facilitate infrastructuring through various activities, such as participatory workshops (Bjorgvinsson, Ehn and Hillgren 2011). During such activities, they claim, designers can construct and maintain an agonistic public space where the voices of a heterogeneous public are heard, where marginalised community members are included, and where intersectional networks are constructed in order to create socially innovating outputs (Hillgren 2013). Rather than designing useful systems or outputs, or 'design-for-use', infrastructuring focuses on 'design-for-future-use', where systems and structures are developed to function as a fertile ground for a community of participant to take shape and to be sustained (Le Dantec and DiSalvo 2013). The participatory process, therefore, concentrates on initiating or shaping a public, as well as co-creating an end product.

In conclusion, infrastructuring aims to create an environment where adoption and appropriation by a public is encouraged in order to sustain a design. This approach is also adopted by some designers for social engineering in spatial design projects, such as the *Collectif etc*[38] and *78TH PLAY STREET*[39] projects, to facilitate citizen appropriation of (neighbourhood) public spaces (Concilio et al. 2013).

While the Living Lab (LL) method has become widely accepted amongst socially-engaged designers, so far, most of these LL initiatives and networks have dissolved after a Lab ends, or the designer/design team leaves the scene (Hillgren 2013). The issues that emerge from the Living Lab activities are often not managed and transformed to challenge existing systems and hegemonies (Hillgren 2013). The approaches proposed here would allow designers to step in and out of a project without jeopardising its afterlife. The first deals with the make-up of the design team vis-à-vis the afterlife of a project, arguing for designers to work in multi-disciplinary teams, where some non-designer team members stay involved for a more extensive period to ensure the project becomes rooted within the local community. The second approach deals with the make-up of the social network around a project and argues that designers are not taking full advantage of existing digital tools that could help them identify pre-existing networks. While the first approach can be feasible for projects with a large budget, the second is a more realistic option for ones with fewer funds and limited resources.

In order to examine the inadequacy of existing participatory design projects, section 4.1 questions whether the designers or design team were able to facilitate ongoing public engagement or whether they merely generate one-off events. This section also examines how the designers, and their teams, have incorporated digital data technologies in their

38 *Collectif etc* aims to create built structures, street furniture, sculptures, installations, and to organise meetings and conferences, training workshops, or more artistic interventions, by integrating the actions of local population in the designers' creative process. The designers organise events and co-design workshops in specific open public spaces where they want to build or design something (http://www.collectifetc.com).

39 *78th PLAY STREET* is a project in Queens, New York that aims to transform a street in a pedestrian area, where families with young children and other people of the community can socialise with their neighbours, read a newspaper, participate in a class, or attend events (http://www.jhgreen.org/playstreet.html).

practices, and what they aimed to achieve with them. Section 4.2 demonstrates how forming multi-disciplinary teams that consist of professionals with different expertise and supplementary knowledge could help designers create more long-term civic engagement in participatory projects such as Living Labs. Section 4.3 proposes an alternative and less resource intensive approach for designers to create more socially sustainable designs and facilitate greater long-term community commitment by analysing socio-spatial digital data. In section 4.4 various digital data sources are then reviewed to identify which could be used by designers for this approach. The examples raise several questions: How did the designers plan to hand over ownership of their project in order to prolong the life of the initiative? What was the role of the designer or design team? Is this a desirable role for socially-engaged designers who aim to bring about long-term engagement in their projects? Finally, this section also explores how such online explorations relate to offline methods.

4.1 Current limitations in participatory design aimed at sustained citizen engagement

4.1.1 Analogical Smart Cities

The Analogical Smart Cities project by PKMN Architects addresses the digital realm and its missing relationship to actual physical spaces in the city. With their public space intervention, the Madrid-based architecture studio aims to reinterpret digital data on public spaces in an analogical way. The architects at PKMN identify two gaps in existing smart city technologies: they often require a high level of technical expertise, and there is a lack of physical relationship between the digital and physical realm. In order to initiate a public discussion and reflection on digital spatial data, the architects have created a public space design intervention where digital information related to public space has been visualised in the actual space and on a 1:1 scale. In this intervention, data on noise levels, the position of tree shadows during a day, CO_2 emissions, and more were projected on the surface of the pavement through physical drawings (fig. 4.1). By engaging participants in carrying out these demonstrations, the Studio aimed to make citizens familiar with the digital data that are continuously being gathered on their environments. Ultimately, the architects aimed to help citizens gain expertise on the environmental (i.e. noise and air pollution, temperature, and shading) and user influences (i.e. movement and circulation flows) that inform the design and management of public spaces, and empower citizens to participate in empirically informed decision-making in future developments of public spaces in their city (PKMN Architectures 2012).

By engaging citizens in carrying out the visualisations of digital data in the physical space, the architects did succeed in creating a participatory design intervention, yet they failed to bring about a long-term output or sustained civic engagement. This project was not embedded in an actual decision-making process on the design and development of a local public space and, therefore, remained a one-off event. While the project might have been successful in raising public awareness on the availability of digital data and its missing relationship with the physical public realm, the architects have not been able to instigate change in existing (participatory) decision-making processes, as they hoped for.

Figure 4.1
Analogical Smart Cities – Visualisations of sunlight shadows and temperatures on different times of day

4.1.2 1:1 Heatmap

Another project that aimed to create awareness amongst citizen by engaging them in the creation of a design intervention is 1:1 Heatmap. A collaboration between DUS architects, media lab LUSTlab and The Mobile City research group[40], funded by several Dutch public and cultural sectors[41], resulted in this public space intervention. The project used socio-spatial digital data to create visualisations in a public space of a deprived district in The Hague, Netherlands, to initiate a discussion amongst local citizens on the public realm in their neighbourhood. During the research and design process, the team explored several opportunities for using digital data generated by and in the neighbourhood. They looked at what local inhabitants posted on Twitter (geo-located Tweets), or what they sell on Marktplaats (the Dutch version of eBay). A reflection on this material, however, did not result in any specific or unique insights about the neighbourhood and its local public space. The team then decided that they would need to generate their own data to realise their design intervention, which resulted in a proposal to create a heat map of the spatial patterns of public space dwellers to gain insights on the use and behaviours of people in this space.

First, a camera was placed to film the local square for two hours on a Sunday afternoon. A specific software translated this material on the intensity of occupation to a colour code, which resulted in a heat map of the use of the space. The designers then marked the outlines of the map on the paving of the actual space and invited local residents to colour the map. Through this participatory activity, the team aimed to engage the local public in a dialogue about their neighbourhood. One of the main topics that emerged from these exchanges concerned co-inhabiting public spaces in a culturally diverse neighbourhood. The design intervention, however, did not provide any insights into diverse cultural uses of the space by its inhabitants. By using novel digital technologies, the designers discovered and visualised spatial patterns of neighbourhood inhabitants' movements in the public space and disclosed the spatial organisation of the neighbourhood's social life

40 themobilecity.nl

41 The project was funded by the Dutch Creative Industries Fund, the cultural Pauwhof Fund and the City of The Hague.

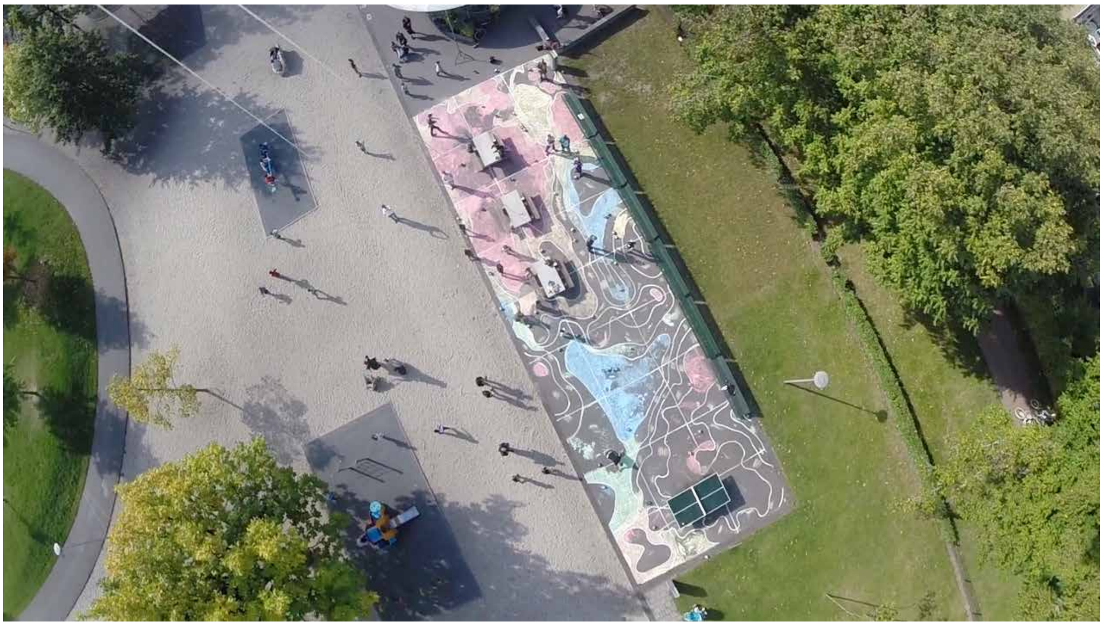


Figure 4.2
1:1 Heatmap design intervention (aerial photograph by LUSTlab retrieved from themobilecity.com)

(De Lange 2014). Finally, by engaging citizens in colouring the heat map, the designers aimed to raise residents' awareness of their dwelling patterns in this public square (fig. 4.2).

Where the Analogical Smart Cities project takes a critical stance towards new digital developments, the 1:1 Heatmap project, on the other hand, absorbs digital technologies to create a participatory design intervention in a neighbourhood public space. 1:1 Heatmap is one of three case studies within the 'Public Space and The Public Good' project; a collaborative research programme funded by the Dutch Creative Industries Fund, the cultural Pauwhof Fund, and the City of The Hague, which aims to explore how digital data can be used to create urban publics in new ways. With their 1:1 Heatmap project, the initiators aimed to investigate how digital technologies could enable citizens to self-organise into publics who can address issues regarding (local) public goods. Through this case study, the researchers aim to learn what role digital media can play in ‘the social organisation of citizens around communal issues’.[42] However, the 1:1 Heatmap project did not involve any collective self-organisation of citizens during in the design intervention, nor has an actual active public been created around the public good, i.e. the neighbourhood space, who could sustain the project and which could result in ongoing activities. Finally, rather than foregrounding the civic self-organising aspect of the intervention, this project focused on the implementation of digital data technologies, which came to determine the research and design process.

42 http://themobilecity.nl/projects/public-space-public-good/ , accessed 30 May 2015.

4.1.3 Feral Robotics

The third example of unsustainable interventions is 'Feral Robotics Public Authoring', a project by artist Natalie Jeremijenko in collaboration with artists' studio Proboscis that took place in 2006 in London Fields park in Hackney, London. Their public realm project aimed to raise public awareness on how environmental factors affect neighbourhoods by empowering locals to measure and visualise local air pollution with the use of sensors. Electronic sensors were attached to DIY modifications of toy robots that could detect air quality, noise and light pollution. By giving people access to these pollution sensing technologies, the team aimed to empower citizens (i.e., non-specialists that have a stake in the quality of their neighbourhoods) in environmental sensing, which often tends to be exclusively the domain of scientific communities. The team organised robot-building workshops and mapping workshops that took place during traditional community events (village fetes and local festivals). By using affordable electronics and publicly accessible mapping tools, the team aimed to create a bottom-up approach to environmental sensing.

Through the combination of toy robots and online tools, the team strived to give people the feeling that they can learn about their environment in a fun and tactile way. Furthermore, the team argued that collecting evidence on the neighbourhood air quality could instigate local action at a policy level and behavioural change at a social level (e.g., promote cycling as a primary mode of transport amongst citizens). The team hoped that their introduced interactive tools (the robot sensors) and community mapping activity could function as an impetus towards a broader debate on the many different elements, including environmental factors, which affect a local environment. With their intervention, they aimed to trigger a social exploration of environmental issues at a local level, empower local communities and, ultimately, act as a catalyst for social activism (Lane et al.2006).

While `Proboscis' recognised the high level of electronics and engineering skills needed for citizens to create their own prototypes, they believed the project had potential to create and mobilise a group of local hobbyist who would appropriate their introduced instruments and self-organise future mapping activities. The studio imagined a growing network of hobbyist data collectors, developing over the years after the project was

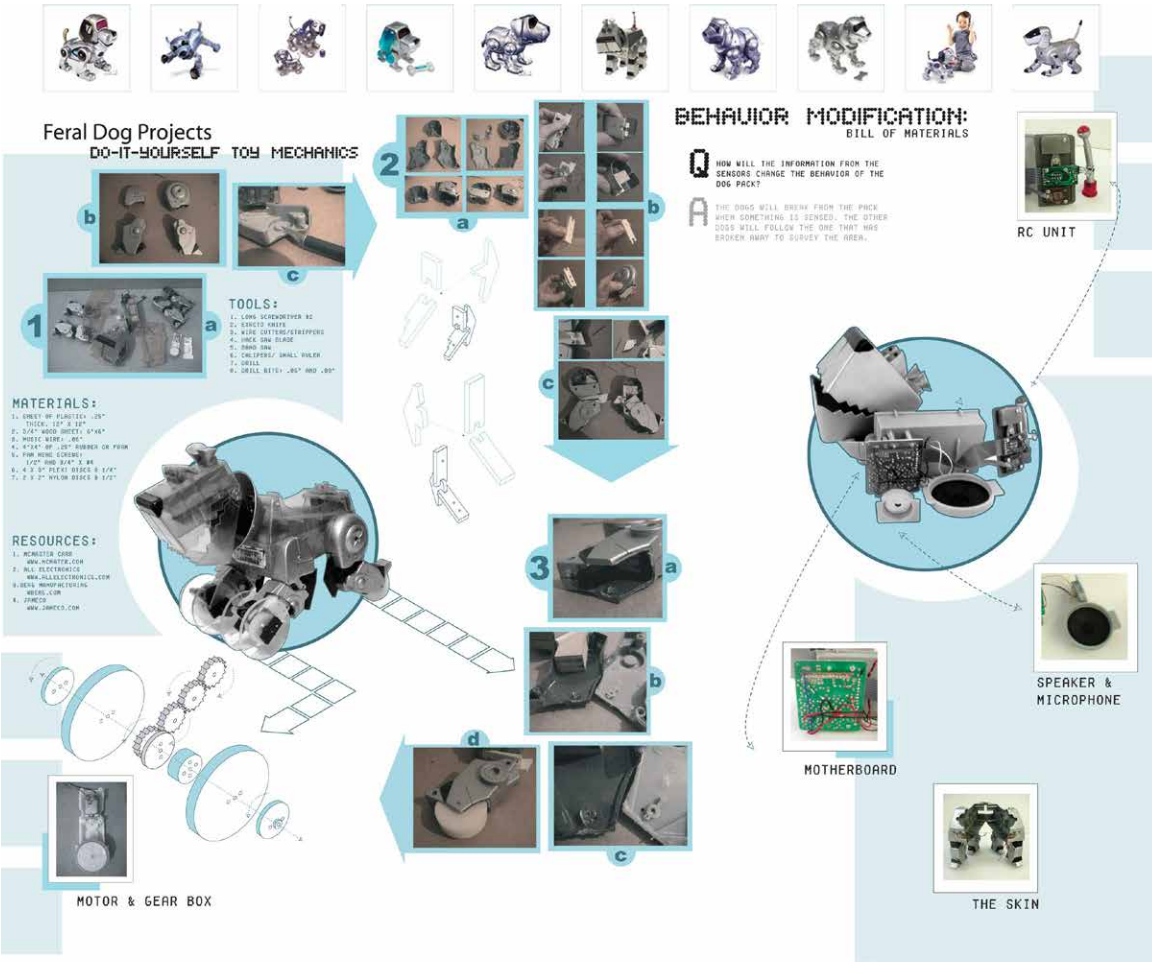


Figure 4.3
The workshop toy-robot building info sheet (top), and a photograph of a workshop participant and her environmental sensing toy-robot

initiated, who would start mapping their own environments and would take action to initiate change, for instance, by using their collected data to check the validity of official government data (Lane et al. 2006). However, the initiative never resulted in follow-up projects or any other long-term initiatives, such as the community organising their own workshops to build tools to measure air quality. The Feral Robotics project intended to activate a local community to become hobbyist data collectors, yet the artists' initiative failed to outlive the short-term intervention. In this project, the artists introduced a theme (air pollution) and method (toy robots with sensors) to local residents. By planning their workshop during a community event, the team was able to approach and involve interested local community members and educate them on their data collection methods. Rather than conducting a prior investigation into the community's concerns and ideas on their neighbourhood, the team introduced their own preconceived ideas of the needs and interests of the local community through predefined themes, tools, and techniques. Also, the public that was created around the intervention was centred around the project initiators, who were the central agents in the temporary network. While the project attracted individual community members to participate in the action, there were no exchanges amongst the participants that resulted in the creation of an autonomous social network, which would be able to take over and sustain the project. Furthermore, the team did not investigate whether their proposed tools were appropriate for the specific community. Their project design was based on workshops in which the professionals trained the participants in constructing robot sensors, which would be used to collect data. However, working with these robots required a certain degree of technical know-how and skill from participants. Within community-focused projects, creating a sense of ownership over the tools and outputs play a crucial role in a project's sustainability (Carrol and Rosson 2007; Merkel et al. 2004; LeDantec and DiSalvo 2013). Artists and designers who aim to sustain their projects beyond their own engagement, therefore, need to find ways of seeding ownership among community groups (Merkel et al. 2004). The Feral Robotics project was unable to cultivate such a level of ownership among the local community and therefore failed to initiate an on-going activity.

With the participatory activity in Feral Robotics, the team was able to initiate a conversation about the issue of air quality among the local community. Environmental data collected by the participants, however, had no greater significance other than serving as input into the discussion. If the crowdsourced data had been used to, for instance, question official government data, citizens might have felt more inclined to undertake such measurements in future. Recognised legitimacy of their data could empower citizens to challenge the accuracy of data from public institutions and advocate for reduced pollution and better air quality in their neighbourhoods. The lack of real empowerment and the high level of skills needed for the activity to take place are factors that the team could reconsider in future projects to reinforce sustained activity. Furthermore, an investigation into the existence and interests of a local hobbyist community group prior to the intervention could have increased the chances of ensuring sustained engagement. In conclusion, rather than taking a techno-centric approach in this design intervention, a study in the interests, issues, and ambitions of an active local community could have resulted in a more sustainable project.

Critique

The three examples that were examined all aimed to sustain public engagement beyond the involvement of the project initiators, yet failed to realise a socially sustained project. Belotti (2015), a social scientist specialised in social network theory, argues that in order to sustain any social initiative, a local network is needed. Projects such as *Feral Robotics*, *1:1 Heatmap*, and *ASC* often begin from the designers' or artists' own interests or preconceptions about the needs of a community. While the themes these projects address might be relevant to raise environmental or societal awareness, their initiatives rarely become rooted in the community where they are implemented. There is hardly ever a follow-up of the social intervention, and they rarely trigger any civic self-organisation. If the initiators had researched the local community before carrying out the interventions, or if they had engaged in a long-term co-production process with the community, they might have been more successful in generating initiatives that locals would be more inclined to take ownership of, and with that, create a project that has an afterlife beyond the initiators' engagement.

4.2 Multi-disciplinary teams to secure a project's afterlife

This section examines two projects where the initiators remained involved for more extensive periods (1+ years) to embed their interventions within a local community. The Living Labs method aims to establish a public by having designers engaged on a project for an extensive period. While a long-term engagement from professionals can be helpful to create new networks of communities around a project, this thesis takes a critical position towards designers who adopt such an approach, which is increasingly common in participatory design practices that aim for long-term civic engagement. Should it be the role of designers to construct new publics around their projects? This chapter explores opportunities for designers to re-engage with spatial design. Looking at a best practice example of a sustained public realm project outside the field of design, there are several lessons that could be applied to socially-engaged design.

4.2.1 External best practice: 596 Acres

596 Acres is a participatory public realm project that was successful in facilitating long-term civic engagement by triggering citizen appropriation. This project was initiated by a team of multidisciplinary professionals, rather than a team of exclusively designers or artists, and serves as a useful example of how a self-initiated project can become rooted within a community.

596 Acres was established by a team of law professionals who started this non-profit organisation to facilitate community empowerment and sustained local action by filling the gap between policy and the people in New York City's neighbourhoods (Segal 2015). Through their initiative, the team aims to help citizens transform vacant public land in the city of New York into community resources (596 Acres Recap 2012). By bringing in external information technology and policy expertise, the team was able to study the city's digital open data sets on vacant land, which led to the discovery of 596 acres of empty plots in the Brooklyn borough. The team aimed to transform these data into

accessible ‘readable’ information for citizens. This was realised by mapping all publicly owned, vacant pieces of land in Brooklyn and visualising these on posters that were published both online on their website and offline in the different neighbourhoods. The team then brought in graphic designers to create the physical intervention; posters were put up on the fences surrounding the vacant lots, which contained provocative texts (e.g. ‘This Land Is Your Land’) and included basic information about the city agency owning the lot and the agency’s contact number (fig. 4.4). These posters, in combination with digital information (numbers, figures, and maps on the 596 Acres website), triggered local neighbourhood inhabitants to contact the non-profit or their local council and take action.

The team aimed to transform the city’s information and political landscape by unlocking data on the urban landscape for those that want to get involved and have a voice in shaping their local environment (596Acres.org). Furthermore, 596 Acres acknowledge the importance of making information available to the community ‘on the ground’ by using both physical (offline) as well as digital (online) tools for presenting the municipal information (Segal 2014). The next step in 596 Acres’ practice is guiding interested participants in the process of appropriation. They provide education to locals about how to participate in decision-making processes by the city government that affect their neighbourhood; they assist communities with legal support on land use issues; they work with the community after they get access to the land in order to build a durable local governance; and they argue for municipal agencies to allow more community participation concerning public resources.

Of the 36 vacant lots they have helped transform since October 2016, 30 have been made permanent community spaces by transferring the land to the NYC Parks Department or through leases with public authorities. Volunteer residents and local community partners have transformed lots to spaces where they gather, grow food, and play. The initiative to transform these vacant lots always lies with neighbourhood residents. While 596 Acres acts as a supporter and advocate for these projects, ultimately, the spaces are managed autonomously by the local community. The team primarily provides legal advice and technical assistance to communities navigating their local council’s bureaucracy. There are

Figure 4.4
596 acres of vacant land in Brooklyn (top) and a poster as physical intervention (bottom) (596acres.org)

even cases where residents took initiative on their own without direct involvement from 596 Acres by following the instructions on the offline posters and online information, and getting in touch with their local authorities to gain access to the land. Finally, the team uses social media to support and grow a larger community around the projects and to maintain a network through which locals can share knowledge and best practices, build relationships with decision-makers, build bridges between neighbourhoods, and establish groups to build sustainable local community governance for the land (Segal 2015).

The 596 Acres project is an example of a data-driven public realm design intervention where a different approach was adopted towards engaging the local public, which has proven to be a more successful strategy in facilitating long-term citizen engagement, appropriation, and empowerment. This project adopted a bottom-up approach; rather than imposing their agenda on a community, the strategically placed posters encourage participants to contact the team for collaboration. By understanding the needs of the community in this specific socio-economic context (there is a lot of competition for land in Brooklyn and communities benefit economically from growing their own produce), 596 Acres was able to create a project that was appreciated and appropriated by the local community.

While this project was successful in terms of the longevity of community participation, it also demonstrates that these kinds of projects can require a long-term commitment and involvement of the initiator to cultivate ownership and help communities appropriate the project. Without a long-term process of counselling and educating to activate and empower the local community, the project would not have become rooted within the community. This chapter therefore argues that designers could work in multi-disciplinary teams, such as the 596 Acres example, to ensure a long-term engagement by part of the team (i.e., law makers, civil servants or social workers). The 596 Acres project receives most of their funding from individual donors and local foundations (including the Brooklyn Community Foundation, the Hudson River Foundation, and the New York Community Trust for NYCommons). In 2017, for example, they received about one-third of their funds from a total of 92 individual donors, and approximately two-thirds from six different foundations. This funding allowed 596 Acres to cover their expenses, about half of which goes towards paying their personnel ($96,284 in 2017) and about one-fourth to external researchers and consultants ($37,542 in 2017) (596Acres 2017).

Working in multi-disciplinary teams allows designers to focus on the design aspects of the initiative and step out of a project without jeopardising its social sustainability (fig. 4.5). Other team members, such as law professionals, social workers, or civil servants can stay involved in a project for a more extended period to help create a reliable social network, and, rather than placing designers as central nodes, positioning the right local actors at the centre of the network. The following section discusses an example of a participatory design project that placed the design team at the centre of the project's network, and therefore failed to generate a socially sustained project.

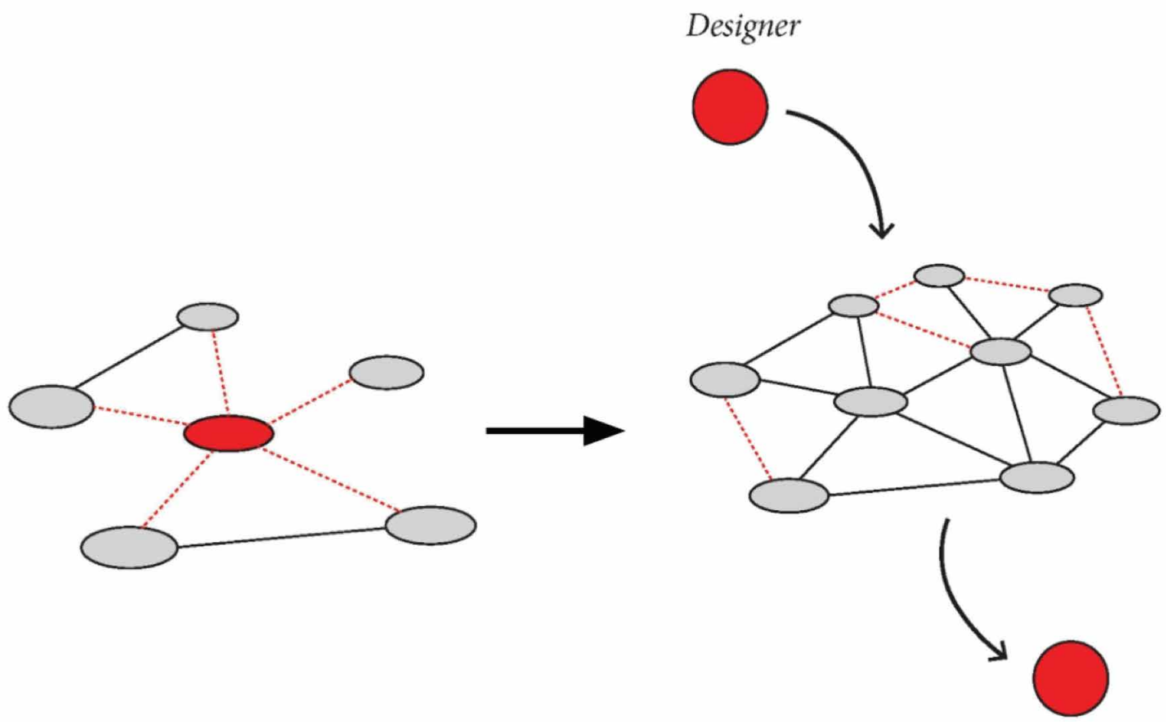


Figure 4.5
Proposal: rather than designers creating a network and establishing a public around themselves, designers could analyse SSDD to identify existing networks, step in to consolidate these existing communities, and step out without jeopardising the project's social sustainability

4.2.2 Participatory design practice: De Andere Markt ('The Other Market')

The following example is a project by one of our TRADERS partners called 'De Andere Markt' (DAM), which can be translated to 'The Other Market'. With this project, the design and research team aimed to address a pressing social issue in the town of Genk, Belgium. Different from the previous examples, the social issue in this project concerns employment rather than the public realm, however, the team's design interventions did take place in public spaces in the town. Furthermore, while this project concentrated on service design rather than spatial design, it nevertheless forms a fruitful example of designers' attitudes and engagement in long-term projects that address public issues. Finally, the direct connection to the project through TRADERS provided access to all the project data, which allowed me to conduct an in-depth empirical exploration into the nature of the social network this project generated.

In 2014 the Ford factory in Genk closed, which was one of the major employers in the region with 4,210 employees, and caused a major increase in unemployment rates in the region, as well as socio-economic problems in the town of Genk. Together with local suppliers and other businesses in the sector approximately 12,000 jobs were lost in the region due to the factory closure.[43] The DAM team aimed to address this problem by planning a series of both ephemeral and long-term design interventions in Genk. By creating a site-based studio as a Living Lab located in an empty shop on one of the town's neighbourhood highstreets, the team aimed to offer a space for locals to discuss future ideas on work, including work-related topics, such as workspaces and work conditions, in Genk and the region (fig. 4.6). With their interventions, the DAM team put forward a critique of decision-making by local authorities on issue of unemployment, where policymakers and worker unions often take a top-down approach in implementing policies, programmes and projects to create jobs without consulting the general public.

43 http://www.dewereldmorgen.be/artikels/2012/11/28/de-economische-krater-na-de-sluiting-van-ford-genk , accessed 18 March 2018.

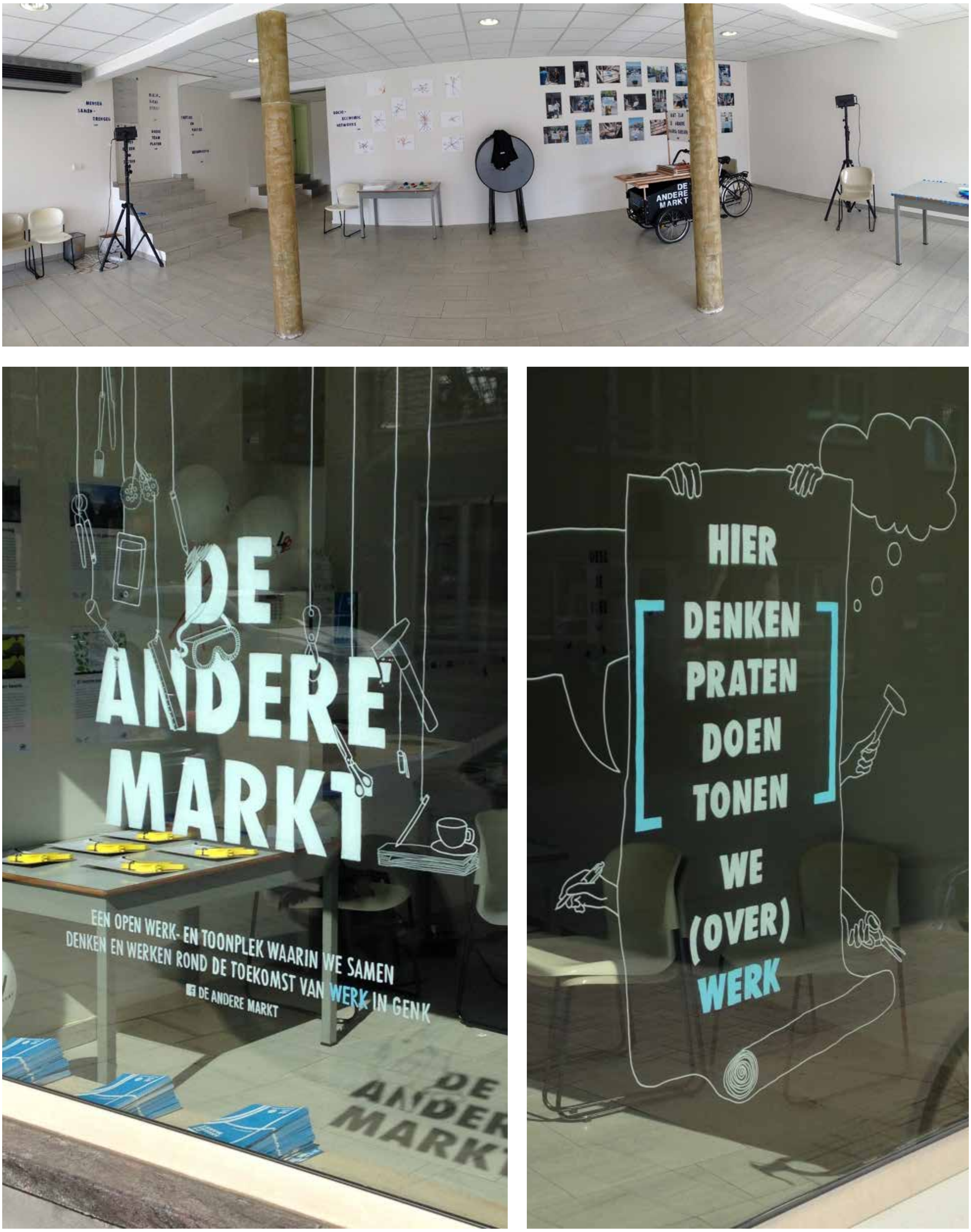


Figure 4.6
Photos of the DAM Living Lab in Genk

The DAM team aimed to increase public input and enhance the public debate on jobs by offering a platform for a wider range and larger variety of voices (e.g. employed and unemployed citizens, citizens from various cultural backgrounds, different gender and age groups) from the town and region. With the help of various design tools and actions the team aimed to co-create several design proposals to address the issue of unemployment and upscale these ideas by connecting them to existing initiatives, institutions and organisations. During the project's two-year lifespan, the team organised various activities in and around the Living Lab. Some of their actions included collecting stories from citizens in Genk via a mobile market (a cargo bike) that team members would ride through the town. During this intervention, the team would invite locals to engage in a dialogue about work and their personal or professional skills. The participants would then be invited to advertise their skills by printing them on large posters with the cargo bike's integrated mobile screen-printing station (fig. 4.7). The team documented these actions through photographs, which are collected and displayed on the DAM project website.

The DAM team also used these stories from locals as input for several public activities in the Lab, such as 'Minilab' workshops where brainstorm sessions were facilitated between citizens, researchers, professionals and policymakers as a method to co-create new ideas on the future of work in Genk. The team also offered individual creative sessions to local entrepreneurs and shop owners, to help locals reflect on their businesses by exploring what social and economic networks they formed and were part of, and how such insights could be of use to evaluate the performance of their business. In these creative sessions, the team introduced participatory mapping activities, where they aimed to elicit local knowledge and local places from participants to create visual representations of this information. The participatory mapping method enabled the DAM team to create a better understanding of the local area and its social connections and attitudes, which emerged from the interactions and conversations with the local entrepreneurs and shop owners. These local stories became another source of qualitative data for the DAM team on the social economy of the town and neighbourhood.

Figure 4.7
Screenshot from web interface of deanderemarkt.be. Poster captions from top-left to bottom-right: 'Compost master', 'Green fingers', 'Contact point', 'Captain, 'Connecting differences', and 'Positive critic'.

Through their design interventions and with the Living Lab method, the team hoped to create a social network of local citizens and stakeholders around their project, which would appropriate and sustain the Lab once the team stepped out. This handing over of ownership has, however, proved to be problematic. During the two-year project, the team acted as the initiator and organiser of all of the events and activities. Once the team members remove themselves from the project, there will be no other agent in the network who will take over their role as facilitators. This dilemma is a reoccurring issue in design projects that aim for social sustainability yet fail to bring about sustained engagement beyond the involvement of the project initiators.

Furthermore, one could question whether the design and design research team of DAM were adequately equipped to address sensitive issues such as unemployment, and whether there were any ethical considerations for the DAM team prior to approaching the former Ford employees. Some of them had worked for the factory for over 30 years and, at the time of the DAM project, were still suffering from emotional trauma caused by their lay-off. Should designers enter into public counselling, or should they leave that to professionals who are trained to work with people and sensitive societal issues?

DAM aimed to spark local interest by locating their Living Lab in an empty shop in a neighbourhood high street. Team member Calderòn, however, said there was still a threshold for locals to overcome: they would often not enter the space, even if they were curious to find out what was going on. Where DAM's shop window texts inviting locals to participate were somewhat ambiguous ('This is a place where we talk about work'), 596 Acres' posters placed on the locations of the vacant lots, contained clear and provocative texts ('This land is your land'), followed by a direct means of action - contact numbers and names of local authorities - which triggered locals to take the initiative by contacting the 596 project team or their local authority. Rather than positioning themselves at the centre of their project, 596 Acres emphasised the action locals could take -- with or without the initiators' direct involvement. With this approach, the team was able to help establish autonomous neighbourhood groups to become stewards of the land, which allowed the team to position themselves in the background as counsellors, and to eventually step out of a project once a solid local governance was in place to maintain the lot. The following section takes a closer look at the make-up of the social network, which is another important aspect that could help sustain a project's afterlife.

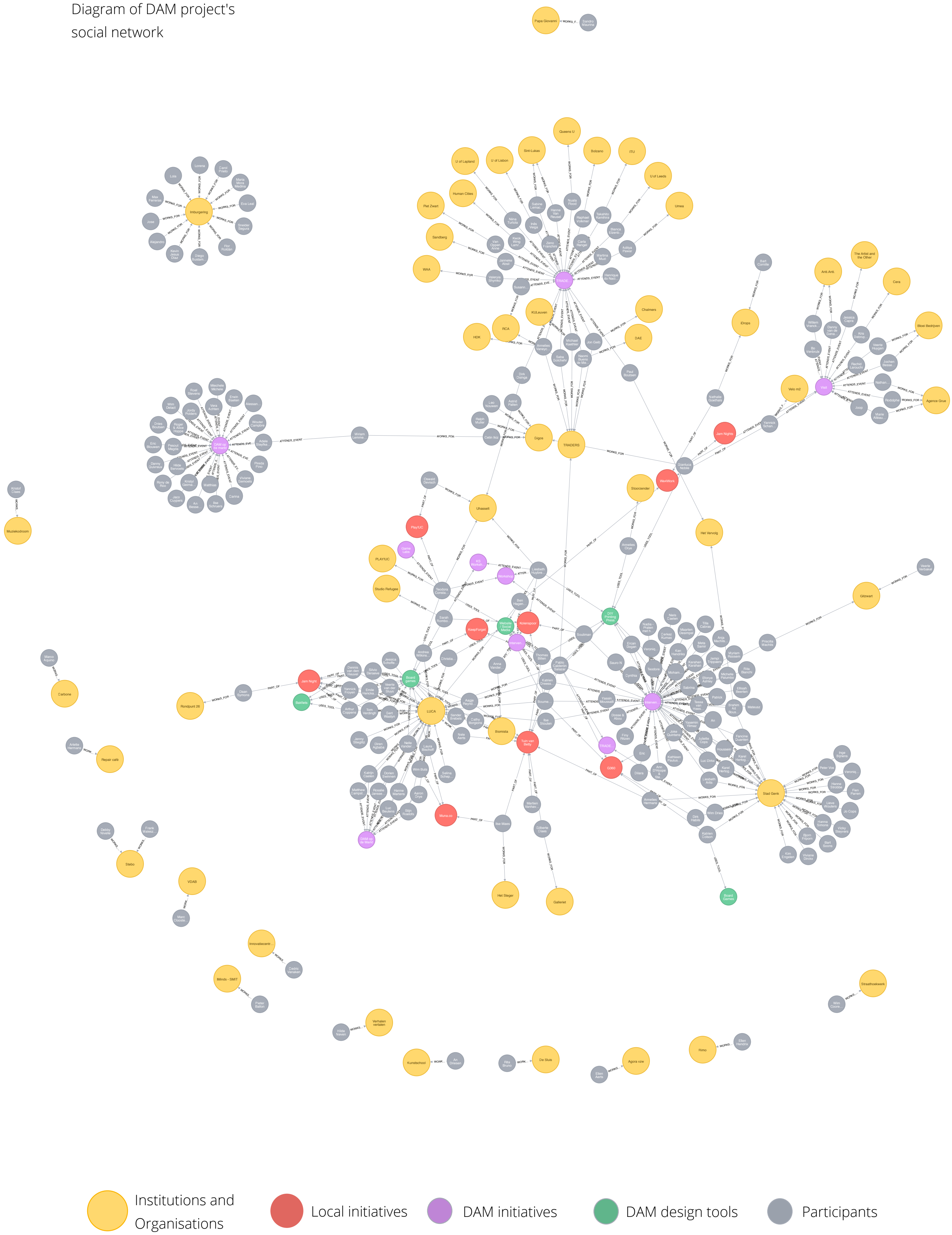
4.3 A social network approach to securing a project's afterlife

This section therefore introduces analysing socio-spatial digital data as an alternative, resource-efficient approach that could help designers create neighbourhood public realm projects that are more likely to have an afterlife beyond their involvement. This approach is built on the premise that social networks are essential in maintaining citizen participation in public realm projects (Belotti 2015). Socio-spatial digital data (SSDD) can help designers analyse online data to identify potential local key players and demonstrate which digital data sources are available for such explorations. Finally, rather than constructing a new public from the ground up, designers could use SSDD to explore and identify existing local networks and communities. This approach requires designers to do their homework prior to entering a context, which would allow them to step into a context, create a project, and step out without jeopardising the project's social sustainability. Some examples from practice are discussed to support this theory and to demonstrate which SSDD sources could be used for this approach.

4.3.1 Principles of a social network approach

A closer reading of the social network of the De Andere Markt (DAM) project offers some insights into the initiative's shortcomings regarding their project's social sustainability. The following graph visualises the network that the team has created around the DAM project, with purple nodes representing projects and initiatives by DAM, the grey ones representing participants, and the yellow nodes referring to the institutions and organisations the participants are part of (universities, research groups, design offices, and so on) (fig. 4.8)

Figure 4.8
Diagram of DAM project's social network



A closer study of this graph reveals that the larger network mainly exists of a collection of smaller networks, where one central actor acts as the magnet that holds together the other nodes (fig. 4.9). The central nodes in this network exist of projects, events, workshops, and so on, organised by the DAM team, or they represent members of the team. Therefore, once the designers disappear as the central nodes within this network, the entire network risks disintegrating.

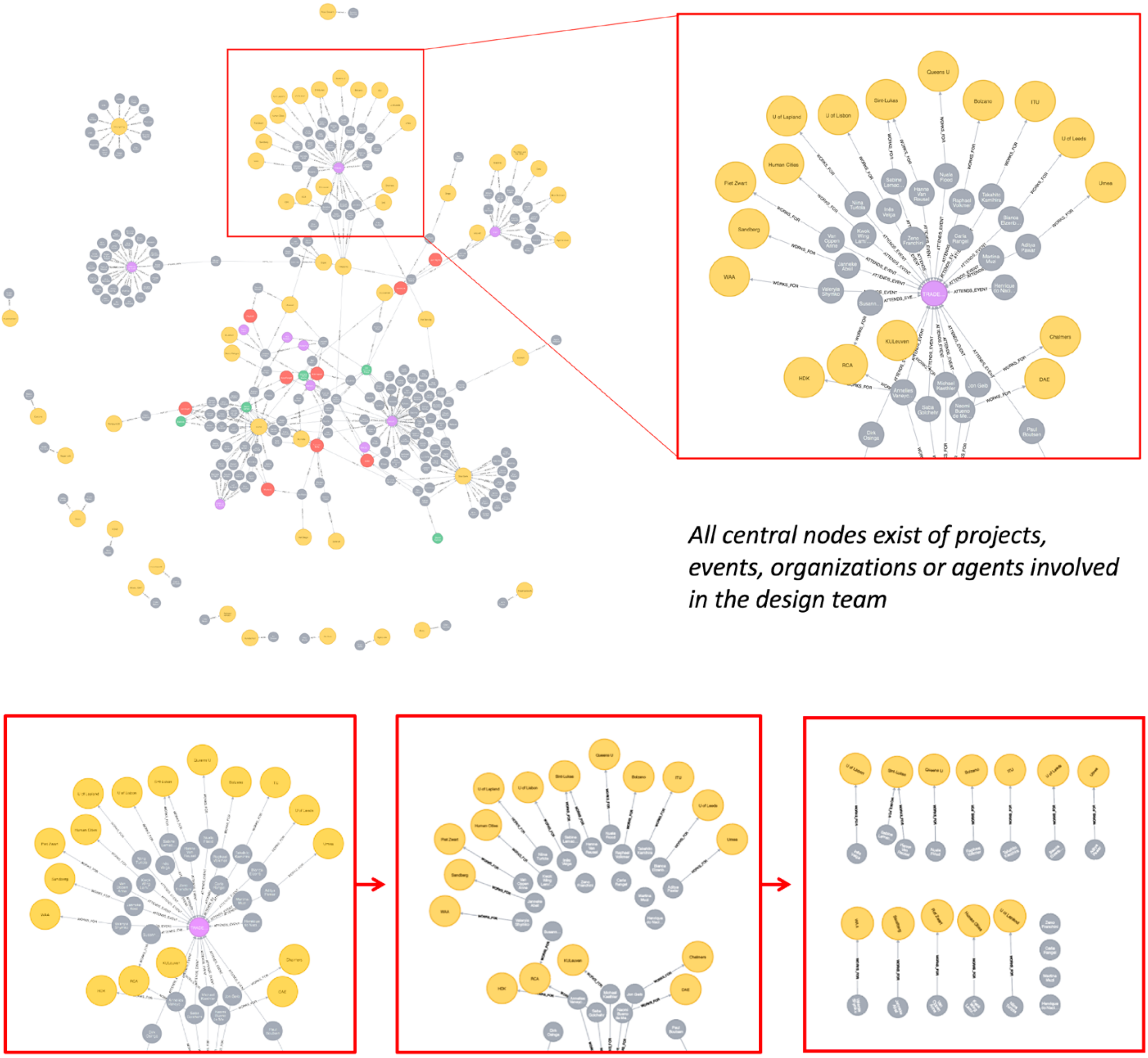


Figure 4.9
A visual representation of what happens to the network if the design team steps out

In addition to participatory design projects like these, there are numerous examples of art and design projects that fail to generate a network altogether, including the Analogical Smart Cities or 1:1 Heatmap examples. While these projects engaged participants during the interventions, and therefore did create a temporary public around the project, the nature of the exchanges do not result in building actual relationships between the participants in order to create a permanent network.

4.3.2 Identifying existing communities

Cecilia B. Merkel and her research team, who are part of the Computer Supported Collaboration and Learning Laboratory at the Centre for Human Computer Interaction, Pennsylvania State University, argue that participatory design for long-term civic engagement is a practice that needs to blend ethnographic methods with participatory design (2004). In the Lab's three-year participatory design project 'Civic Nexus', the research team worked with non-profit groups in order to co-create digital tools that would help solve local community problems. Most non-profit groups have limited funds and rely on small grants, which often limits them from hiring human resources and purchasing technological equipment (Merkel et al. 2004). With Civic Nexus, the research team aimed to help community groups define problems that they would like to address with technology, and help them initiate and facilitate this process. The team were involved as co-designers to ensure that ownership of the project would remain with the community groups, and to empower the group to take control over their use of technology. In the early stage of the participatory design process, the research team focused on identifying and recruiting community members who were interested in participating. With this approach, the team aimed to engage participants who were more likely to take control of both the participatory design process as well as the design output.

Through the recruitment process, the researchers were able to identify five diverse groups, all based in Centre County, Pennsylvania. These groups represented a range of people and issues, including an environmental group (the Spring Creek Watershed Community), a high school learning enrichment group (State College Area School District Learning Enrichment/Gifted Support Programme), and a historical society (the Centre County Historical Society) (Merkel et al. 2004:2). The research team first conducted fieldwork for eight months to generate a better understanding of the community groups, including their overall mission, activities, and the role of technology in their organisation. As part of this fieldwork, the team also aimed to identify key stakeholders in the groups and explore possibilities for collaboration.

In the Civic Nexus project, Merkel et al. (2004) conducted in-depth qualitative ethnographic research by observing participants over an eight-month period. The team would attend meetings where they took the role of "lurkers" who would observe and analyse group conversations (Merkel et al. 2004:3). Undertaking such an ethnographic study, however, requires many resources, including time and labour. Ethnographic research is traditionally conducted by anthropologists, who fully immerse themselves in the lives, culture, or situation they aim to study. Socially-engaged designers who undertake such in-depth studies risk becoming involved in a project for an extended period, which can be financially challenging due to typically limited (public) funds. Short ethnographic studies without specialist professionals as part of a multi-disciplinary team, however, can be beneficial for designers who aim to seed ownership within a local community to generate a socially sustainable design output. Some designers, such as muf art/architecture, have already adopted traditional ethnographic methods to observe and analyse a local public. Such methods, such as participant observation, interviews, and surveys, however, require significantly more resources than just digital tools (Marcus and Tidey 2015). This chapter, therefore, proposes that socio-spatial digital data, which is readily available and accessible online through various sources (such as social media channels), could help designers conduct similar ethnographic studies in more resource-efficient ways. Analysing socio-spatial digital data could help designers save time in their user research or complement findings of a field study to paint a more accurate picture of a local social context. The following example demonstrates how SSDD from social media platform Facebook has helped a team of architects generate a spatial design that would enable user appropriation by local communities.

SSDD for sustained engagement in spatial design

For the renewal of the old energy plant 'Strijp-S' in Eindhoven, Netherlands, architecture and research office Space and Matter were invited to conduct a conceptual study on the transformation of several interior spaces of the building. Several groups would occasionally use the spaces in the abandoned industrial building for various activities. In order to find out what these informal activities were and who these groups were, the office embarked on a digital ethnographic investigation, aiming to develop a design proposal that would be appreciated and appropriated by an existing network of active users. To find out who those users were, the office aggregated and analysed location-specific digital data from various social media platforms. Exploring online data, in contrast to in-situ observations, allowed the studio to gain insights into the location's use and appropriation at different times of day and over a more extended period (weeks, months, years). From this analysis, the designers discovered two existing communities who were active on Facebook: a group of skaters and BMX bikers, and a group of climbers (De Waal and De Lange 2013). As a result of these findings, the office contacted and interviewed these communities to elicit their specific programmatic and spatial needs, and develop a conceptual design for a hybrid space which both communities would be able to appropriate (spaceandmatter.nl).

Although the firm's design was never implemented, with the help of the municipality of Eindhoven the two communities were allowed to officially take ownership of the spaces in the old energy plant. In 2008 the climbing facility 'Monk Boulder Gym' established their climbing facilities here, and in 2010 '040 BMX Park' moved into the building (monkeindhoven.nl; 040bmxpark.nl). Notably, the relocation of the BMX community has since triggered a broader community of hip-hop artists to establish their studios in this building. Break-dancers and rappers, for instance, were attracted by the location, which has resulted in an extensive network of related communities of artists and sub-cultures within the local hip-hop scene who are increasingly appropriating the location (Eindhovens Dagblad 2014). As the Eindhoven example demonstrates, the architects gave voice to the informal users of the space and helped them gain recognition, which eventually helped them formalise their activities, presence, and ownership.

As communication mediated by technology is ever more integrated into various aspects of everyday life, the study of social media data has become increasingly relevant in ethnographic research (Garcia et al. 2009). Science and technology sociologist Christine Hine (2015), who specialises in the use of the Internet in social research and ethnography, argues that researchers could conduct ethnographic studies by following an object on various online platforms, to explore different audiences that engage with an object, and the various meanings these groups attach to it. Such an online investigation could also open up new opportunities for a more in-depth investigation offline. This 'virtual method' corresponds to the approach the architects at Space and Matter adopted. By first exploring various online social media platforms, the architects were able to identify groups who were already active users of the space. Following this online investigation, they conducted qualitative interviews with these user groups offline to learn about their interests and spatial needs and ultimately used these data as input into their design brief.

User communities can, however, also take shape through alternative features, which designers could leverage to help generate a sense of ownership. An example of a successful long-term appropriation and community engagement in a public space is described in Dr. Efrat Eizenberg's book 'From the Ground Up: Community Gardens in New York City and the Politics of Spatial Transformation' (2013). In her study on community gardens in New York City, she explored different cultural identities in neighbourhoods and learned that, due to ethnically segregated areas and building blocks, many of the gardens were occupied by mono-ethnic cultures. This cultural clustering allowed for a culturally-specific spatial expression, which in turn helped attract other community members who shared the same cultural background and resulted in the materialisation of a network of active users around the space. Most of the gardeners in Eizenberg's research were immigrants who used the gardens as spaces for a symbolic re-enactment of their childhood landscapes. Identifying with these spaces on a cultural level encouraged residents to develop a sense of ownership and to experience and appropriate the neighbourhood public spaces collectively. This way, the community gardens obtained a symbolic role as carriers of, and windows to different cultures within the city. Eizenberg's study demonstrates that identifying a shared cultural semantic could also be a strategy that designers could use to seed ownership among a local community.

It is essential to define what kind of communities to look for in an online investigation. According to the Oxford dictionary, a community is 'a group of people living in the same place or having a particular characteristic in common,' such as 'Montreal's Italian community' or 'the scientific community.'[44] Communities can be a group of people

44 https://en.oxforddictionaries.com/definition/community , accessed 21 April 2018.

living together and practicing common ownership, such as 'a community of nuns'. It can also be a particular area or place considered with its inhabitants, such as a rural or local community.' The term community is generally used to describe a network of interpersonal interactions between individuals who share some similar territory (off- or online) and share a set of similar values (Muñiz and O'Guinn 2001). Furthermore, since this chapter proposes the exploration of online data on community networks, it is important to differentiate between virtual and physical communities. While one can find numerous virtual communities through online explorations, the existence of a digital community cannot automatically be interpreted as evidence of a local public. Caliandro (2017) argues that most online interactions, such as updating a Facebook status or retweeting a post, often do not necessarily result in the creation of social groups. He therefore questions whether one can speak of 'online communities' in these situations, and introduces a different vocabulary of 'online crowds' or 'publics' to describe the ephemeral social groupings that are commonly found on online communication platforms (Bennett et al. 2014; Papacharissi 2015).

Rather than identifying online crowds or publics, I explore ways of discovering physical communities and community members who have some kind of internet presence. This search for online geographical communities, however, does not have to be limited to local communities who live in the same neighbourhood(s). In the Eindhoven project, for example, the network or users who took ownership of the vacant spaces consisted of a community formed from different neighbourhoods, who travelled to the location to make use of the space. While it is vital that a virtual community is also active offline, and has some physical presence, the community members can share a geographic location either as the place they live or as the place where they gather, such as in the Eindhoven example.

4.3.3 Identifying key actors within existing social networks and local communities

Within social networks, some agents are more likely to engage with, and take over ownership of a project than others. Designers could study socio-spatial digital data to identify these potential agents. In some cases, there are people within a network who are 'essential connectors'. These central nodes have many connections with others, or they may even form essential connections between various autonomous groups within a more extensive network (fig. 4.10). Involving these agents could result in the broader reach and potentially a more significant impact of the intervention. In the Eindhoven example, for instance, the skate and BMX-bike user groups were connected to, and brought in a more extensive network of hip-hop artists. This wider network, which shares a specific lifestyle, brings together a variety of activities that result in a more hybrid space, which can potentially increase its resilience regarding sustained engagement. When one of the communities formed around a specific activity loses its interest or motivation to engage with the space, other communities can take over or can use the space differently.

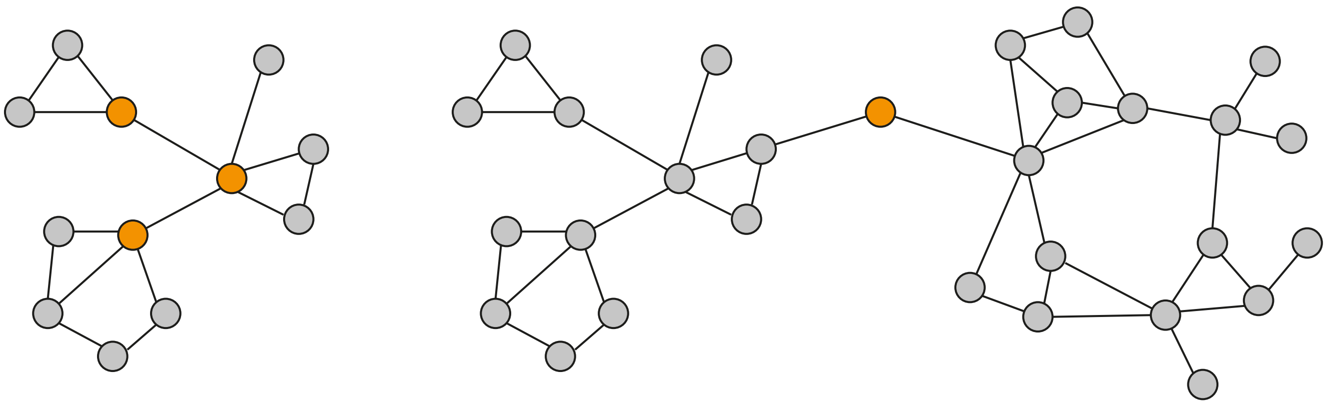


Figure 4.10
Two diagrams of key nodes in social networks (in orange). Left illustrates key nodes within a social network, right illustrates key nodes as connector of two (or more) networks

Within Social Network Analysis (SNA), key nodes within networks are identified through indicators of centrality. Measuring the centrality of a network helps identify the most critical nodes, i.e. the most influential person or unit within the network. SNA is a recognised method within the social sciences to study relations, ties, patterns of communication, and behaviours within social groups (Ortiz-Arroyo 2010). Over the past years, computer scientists have increasingly adopted this method to study internet traffic, web pages and information sharing through social networks. Social networking platforms, such as Facebook, use elements of SNA to identify and recommend potential friends to its users. Various companies use SNA to identify influencers (i.e. key nodes) to establish content tailored to their audiences (Divakaran 2017). One of the primary uses of SNA is to identify groups within complex social networks. Groups are identified as a collection of individuals who are connected through some kind of relation or interaction. Within such groups, different members can have different positions. Some members might occupy central positions, while others are located in the periphery, or somewhere in between. Groups can have one or more key players, which can be identified through SNA by conducting centrality measurements. Centrality describes the position of an agent within the context of their social network, and is one of the most studied measures within SNA used in various fields[45] (Friedkin 1991; Ortiz-Arroyo 2010). There are numerous studies that have used centrality measures to discover key players within social networks (Freeman 1977; Krebs 2002). In order to demonstrate such an approach, this section will revisit the DAM project in Genk, Belgium, and by exploring social media platform Twitter, examine whether key players can be identified from SSDD extracted from this data source. In this way, one can speculate on how involving these agents could potentially have helped the DAM team sustain their project.

The micro-blogging platform Twitter contains a rich source of data on user interactions. Technical functions in the social media platform, such as hashtags and retweets, are devices that help create social formations. Due to these functions, Twitter has become a

45 Centrality measures have been applied, for instance, to analyse influencer patterns within networks, to study the structure of criminal networks, and to analyse employment opportunities (Borgatti and Everett 2006)

popular source for measuring and visualising such social structures (Caliandro 2017). For the DAM project, I conducted two data studies. For the first exploration I collaborated with fellow RCA PhD student Jimmy Tidey[46], who developed an online tool that helps visualise social networks by analysing Twitter data[47]. We started this exploration by looking at two Twitter user accounts who we believed would likely be core members of the town's social network: 'stadgenk' (the town's official Twitter account) and 'stadhasselt' (Hasselt is a town located closely to Genk, together they form the urban agglomeration of the Limburg province). By mapping the connections of these Twitter accounts (i.e. who they interact with, who interacts with the users they interact with, and so on), we aimed to discover the social network of these two towns. This exploration resulted in the visualisation below of the towns' respective networks (fig. 4.11).

The nodes in the graph represent Twitter users who are linked to the user accounts of 'stadgenk' and 'stadhasselt'. Twitter users are considered linked if one user mentions the other in a Tweet. The thickness of the line between the nodes indicates the number of links between these two users. If users mention each other often, and therefore share more links, the line between them gets thicker, which, in turn, indicates a stronger connection. The two colours in the graph indicate identified 'communities'; the green network represents the town of Hasselt, and centres around the user 'stadhasselt', and the purple network represents Genk and is centred around the user 'stadgenk'. The nodes that are connected to these two towns consist of diverse user accounts, including local institutions (e.g. 'politiemidlim' – the police station in the mid-region of the province Limburg, 'uhasselt' – the university of Hasselt, or 'museumbokrijk' – a museum located in Genk), local businesses (e.g. 'differenthotels' – a hotel in Genk), other towns and cities in Belgium (e.g. 'stad_antwerpen' – the city of Antwerp), and individuals (e.g. 'wimdries' – the mayor of Genk, or 'koenvanmechelen' – a Belgium artist whose latest project is located in Genk). There are several user accounts that have links to both communities, including the user account 'radio2limburg' (a regional radio channel). The large amount

46 http://jimmytidey.co.uk

47 http://localnets.org

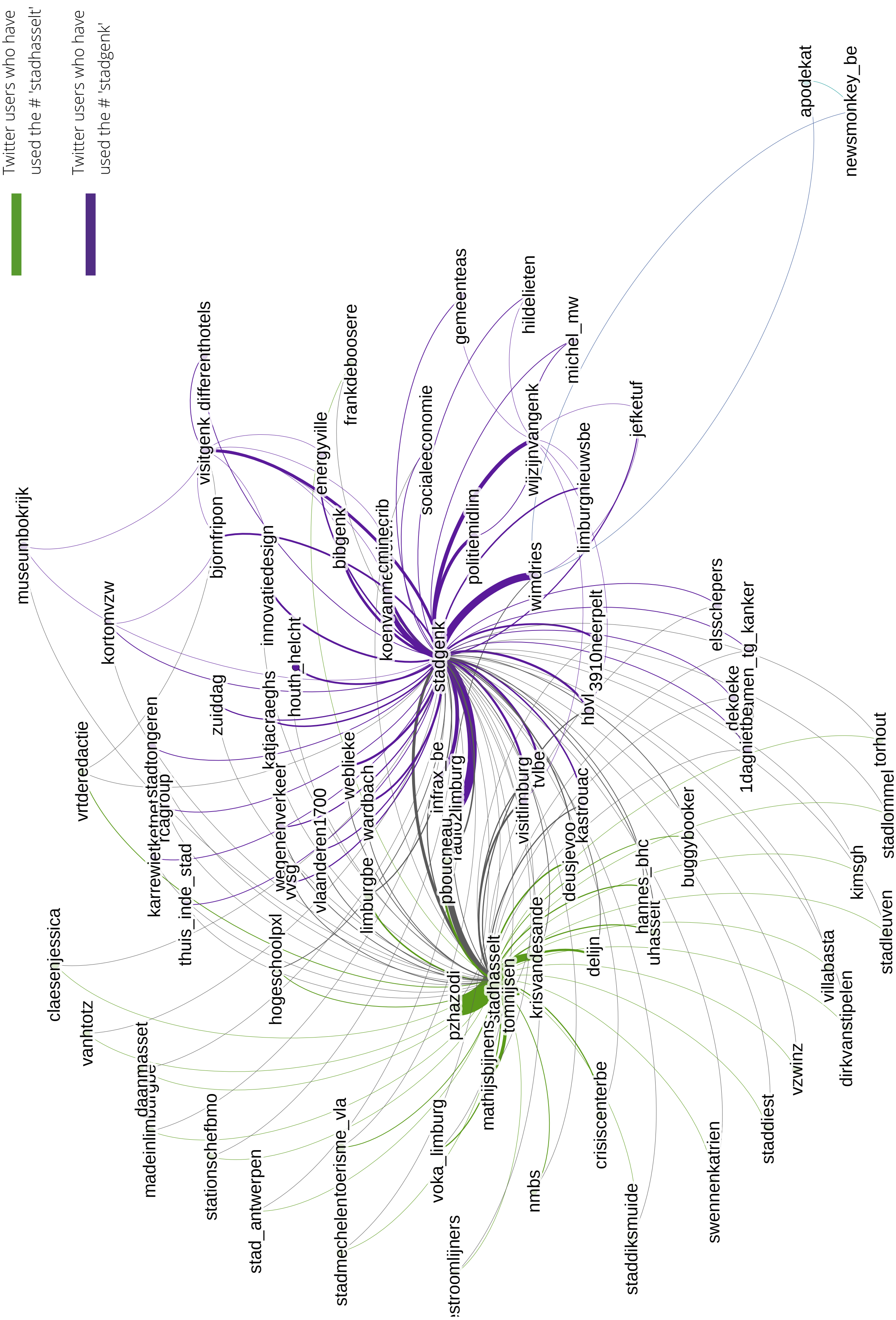


Figure 4.11
Visualisations of Twitter users 'stadgenk' and 'stadhasselt'

of user accounts with links to both 'stadgenk' and 'stadhasselt' indicate that the networks of Hasselt and Genk are quite interconnected. This graph therefore demonstrates that the towns not only physically but also socially seem to form an agglomeration in the region.

While this visualisation helps demonstrate the interconnectedness of the networks of the two towns, in this particular graph it is difficult to identify local community actors who could function as potential key stakeholders in the DAM project. The diagram, however, does reveal that Genk has a slightly more extensive network than Hasselt (i.e., more nodes that are only connected to 'stadgenk'). It also counts more users who have stronger ties with their town (i.e. thicker lines between nodes and 'stadgenk'). This could indicate a stronger and more interactive engagement of citizens from Genk in the discourse on the town. In order to explore this hypothesis further, I conducted a follow-up study of Twitter data.

In the second exploration, I analysed data from Twitter to find out which recent topics and user profiles would emerge for Genk. To do this, I pulled the latest 500 tweets that included the hashtag 'genk.' This returned data from 185 unique users from 273 unique locations. The discrepancy in these figures is caused by the various names that can be used to describe the same location. For Genk, for instance, there are various options including; Belgium, Genk; Genk, Belgium; Genk; Genk centrum; city of Genk in Belgium; Genk, Limburg, Belgium; and more. Also, the various locations for #genk were situated in different parts of the world (fig. 4.12).

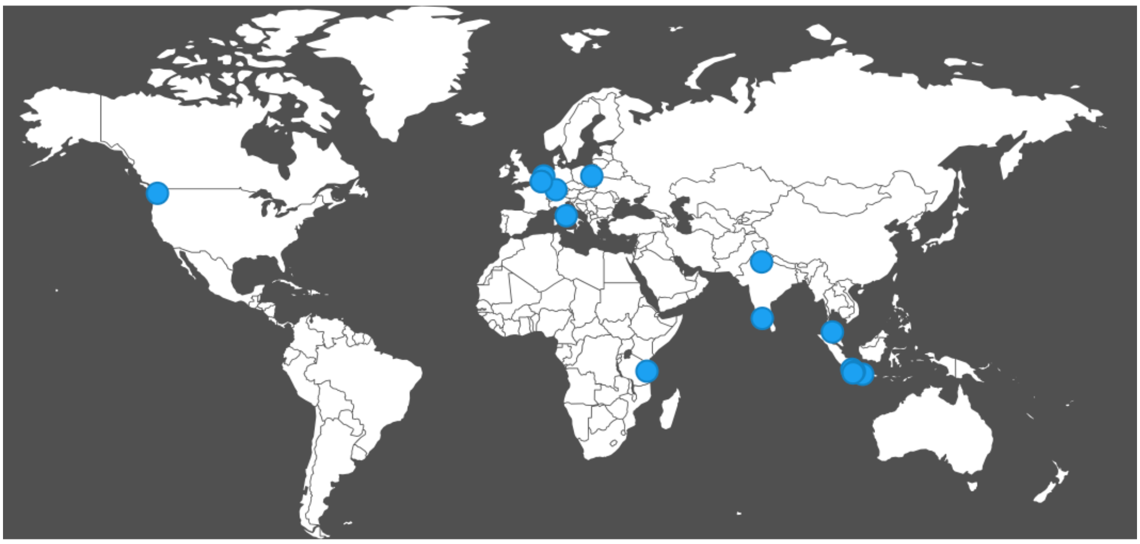


Figure 4.12 Location of tweets containing #genk

In order to explore data from locals in Genk exclusively, I filtered the tweets to create a subset only containing data from locations that refer to Genk and Belgium, which resulted in a list of 60 unique users. I then ranked this list of 60 unique users by number of followers to determine which of these users could be identified as influencers or key players. Next, I conducted a qualitative analysis of the top 25 with the highest number of followers, to determine how these users could be categorised (i.e., whether they could be grouped and what these categories could be). From this analysis, I deduced nine categories. The following diagrams illustrate which categories emerge as most relevant from this exploration (fig. 4.13, 4.14).

#genk tweets from users with highest number of followers

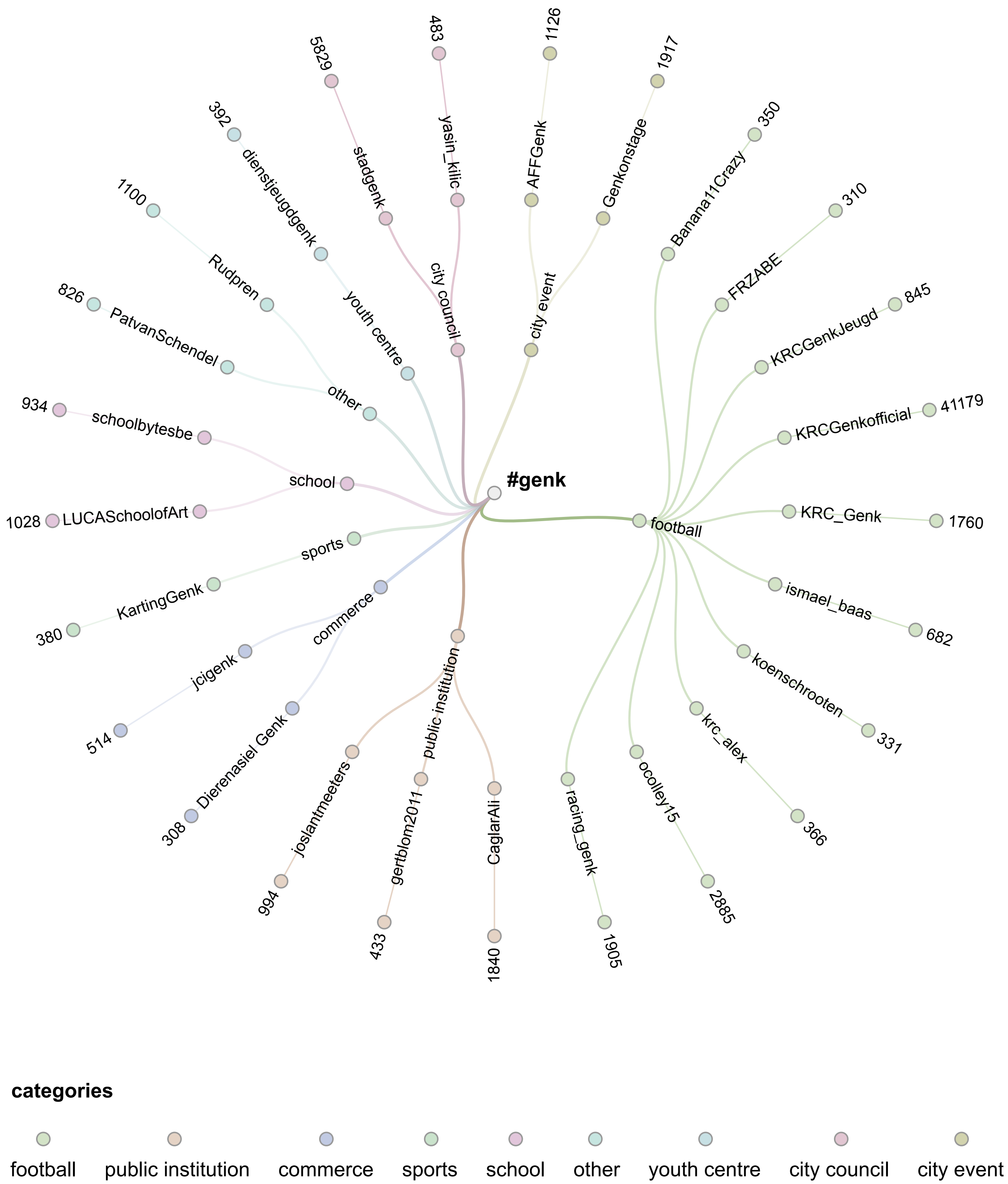


Figure 4.13

Diagram visualising '#genk' tweets from users with highest number of followers

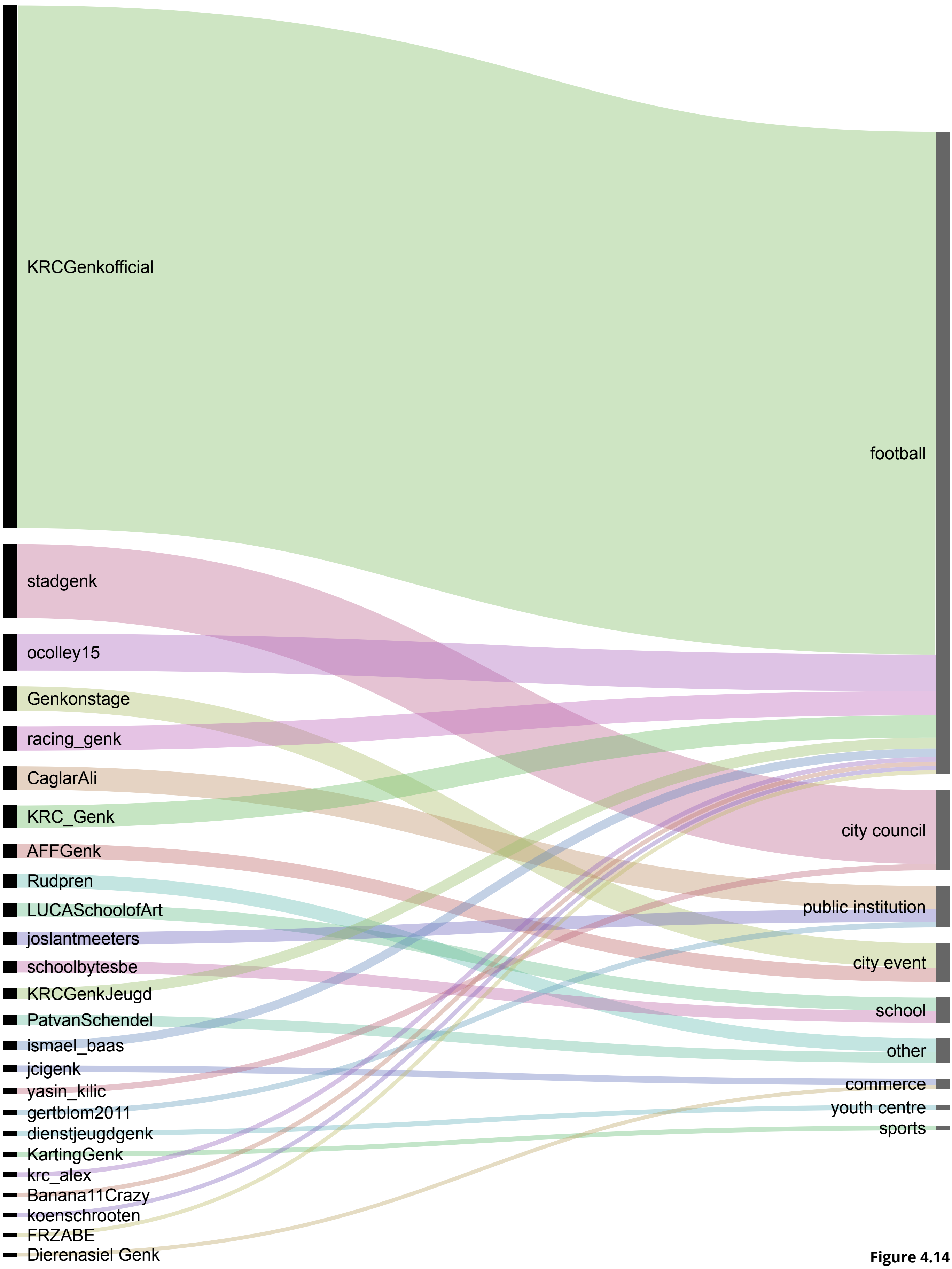


Figure 4.14
Flow diagram visualising categories of '#genk' tweets from users with highest number of followers

These diagrams demonstrate that 'football' is the category most users in Genk tweet about (32% of the top 25 according to the number of followers can be categorised as football-related), and is the category that has the most twitter followers, particularly through the twitter user 'KRCGenkofficial.' The circular graph demonstrates which categories the different user accounts can be classified under. This diagram shows that most user accounts can be categorised under the theme 'football'. The flow chart indicates the size of the user accounts by number of followers. This graph demonstrates that the category of 'football' does not only contain the most Twitter users, it also has the largest user account, and therefore has the largest public discourse by number of followers on Twitter.

KRC Genk is a professional Belgian football club that regularly qualifies for European competitions and has been one of the most successful teams in Belgium since the late 1990s. KRC Genk was formed in 1988 by merging the two existing football clubs Waterschei Thor and KFC Winterslag. FC Winterslag was founded in 1923 and Waterschei Thor in 1919, which happened shortly after the opening of three major coal mines in Genk, one in the neighbourhood Winterslag (1917), one in Waterschei (1924) and one in Zwartberg (1924). These mines were three of the seven coal mines in the region that were opened in the late 1910s and early 1920s (fig. 4.15).

Figure 4.15
The seven coal mines in the region

The development of the three neighbourhoods around the coal mines in Genk already started in 1914. Even after the mines closed in the 1970s, the neighbourhoods and their social infrastructures (such as the football clubs and neighbourhood centres) remained intact (Schlusmans 1981). Due to Genk's urban development history, the town does not have a historic centre, and, both morphologically as well as socially, the town consists of a collection of autonomous neighbourhoods, which all have their own amenities and public facilities (football clubs, youth centres, schools, shops, and so on). The town has a scattered urban layout and limited internal cohesion and has therefore been coined 'the fragmented city' (Municipal Strategic Plan 2006). While there is little social cohesion amongst the cités, there is a strong social structure and cultural cohesion within the various neighbourhoods due to the seeds planted by the mine directors and their demand to develop autonomous neighbourhoods (or villages) with diverse social programming and amenities to help establish a strong social network (fig. 4.16).

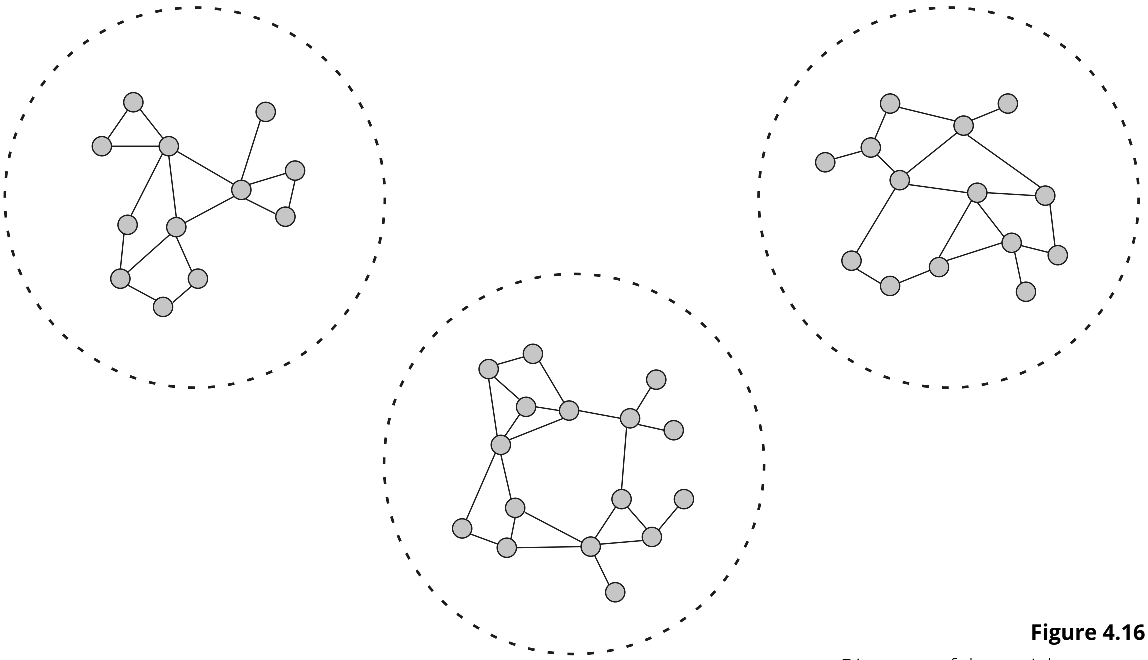


Figure 4.16
Diagrams of the social structure of the three cités in Genk; all neighbourhoods have a strong social structure internally, but there is little to no social cohesion between the neighbourhoods

For the DAM project, the team established their Living Lab in one of the three neighbourhoods, Winterslag. While the team did conduct public space interventions in various places in Genk, the choice of locating their Lab in only one of the neighbourhoods, and therewith choosing one cité over the other two, could have influenced citizen's interest in participating (fig.4.17). Rather than choosing a site in one of the cités, the DAM team could have opted for a location in a more neutral area in the town, or they could have chosen to equally represent the project in all three cités by establishing multiple locations. Also, rather than placing their Lab in an existing community space, the team chose a blank canvas and created their Living Lab in an empty shop in the neighbourhood high street of Winterslag. DAM team member Calderón noted that passers-by were not immediately inclined to enter the space and participate in projects, and the team learned that locals' unfamiliarity with the space inhibited citizen participation. Establishing their Lab in existing community spaces (such as neighbourhood community centres or youth centres) could have lowered this participation threshold and increased the likelihood and reach of citizen engagement.

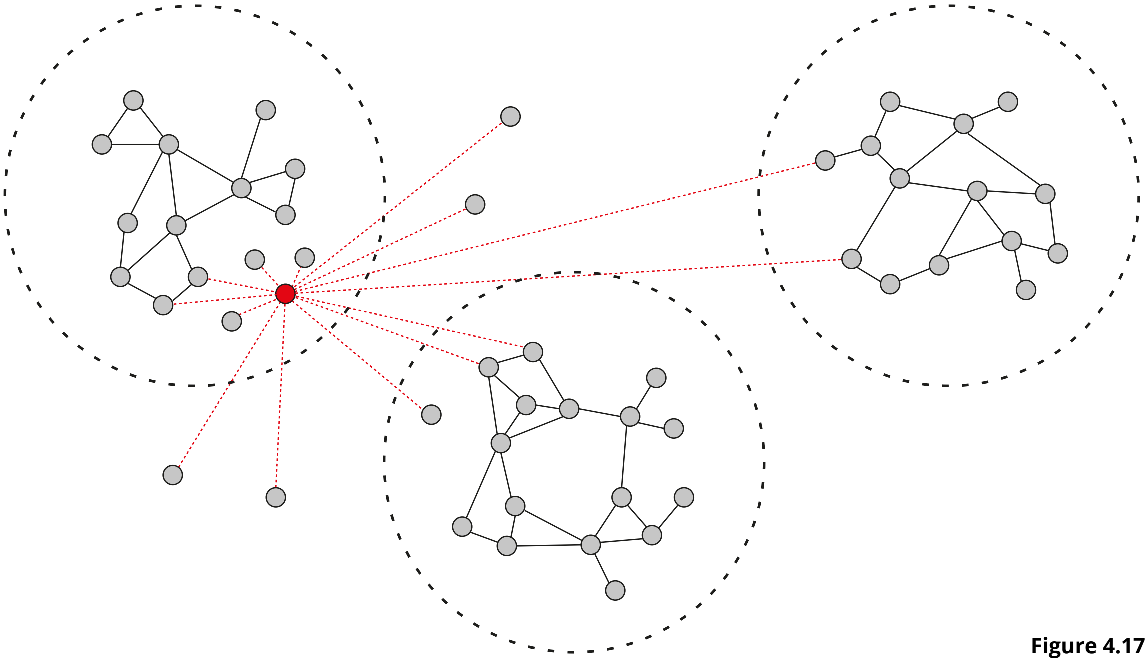


Figure 4.17
Visual representation of how the DAM team positioned themselves within the existing social structure of Genk

Another intervention of DAM was directed towards local entrepreneurs to help them visualise their social networks in order to reflect on their businesses. The team offered individual creative sessions to shop owners and other local entrepreneurs to help them gain insights into the social and economic networks they are part of, which would help them evaluate the performance of their business. Through an extensive research of local entrepreneurs and their social networks of family, friends and acquaintances, Volker et al. (2015) conclude that most social capital is generated by entrepreneurs' 'weak ties' (i.e., acquaintances), while ties with family and friends do not seem to contribute noticeably to success in their business. They found that if the entrepreneur's number of weak ties in their network increased, it would benefit their annual turnover. Therefore, the proliferation of weak ties would contribute to entrepreneurs' social capital and thereby enable the acquisition of greater economic capital. Weak ties can bring entrepreneurs into new circles, and therefore benefit their businesses through establishing new connections. DAM could have used insights into the social structure of Genk to tap into the existing social networks in the neighbourhoods and create interventions that could help local entrepreneurs from one neighbourhood establish ties with new acquaintances in the other neighbourhoods (fig. 4.18).

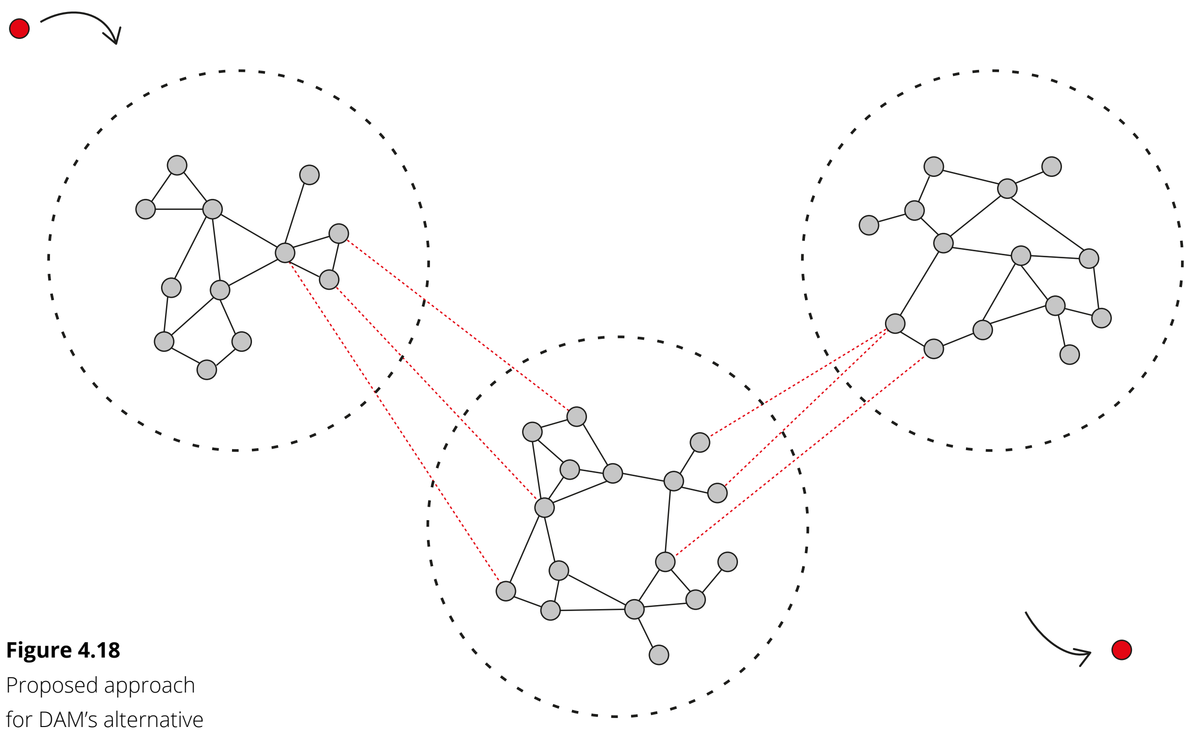


Figure 4.18
Proposed approach for DAM's alternative engagement in working with local entrepreneurs

4.4 Potential data sources to identify user groups

4.4.1 Social media data

Over the last years, there has been an increase in geo-located social network data generated through social networking services such as Facebook, Twitter, and Foursquare. These location-based social networking tools allow users to "check in" at physical locations and share their whereabouts with their online contacts (Gao and Lui 2014). Such platforms are increasingly using location-based services to assist users in physical, social encounters and the discovery of new places in a city. This chapter argues that data from such networking services can be a valuable resource for designers who aim to enable on-going civic engagement in their projects. By evaluating several examples of social media data studies, this section aims to assess how socially-engaged designers could benefit from these social media data sources. Finally, this section provides an overview of different social networking services and their respective potential value for designers.

4.4.1.1 Exploring different behaviours on various social media networks

The first case study stems from the 2014 Digital Methods Initiative Summer School, in which different SSDD media platforms were analysed and compared to find out what digital communities are saying about Amsterdam through social networking services. The data for this study were produced and published by Amsterdam-based users and extracted from the networking services Twitter, Meetup, Pinterest, and Geocaching. Geo-located embedded links, tags, threads, and pin-boards were mapped (fig. 4.19), demonstrating the places in the city where different virtual communities talk about or 'hang out.' For the Twitter dataset, the hashtag 'Amsterdam' was retrieved over a ten-day period (13-22 June 2014). As for the datasets of Pinterest, the participants searched for the term 'Amsterdam' in users' 'place' boards. The exploration of Meetup returned 489 events over a four-month period in the city of Amsterdam. Finally, for Geocaching all the existing caches (718, of which 39 temporarily inactive) placed in Amsterdam were collected.

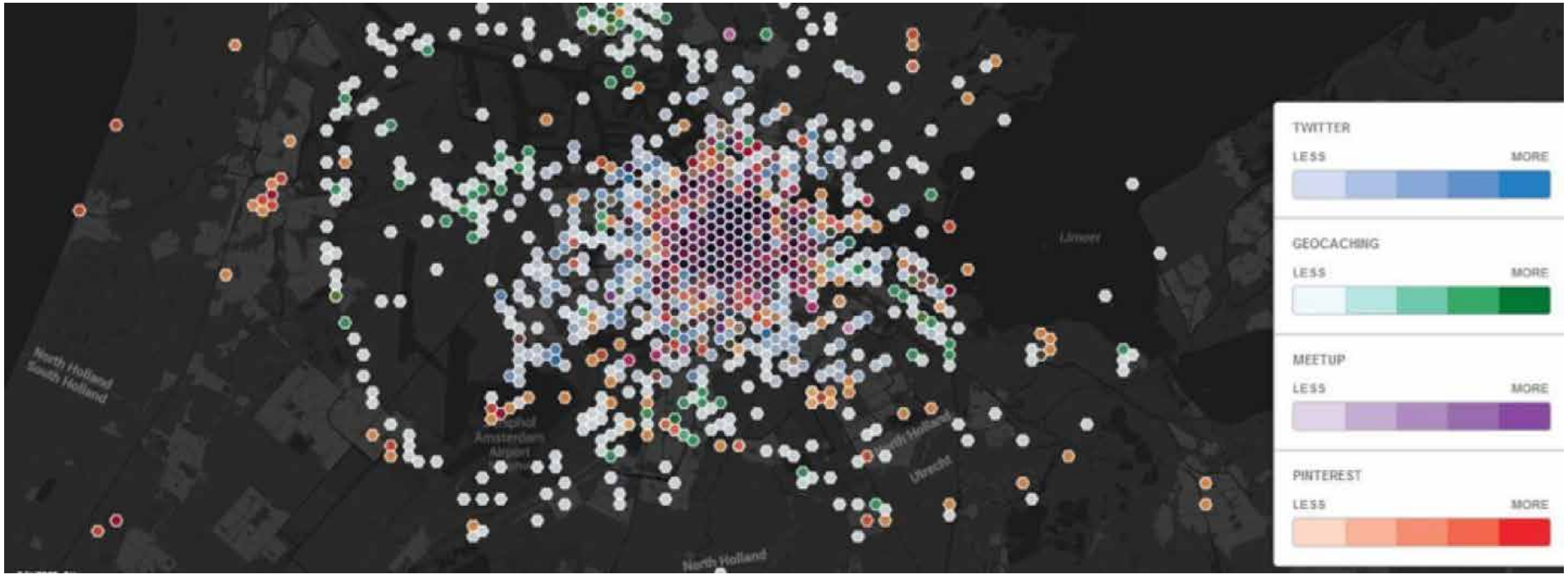


Figure 4.19
Virtual communities formed on Twitter, Geocaching, Meetup and Pinterest in Amsterdam

The map reveals that users of Twitter, Meetup, and Pinterest are located in or around the city centre. Pinterest represents the 'boutique view' of Amsterdam, outlining the shopping area of 'the nine-streets,' Haarlemmerdijk and Haarlemmerstraat. The virtually constructed communities of Meetup consist of people with a common interest (for instance in technology, fitness or fine arts) who temporarily gather in places such as bars, with a high concentration around the square of Nieuwmarkt. Of these four social networking services, only the users of Geocaching are likely to engage with places that are harder to get to, e.g. the city's periphery. As for comparing the activities on the different social networking services, the Summer School participants found that Twitter is more subject to change when events take place in the city. Their studies demonstrated a changing intensity of use and content in the data sets when certain events took place, such as a concert, a football match or a strike. For instance, when a garbage strike took place in Amsterdam in June 2014, the hashtag 'Zwerfie' (taking a 'selfie' while picking up trash) became a hit in Amsterdam West. Twitter allows designers to follow and explore a public discourse, and could, therefore, be a potential source of information for designers who are interested in groups that are formed around a local event.

The DMI research also revealed that Pinterest is more of a profiling platform where user activity is less subject to change when specific events take place. Locations are used to put forward a particular identity or association with a group and are often linked to other personal profiling sites, such as Facebook. The study also discovered that the communities on Meetup and Pinterest focus primarily on strengthening their online identity linked to commercial places, therefore mainly providing insights into users as consumers of places. The Geocaching community, on the other hand, is keen on exploring a wide range of locations that are not limited by commercial use, or the city's borders. However, Geocaching is less of a popular social media platform, as it focuses on a specific community of users who share a common hobby. This example does not comply with the central research goal in this chapter, which aims to explore communities through mainstream social networking services, and was therefore excluded from the further study of analysing SSDD.

4.4.1.2 Exploring mono-cultural communities through socio-spatial digital data

Other examples of the use of digital methods to identify (virtual) communities, and their respective use of different locations in the city, can be found in mapping artist Eric Fischer's study of Locals and Tourists[48] and the Twitter Tongues[49] project by the Centre for Advanced Spatial Analysis (CASA) research lab at UCL[50]. The Locals and Tourists maps trace geo-tagged photos in fifty different cities from photo sharing platforms Flickr and Picasa, documenting the city from either the locals' or the tourists' perspective (fig. 4.20). The Twitter Tongues study visualises the multilingual social city of London by highlighting areas where different languages are spoken (fig. 4.21). In this map, coloured clusters emerge demonstrating dominant language use in different areas. However, what this second map does not differentiate between are locals' versus visitors' tweets. In Fischer's maps, the distinction between tourists and locals is made by the speed at which the photographers travelled (observed by analysing the timestamps and geo-tags of the photos). Different coloured dots on the map represent locals (users taking pictures in the same city for over a month) and tourists (users taking pictures for a period that is less than one month).

48 Fischer's Locals and Tourists map. Available from: https://www.flickr.com/photos/walkingsf/albums/72157624209158632 , accessed 24 April 2015.

49 CASA's Twitter Tongues map. Available from: https://www.twitter.mappinglondon.co.uk , accessed 24 April 2015.

50 The Centre for Advanced Spatial Analysis (CASA) is an interdisciplinary research institute at University College London (UCL) that explores the science of cities.

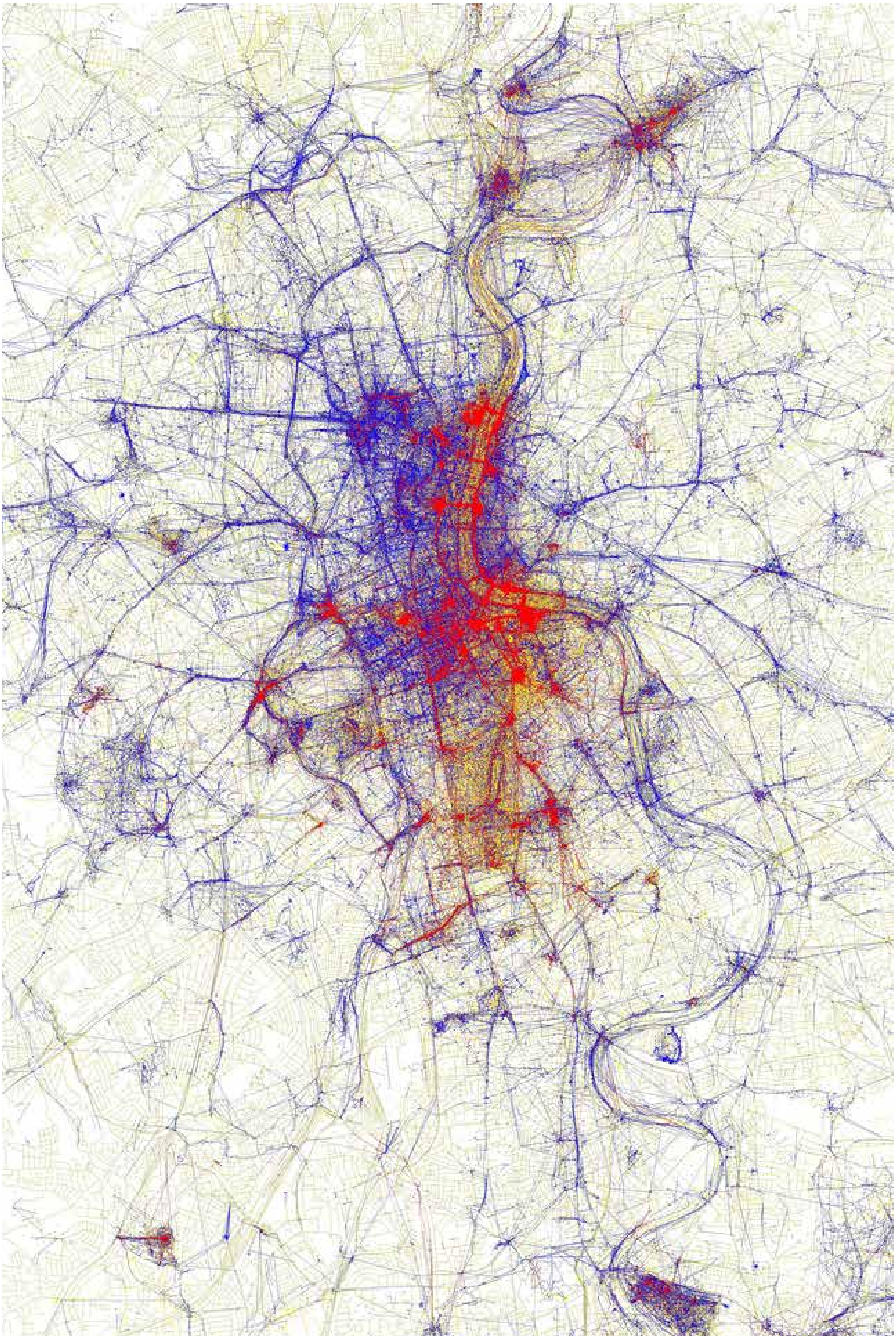


Figure 4.20
Eric Fischer's Locals and Tourists map visualising pictures taken by locals (purple) and tourists (red). This map was developed by analysing data from photo sharing platforms Flickr and Picasa

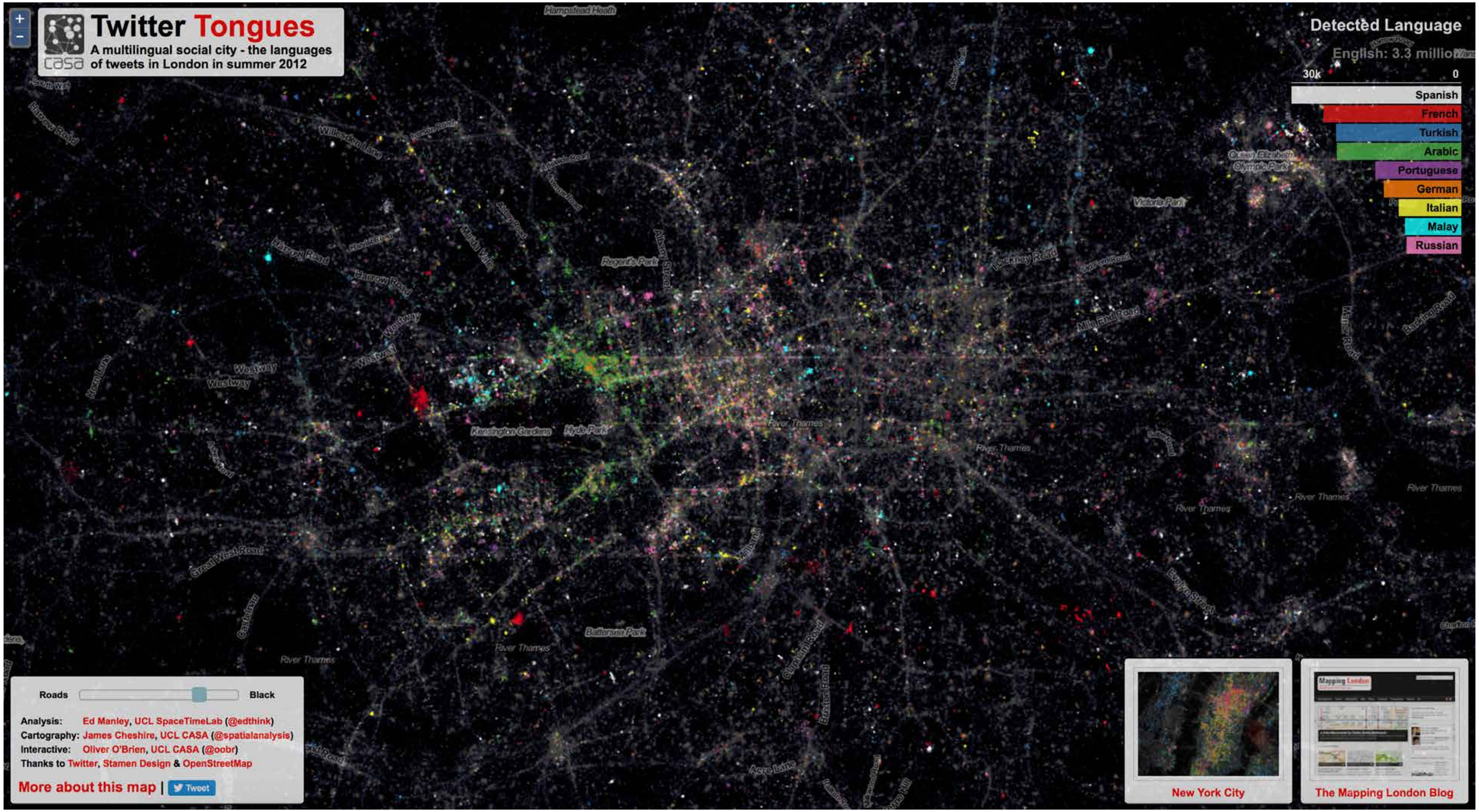


Figure 4.21
Map of different languages detected through analysing Twitter data (London summer 2012) developed by UCL's Centre for Advanced Spatial Analysis (CASA)

Although Fischer's and CASA's studies do not directly pertain to exploring long-term participation, they do illustrate an interesting point of departure for designers. Exploring this kind of socio-spatial digital data can be valuable for designers to understand the cultural background of a place where a design is planned, or to attract a particular cultural community for their design; in that case, the findings can inform designers on how and where to best plan their project. Combining the analytical approaches of Fischer's and CASA's studies could unfold in an exploration into monocultures, or multi-cultures, of local residents in an urban area. Such findings could inform designers on how to develop projects that consider the cultural dimension of the area they plan to intervene in. This approach could furthermore help designers work with, or focus on, an established community or cultural group, and facilitate the appropriation of the design project by this specific local community.

An example of a project that was successful in bringing about long-term appropriation and community engagement in public space is described in Eizenberg's (2011) research, which was discussed earlier on in this chapter. In her study on community gardens in New York City, she explored different cultural identities in neighbourhoods and learned that, due to ethnically segregated neighbourhoods and building blocks, many of the gardens existed of mono-ethnic spaces. This cultural clustering allowed for a spatial expression of these specific cultures, which in turn attracted other community members that shared the same cultural background. Most of the gardeners in Eizenberg's research were immigrants who used the gardens as spaces for a symbolic re-enactment of their childhood landscapes. Identifying with these spaces on a cultural level encouraged residents to develop a sense of ownership and control over the gardens. This example of diverse mono-cultural uses and its implications for the appropriation of neighbourhood public spaces demonstrates potential applications for studies such as CASA's language map in design for sustained civic engagement. Identifying local mono-cultural community groups could help designers incorporate cultural specificities in the design of public spaces to seed ownership and catalyse appropriation by particular user groups. However, while such a culturally-specific public space design allows for certain local community members to identify with the particular spatial expression, designers should be aware that such an approach risks excluding other users (i.e. the 'general' public).

Another useful, yet underexplored source of socio-spatial digital data useful in identifying local communities is the social networking platform Instagram. Instagram is an application which allows users to share photos and videos from their smartphones. Similar to other social networking apps, such as Facebook or Twitter, users have to create a profile to upload content and the main user interface exists of a news feed. When a user posts a photo or video on the platform, it will be displayed on their profile. Others who follow this user will also see their post in their news feed. Users can choose which accounts they like to follow, and with that decide whose content shows up on their news feed. Instagram also allows users to interact with each other by commenting on photos, liking photos, sending private messages, and tagging others in photos. Instagram was launched on October 6th 2010 and quickly became one of the most widely used social networking platforms in the world (Duggan 2015). The platform has 800 million monthly, and 500 million daily active users (Smith 2018). Over 40 billion photos have been shared on the platform so far, and according to Instagram an average of 95 million photos and videos are shared per day (Mathison 2018). Photography, in general, has changed dramatically over the years: today more pictures are taken every two minutes than during the entire 1800s (Smith 2018). Instagram can be interpreted as a participatory sensing system, where users produce data through their smartphones as they navigate their everyday lives (Lane et al. 2008; Burke et al. 2006; Boy and Uitermark 2016). Users can also choose to tag their uploaded content with geographic information. These geo-tagged photos form an unparalleled source of digital data for researchers to uncover new insights into socio-spatial dynamics in urban environments.

A study of Instagram data on the city of Amsterdam and Copenhagen by Boy and Uitermark (2016) demonstrates how geo-tagged data from this social networking service can be used to identify local communities and sub-cultures in urban environments. By collecting geo-tagged Instagram data over a twelve-week period, the researchers explore how this data could be used to study and visualise socio-spatial patterns to explore segregation, (the formation of) subcultures, and more socio-spatial phenomena in the two cities. By using the social and geographic features of Instagram data, the researchers were able to conduct social network analysis to identify distinct groups of city dwellers and socio-spatial divisions in the two cities. In this study, Instagram users are considered connected if they like or comment each other's posts, and a reciprocated relationship (mutual liking or commenting) is considered to constitute a social tie between two users (Boy and Uitermark 2016).

With their study, the researchers demonstrate that data from social networking platform Instagram can be useful to complement, and fill the gaps in more traditional and recognised quantitative and qualitative research methods on urban dynamics (Goodchild 2007). Data from social networking platforms can be used to identify groups based on observed behaviour rather than through predefined classifications. This allows for more granular and dynamic insights into urban populations and subcultures (Boy and Uitermark 2016). Furthermore, these data also provide insights into the dwelling patterns of different user groups in the city and can help explore what role these places play in the formation of subcultures and groups. In their research on dwelling patterns in Amsterdam and Copenhagen, Boy and Uitermark (2016) used both network and spatial data from Instagram to identify communities or user groups and to map the places Instagram users take pictures of. Combining this data allowed the researchers to discover socio-spatial segregation through the presence or absence of social networks in different places in the city.

4.4.1.3 Location Based Social Networks (LBSN) analysis in marketing and computer science research

Examples of design practices that work with socio-spatial digital data to discover local communities are scarce. Moreover, information on existing examples that do answer to these criteria, such as the Eindhoven project, is often limited and hard to find. The meagre results in this field could be a result of the novelty of designers working with SSDD. Therefore, rather than being restricted to the art and design fields, this section looks towards other fields, such as computer sciences, where new uses and approaches for analysing digital data have been widely adopted as it has proven to bring financial success to numerous businesses (such as Amazon, Google, and Facebook).

Several architecture and urban design professionals, such as Carlo Ratti (architect and director of MIT's Senseable City Lab) and Michael Batty (Professor at the Centre for Advanced Spatial Analysis at UCL), are engaging with data from social network services to uncover, and gain insights into, the distribution and spatial patterns of social life in cities. In marketing and computer science studies, however, a different approach towards such SSDD has been developed. Location-based social network (LBSN) data from sources such as Foursquare or Facebook Places are analysed by computer scientists to discover communities of users (Cranshaw et al. 2010; Hung et al. 2009; Ying et al. 2010). While studies from a marketing perspective aim to find new ways to improve the recommendation features of these platforms (Wang et al. 2014; Zheng 2011), this section addresses whether such an algorithm-driven method of community discovery could be a useful tool for designers. Therefore, rather than discussing the technological features of recommendation systems, or the computational specificities involved in discovering user communities, this section focuses on how these studies define user communities. What qualifies as a community in their data analysis? Could this method be useful for designers who aim to discover active local communities who could potentially appropriate a design?

By estimating the similarity of location histories of two different users, computer scientists believe they can calculate the likelihood of these users belonging to the same physical community. LBSN services, such as Foursquare, apply these user-similarity findings to optimise their friend recommendation and location recommendation features. Such services can, for instance, discover new locations based on other users that are compatible with a user's preferences, and with that offer a 'personalised location recommender system' (Zheng 2011:262). The LBSN studies expect that people who share similar location histories are likely to have similar interests and preferences. As this is a quite optimistic and simplistic hypothesis, not only the geographic space is analysed; the semantic space is another critical factor that is taken into consideration. LBSN researchers believe that a person who often visits stadiums and gyms is likely to be fond of sports. Therefore, the researchers articulate a second claim: people who access locations with similar semantic meanings have a higher likelihood of having similar interests and therefore are more likely to belong to one or more of the same communities.

The LBSN studies indicate that communities are not only shaped by shared geographic locations, but also by a shared semantics of places. This notion is reflected in Eizenberg's (2011) example, where communities were established though shared cultural semantics, which allowed them to collectively experience and appropriate a local public space. While identifying physical communities through LBSN data based on only two features (geography and semantics) is not entirely unambiguous and reliable, the computer science approach could serve as an interesting starting point to assess how useful different socio-spatial digital data sources are for designers. Could exploring the use and semantics of shared spaces through digital data potentially help designers discover and articulate a suitable programme and design?

The LBSN studies demonstrate two essential features that designers need to be aware of when studying communities or user groups through socio-spatial digital data. The first feature, which has already been discussed in the Eindhoven example, is users' shared geographic locations. This feature is relevant in addressing communities who are active in the physical realm, and not only in the virtual, since physical presence is an essential aspect in maintaining material, and local, engagement in a project. The second feature concerns identifying the semantics of a location and determining whether different users share these. The case studies in this chapter demonstrate that not all social networking services provide insights into both of these aspects. Particularly the search for a shared semantics is challenging. Moreover, even if different users share a geographic location and its semantics (e.g. Pinterest users' shared interest in shopping in the 'nine-streets' of Amsterdam), it does not necessarily indicate a potential community that would sustain a physical design project. Therefore, another fundamental aspect to explore is the nature of a shared semantics.

The examples of the DMI Summer School (section 4.4.1.1) illustrated this difference, where data from Pinterest demonstrated a predominantly consumerist view of the city of Amsterdam, while data from Twitter, particularly with #Zwerfie, demonstrated a group of users who share a concern about a public matter, i.e. the pollution of public spaces in the city. Assessing whether a shared interest, event or topic belongs to a public good (such as public space or air quality) or a private good (e.g. products of consumption such as clothes, food and beverage, and so on) could help designers estimate the likelihood of a user group's interest and willingness to participate in, and appropriate, a public space design project.

Fischer's and CASA's studies revealed the geographic locations of users who share specific features. By studying pictures uploaded on photo-sharing platforms Flickr and Picasa, Fischer explored whether users were locals or tourists, and by analysing different languages used in Twitter posts, CASA mapped the locations of various cultural groups in London. Different from the other examples, these studies do not tell us anything about a shared semantics between users. However, these data can be used as a first step into a more elaborate and qualitative exploration into possible shared semantics among cultural groups. These studies also demonstrate a different approach towards mining socio-spatial digital data. Rather than exclusively mapping geographic data, such as the DMI studies where tags of 'Amsterdam' were mapped for different social media platforms, Fischer's and CASA's examples explore similarities and differences in people's use of the online platforms. The Locals and Tourists map, for example, not only differentiates in the locations where pictures are posted but also in speed and frequency with which different users upload their pictures.

CASA's Twitter Tongues study could be a useful starting point to learn about possible cultural networks of locals based on the language they share, and reveal where certain cultural groups are located in a city. This could be succeeded by a more in-depth (offline) exploration of specific cultural dynamics and habits in, or uses of, public spaces (as illustrated in the Eizenberg example). By addressing the spatial needs and desires of these user groups, designers could create spaces that are more likely to be appropriated by a specific cultural community. The single-ethnic gardens in New York demonstrated that unique uses shaped by a community's cultural identity allowed for different user experiences of a space through its particular spatial arrangement, aesthetic expression, and specific use (influenced by culinary preferences, customs, rituals and so on). Through these cultural clusters, the gardeners were able to experience, celebrate and express their culture in a collective way, which allowed them to contextualise their sense of belonging to their collective culture. Enabling on-going production and participation in the gardens allowed community members to grow a sense of ownership, which has led to the sustained engagement of a specific community in these local public spaces (Eizenberg 2011). Designing a space with such a hyper-specific semantics for one particular community, however, also leads to the exclusion of others. Those who don't belong to these specific communities will feel less welcome to use the space. The spaces will therefore no longer be available to the wider public.

While developing a highly tailored programme that caters to the needs of a particular community (such as the mono-cultural community gardens) can function as a catalyst for the appropriation of a design, it risks excluding other users. The Eindhoven example demonstrates that a shared semantics does not have to be limited to one specific programme or activity. Shared semantics can also exist in a broader subculture, such as the hip-hop scene in Eindhoven. This broader inclusion of several activities, held together by a specific lifestyle, has increased the resilience of the space. When one of the communities formed around a specific activity loses its interest to engage with the space, other communities can take over or can use the space in a different way. By incorporating a certain degree of hybridity, designers can generate spaces that are more resilient in dynamic situations where user patterns may transform over time.

The following taxonomy (table 4.1) summarises the lessons drawn from the different case studies, and assesses the value of the various social media platforms for this chapter's proposed approach. The table demonstrates that there are different approaches towards analysing social media data, and different levels of usefulness of digital data sources for designers. Some of the analysed case studies start off from a geographic location to find user groups, while others start from a particular feature that is shared by a user group (such as language-use in CASA's example) and then explore the geographic locations related to these features. The taxonomy highlights the importance of identifying the nature of a shared semantics, which can inform designers on the likelihood of participation in, and appropriation of a design by specific user groups.

Finally, the section acknowledges the ambiguity of LBSN explorations. While such studies are too unreliable to function as standalone evidence of active local communities, studying LBSN data could form a useful initial exploration to inform a more directed and detailed investigation through offline methods (e.g. surveys, interviews, observations). This synergy between online and offline methods is explored in more detail in Chapter 4.4.3.

Next to data from social media services, there are numerous other digital data sources available that generate useful data on user engagement and could be of value to designers who aim to bring about sustained engagement in their projects. The next section explores one of these sources and evaluates how data from civic apps could be valuable in this endeavour.

Table 4.1
Taxonomy of case studies

Case study & social media service	Location > User group or User group > Location?	Established network? (digital or physical)
DMI - Pinterest	Location > User group	No (based on individual profiles)
DMI - Meetup	User group > Location	Yes (digital: users belong to digital networks/groups sharing an interest/hobby)
DMI - Twitter	User group > Location	Yes (digital: by applying same hashtag)
Eindhoven - Facebook	Location > User group	Yes (both digital and physical; users are members of Facebook group pages)
Eric Fischer & CASA - Twitter, Flickr and Picasa	User group > Location	No (based on individual's language-use)
Amsterdam & Copenhagen study - Instagram	Location > User group	Yes (digital: by applying same geo-tag and by following and liking other users' content)
LBSNs research - Foursquare and Facebook (places)	Location > User group	No (research to discover possible networks/connections)

Shared semantics? (Programme? Specific use of space?)	**Useful source of data for sustained community engagement in public realm project?**
Yes (consumerism; shopping, food and beverage, and other lifestyle aspects)	- Pinterest users are generally more interested in consumer goods rather than public goods
Yes (use for their specific hobby or commercial places such as bars to meet)	- Meetup users are generally more interested in commercial places and personal interests (i.e. hobbies such as sports)
Yes (public space as a public good, improving the quality of it)	+ Twitter can be a useful source to follow a hashtag about a public good and map the online community around it (along with their geographic relations)
Yes (skate and BMX program and hip-hop subculture)	+ Facebook can be a useful source to identify community groups who organise themselves around a subject or place
No (however, cultural use could be derived from language, therefore language study is just a first step in the semantic xploration)	+- Further research is needed to analyse whether there is an active local community, this data could be used as an initial exploration
Yes (can be derived from content of posted images and of content of liked and followed content)	+ Instagram data can be useful to start an exploration into (local) subcultures
Yes (e.g. sports bars, gyms, etc. are seen as a shared semantics: sports, and are therefore used to indicate possible connections between individual users)	+ Can be useful data to start exploration, however further research is needed to identify whether geographically similar users have shared interests (or interest in public goods)

4.4.2 Data from civic applications

There is another important source of data, which has, so far, remained largely underused in general, and by socially-engaged designers in particular: 'civic apps'. Civic apps are software applications that aim to encourage citizens to participate in decision-making in their local environments. Such apps are used by various design firms, such as BPM architects, for community consultation in neighbourhood projects. At the moment, however, there is no deeper exploration of data on citizen engagement produced by these apps. Civic apps, such as Commonplace or FixMyStreet, harvest vast amounts of data on users' perceptions and desires for their local environments, i.e., through comments by locals on the quality of the local public spaces or their ideas on proposed new developments. These apps also produce a lot of meta-data; a by-product which results from user engagement with the digital tool. This meta-data includes the time users spend on the platform for each visit, whether users are first-time or returning visitors, when users have placed a comment, and so on. Furthermore, for users to be able to engage with, and place comments on platforms such as Commonplace and FixMyStreet, they first have to sign up and create a user account. In order to create a user account on Commonplace, for example, users have to fill out some personal information, such as their age, gender, ethnicity, and their ownership status (i.e., whether they rent or own their property). While these data could offer valuable opportunities to gain more insights on user engagement, they are currently often interpreted merely as 'digital exhaust' of the technological application, and there are few to no studies that make use of these data and meta-data. Chapter 3 demonstrated how these demographic data could be used to explore whether civic app users form a representative sample of the local population in community consultation processes, and how designers could use the findings from these studies to identify underrepresented groups. This could empirically demonstrate that there are community groups and members who are excluded from local decision-making processes. It was argued that designer could use this input to act on behalf of those marginalised communities.

Below, I propose a second use for civic app data sets, and explore the meta-data produced by Commonplace. More about the nature of user engagement in local urban and public space development processes can be learned by analysing the app's meta-data. Meta-data produced through the engagement of users with the app could be used to identify key players in local communities and community members who are more likely to engage in and take ownership over public space projects.

4.4.2.1 Analysing Commonplace's meta-data

During a 6-month secondment at Commonplace (see Chapter 3), I conducted several studies on the performance of their civic technology by analysing the digital data their app produced. Through various studies, I analysed what meta-data was produced through users engaging with the app, and how this data could be of use both to the tech start-up to improve their digital technology, and to socially-engaged designers who aim to gain insights into citizen engagement in participatory processes. Rather than looking for specific information or aiming to validate a predefined research question or hypothesis, I adopted a Grounded Theory approach (see Chapter 2.3.1) and let the data lead the investigation. I explored the various datasets to learn what information they disclosed. During my secondment, I also created an online survey containing questions on user's experiences with the app, which resulted in an additional dataset of survey responses to explore. I analysed whether the various datasets could be amended to look for correlations within a wider range of data. This approach led to a number of studies, including one of Commonplace users' likelihood for long-term engagement in design feedback projects (i.e. projects that present users with a design proposal for the neighbourhood and ask them for feedback) compared to needs analysis projects (i.e. open projects where users are invited to comment on anything they find relevant for the neighbourhood, including problematic places, places they enjoy and what they would like to add to the neighbourhood) (fig.4.22). Other studies included a visualisation of the percentage of returning visitors to the platform (fig. 4.23), the number of comments placed for a design feedback in comparison to a needs analysis project in the same neighbourhood (indicating how users engage in the different type of consultation projects) (fig. 4.24), and the average time it took users to place a comment for the different type of projects (fig. 4.25). In one of the studies, I ranked the most engaged

Ongoing engagement - Cp data

Only comments dataset Leabridgeroad and LBRProposals available with email addresses...

Leabridgeroad (Needs Analysis):
Registered users: 143
Emails (opted to be contacted): 65

45% of registered users wanted to be kept in the loop

LBR Proposals (Design Feedback):
Registered users: 187
Emails (to be contacted): 97

52% of registered users wanted to be kept in the loop

Conclusion:
Users are more willing to be engaged in an ongoing way in Design Feedback projects than in Needs Analysis.

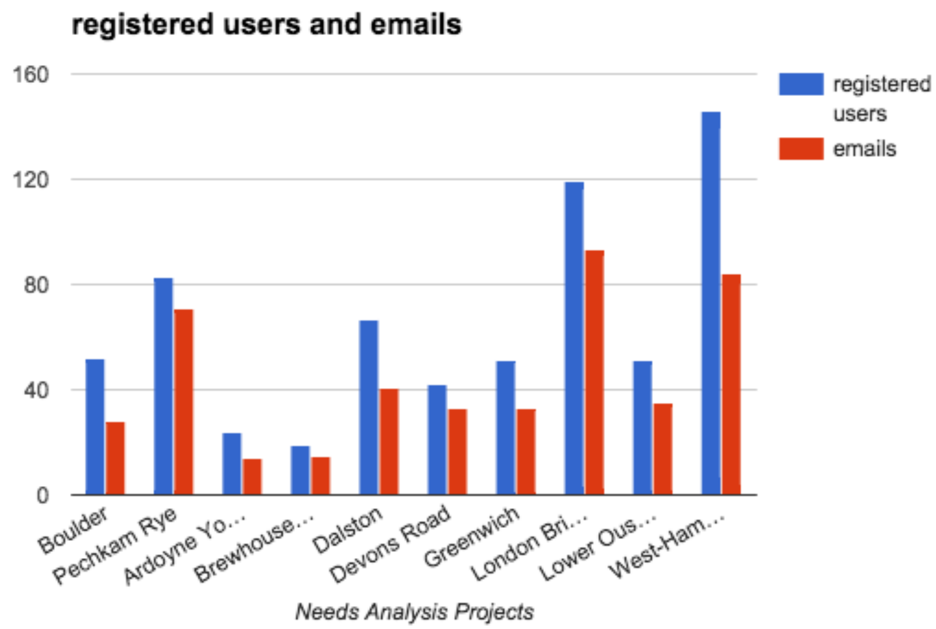
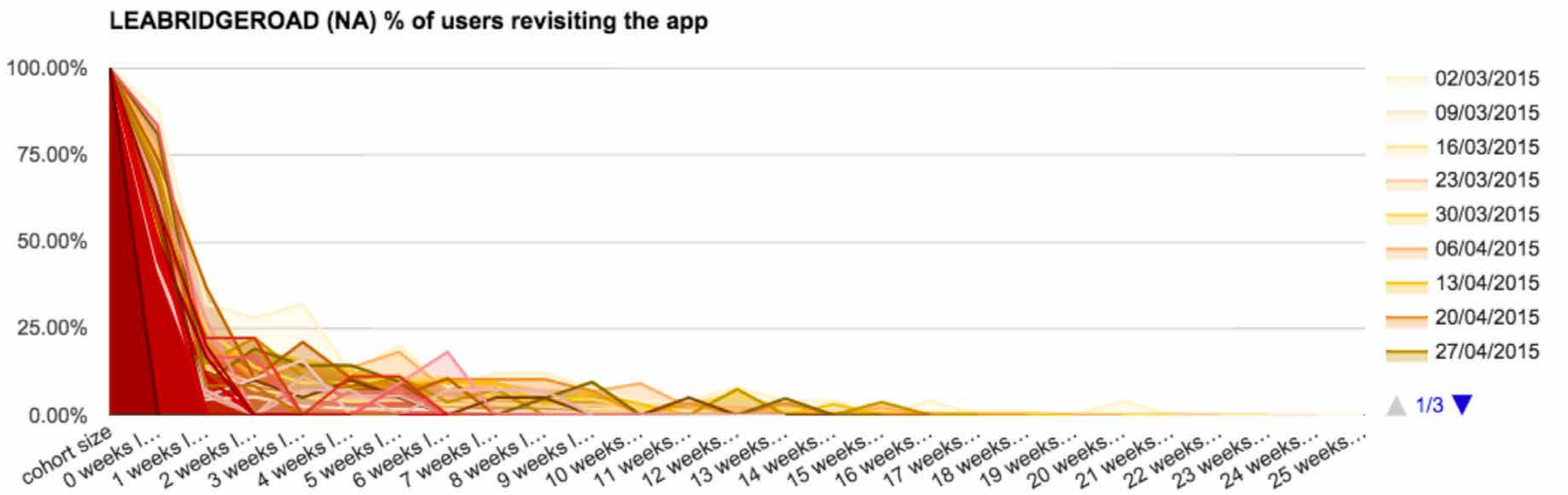


Figure 4.22
Diagram comparing willingness of long-term engagement by Commonplace users for different Design Feedback vis-à-vis Needs Analysis projects

Ongoing engagement - Mixpanel data



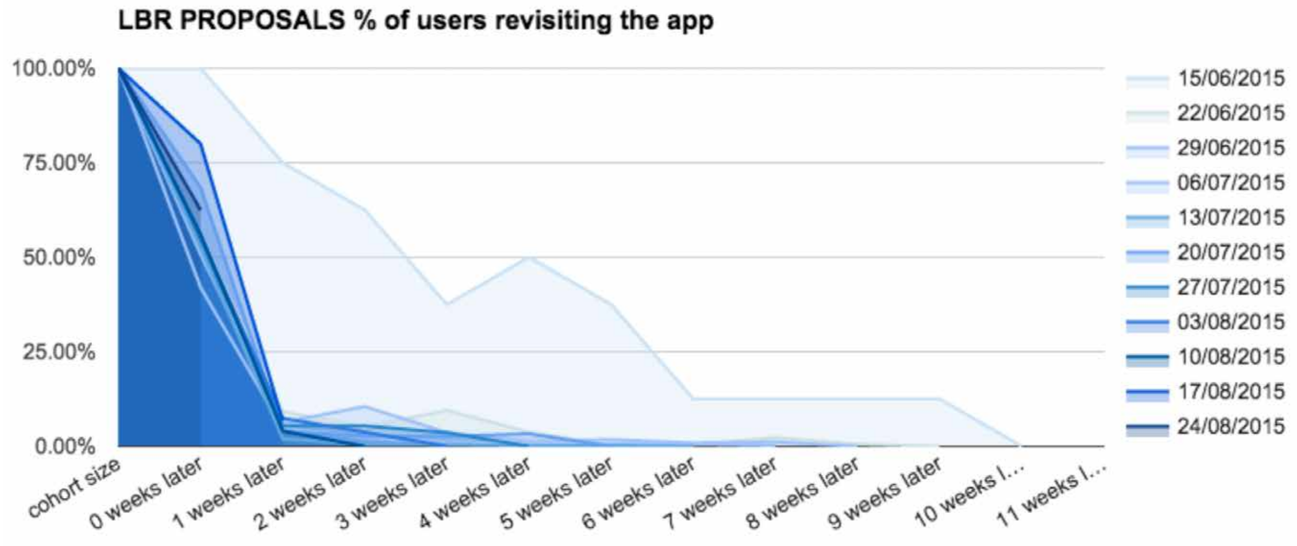
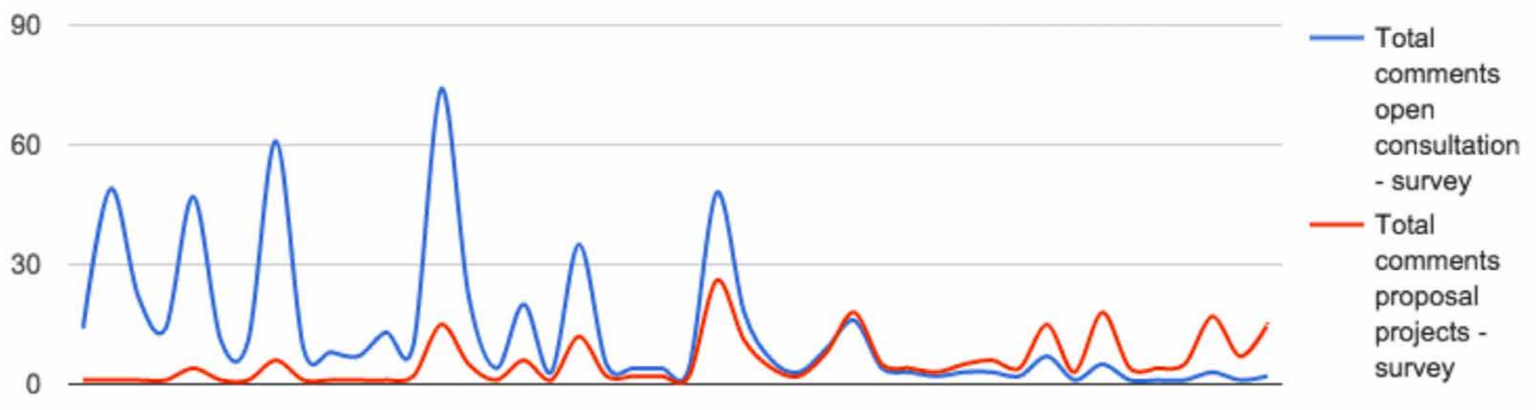


Figure 4.23
Diagrams visualising percentage of users revisiting the app for a Needs Analysis project (top) and a Design Feedback project (bottom). Diagram reveals that there are more returning visitors in the Needs Analysis project

User activity

Of the users that commented in both NA and DF projects for Mini Holland: nr of comments per project



Conclusion:
For Mini Holland: Users that commented in both NA and DF projects generally place more comments in NA than DF projects.

This might be due to the number of NA projects (8) in relation to DF projects (2).
Analysis could be improved by focusing only on Lea Bridge Road & Church Road vs. LBR Proposals & Churchroad Proposals.

Figure 4.24
Diagram showing the number of comments for a Needs Analysis (NA) versus a Design Feedback (DF) consultation. Diagram demonstrates that Commonplace users tend to place more comments in a NA consultation

User activity

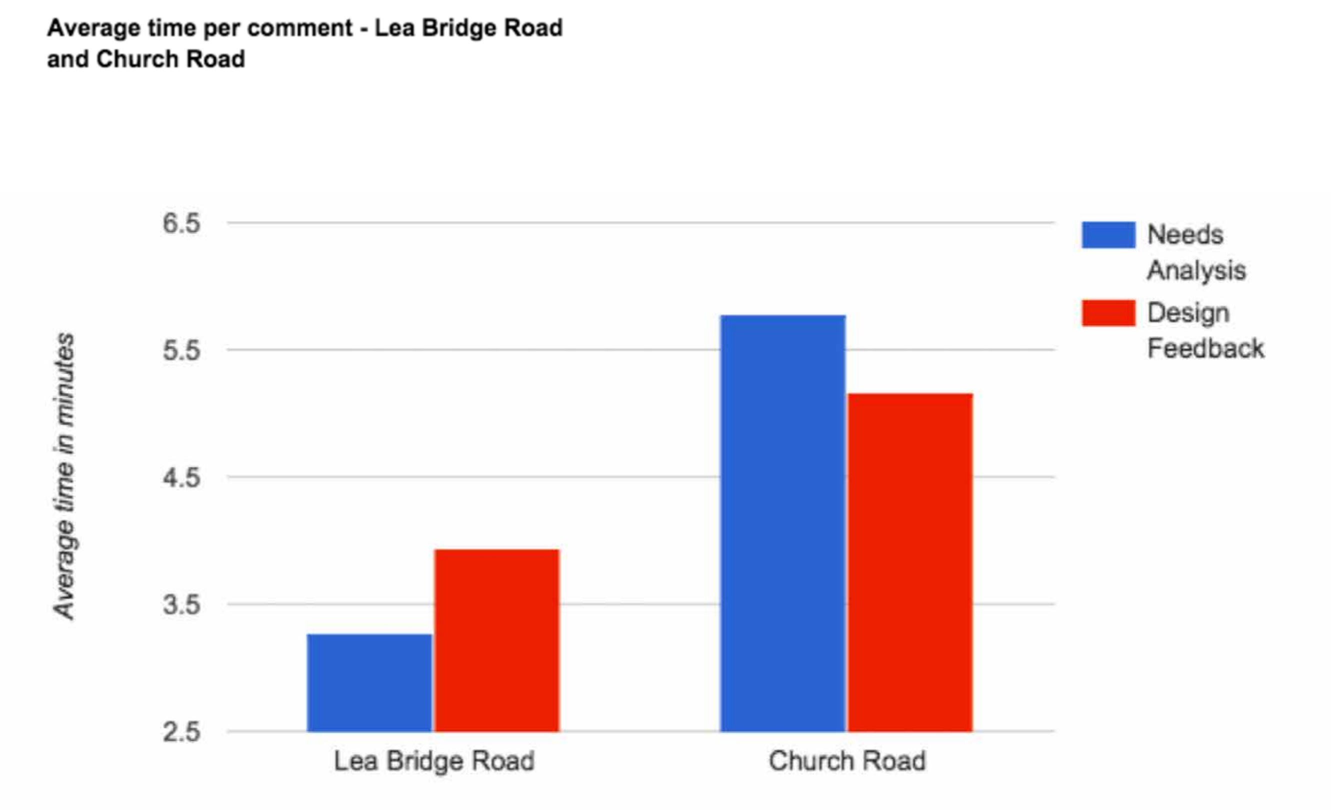
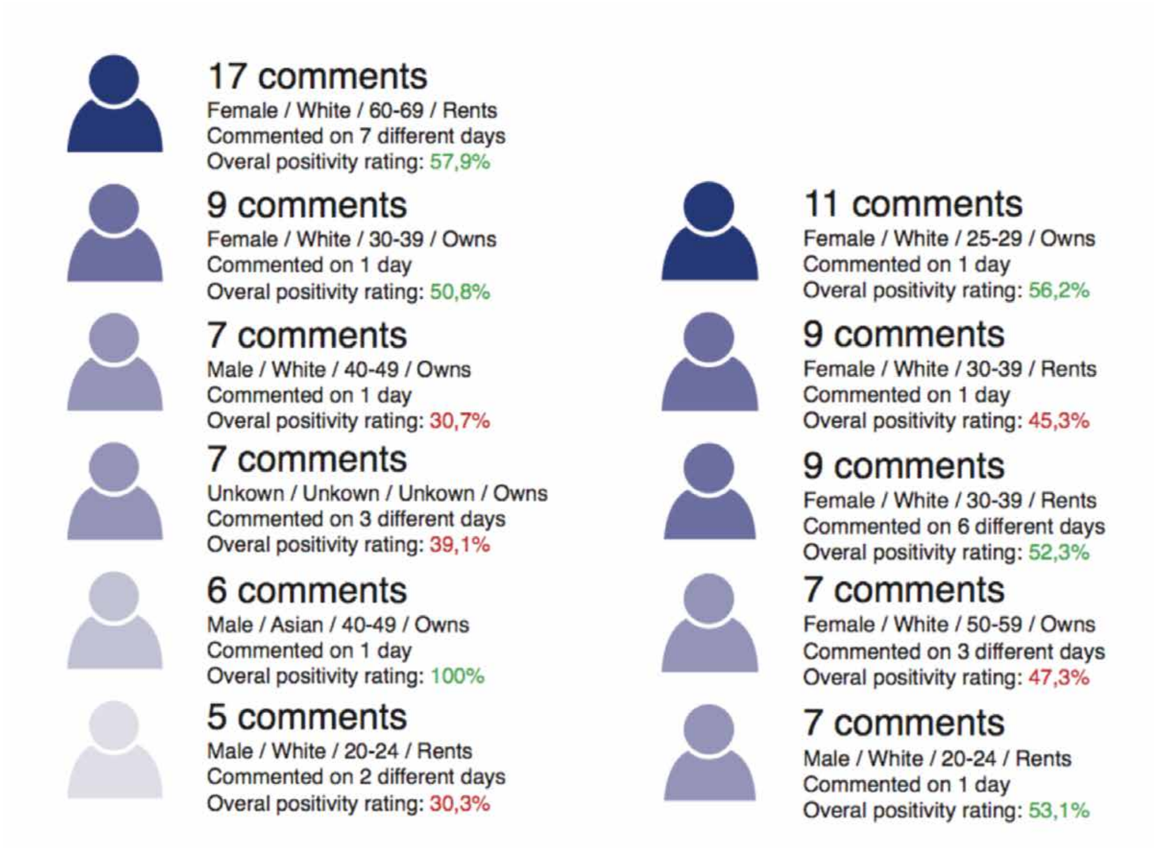


Figure 4.25
Diagram demonstrating the average time Commonplace users take for placing a comment. The chart visualises the time for Needs Analysis projects compared to Design Feedback projects

users by the number of their comments posted on the platform. I then attached the dataset on user profiles to the ranking and, with that, created a user engagement ranking containing information on users' number of comments, when the comments were placed, whether these were positive or negative comments, and what the users' age, gender, ethnicity, and ownership status were (fig. 4.26).

Figure 4.26
Ranking of 'most engaged' Commonplace users by number of comments placed in a project



This analysis demonstrates that the most engaged users for these Commonplace projects (i.e. users who posted most comments and in some cases over an extended period) are females from a white ethnic background representing all age ranges (20-69 years). While earlier studies that explored whether the app users were a representative sample of the local population demonstrated that most Commonplace users are white males between the age of 40-60, this study demonstrates that those users are not the groups who can be classified as 'most engaged.' The white female user group seems to take more time in interacting with the platform by placing more comments and, in some cases, revisiting the platform and uploading comments over a more extended period (i.e. placing comments over a period of several days). The findings of this study could indicate that white female community members are more likely to engage long-term in public realm projects in these areas. These female community members could therefore also be more likely to take ownership of a design and safeguard its social sustainability.

These studies are limited to the degree that they only use one source of data (i.e. Commonplace data), and therefore do not paint a complete picture of user engagement in these areas. However, these findings could be used by designers to identify engaged community members and conduct further investigation into key figures within a local context. The next section will elaborate on this issue and discusses the limitations and benefits of socio-spatial digital data to identify locally active communities and community members.

4.4.3 Online versus offline methods for mapping community resources

While analysing socio-spatial digital data can enable designers to identify certain community groups and members in some situations, particularly when neighbourhood communities have some internet presence, for instance, through a project web-page or by being active on social networking platforms, there are a large number of community groups and community members who have no, or limited online presence and are therefore left out of the digital exploration. A study by Marcus and Tidey (2015) focuses on precisely this dilemma. In their 'Community Mirror' study, funded by innovation foundation Nesta[51], the researchers analysed the performance of online data-gathering techniques compared to offline door-to-door methods for identifying and learning about local communities. In their study, the researchers recognise that collective community activities (such as pub quiz nights, street markets, and so on) and community places (such as pubs, parks, streets, and so on) form the so-called 'social economy' of a neighbourhood, which, for a large part, are not recorded in any formal or structured way and often take place 'below the radar' (Markus and Tidey 2015:5).

In their online study, the researchers explored digital data both from local web platforms and from social networking platform Twitter. They then conducted offline research through surveys and interviews to map local social networks and community assets (including people, organisations, and events). In order to identify relationships and connections that make up the community, the researchers asked neighbourhood residents from whom they get their information, to whom they might go to discuss local matters, and which (local) places people would go to feel part of the community. The research team then mapped the community assets that emerged from these interviews, along with the connections between the assets and the interviewees, to create a visual representation of the neighbourhood's social network. By comparing these offline results to their online findings, the researchers discovered that through their digital data exploration they had successfully identified 31 percent of the community spaces that were mapped offline.

51 www.nesta.org.uk

Furthermore, the researchers found that with their online data study they identified additional community assets that were not mentioned in the offline interviews. Therefore, the researchers conclude that digital data could help supplement offline findings of community asset mapping.

The Community Mirror project demonstrates that, while digital data does not entirely represent the local social context, online data analysis can result in discoveries that could supplement, or lead to more targeted, offline explorations. Digital methods could, therefore, be combined with offline asset and community mapping methods to generate a more accurate picture of a local social context. Keywords, locations, or persons emerging from surveys or interviews could function as input into the digital exploration to discover more relevant results. On the other hand, the digital exploration could also function as a starting point for more qualitative offline research into local communities and local resources. Such an initial exploration of online communities, for instance, helped architects at Space and Matter (see Chapter 4.3.2) identify two geographically active community groups who were informal users of the space they were commissioned to redesign. The user groups who were identified by analysing digital data from social networking platform Facebook were then approached by the architects. By conducting qualitative interviews, the architects learned about the community's wishes and spatial requirements for the space. Designers could start their exploration with digital methods to identify active communities or key players in the community, such as in the Space and Matter example, and follow-up their investigation by contacting these identified communities (and community members) for physical face-to-face interviews to gain more in-depth and qualitative insights into the local needs and wishes.

The nature of the data that can be extracted from digital sources is different from information one gains from face-to-face encounters, which is often more qualitative. Furthermore, in an offline face-to-face approach, the role of the designer or researcher transforms from an observer to an interviewer, a more engaged role through the interaction and two-way relationship with locals. Stakeholders involved in the Community Mirror interviews emphasised that door-to-door asset mapping and face-to-face contact with locals are vital methods to engage neighbourhood residents in local projects. Such an interpersonal exchange and engagement would be lost if these offline techniques would be entirely replaced by digital data analysis. This sentiment is supported by some of the Commonplace app users, who voiced their concerns about digital consultation tools taking over traditional face-to-face methods. One of the Commonplace survey respondents commented that they preferred 'meeting as a group to discuss concerns' and voiced their discontent about the lack of constructive offline discussions with fellow residents, members of their local council, and property developers (Golchehr and Schmidt-Soltau 2015). Another respondent argued that it was not clear to them that an online consultation process was going on, and that they missed information 'on the ground.' This particular survey respondent raised that 'with something so massive [as a local urban regeneration project] it should have been people on the street talking to people, you cannot rely on leaflet drops and the odd pop-up that I saw once as I drove by having no idea what it was about'. At the same time, another respondent commented that 'the ease of access means you are getting more opinions' (Golchehr and Schmidt-Soltau 2015). Furthermore, local stakeholders in the Community Mirror project raised concerns about offline techniques, which require a lot of time and resources and could therefore only be conducted over long periods of time. Due to changes in volunteer availability and scarce financial resources, such on-the-ground interviews and mapping exercises cannot take place regularly, risking information acquired during these sessions to go out of date and become unrepresentative of the actual local situation. Analysing digital data from social media platforms, on the other hand, can provide live and up-to-date information and therefore provide a more dynamic insight into the social economy, while, at the same time, offering a wider reach. Furthermore, digital data analysis is less resource-intensive than current offline approaches involving manual methods, such as door-to-door surveys and participatory asset mapping exercises.

As with any method, there are limitations to a digital approach in mapping the social network and community assets of a neighbourhood. First of all, several community groups and members, i.e. those that have little or no access to the Internet, will be underrepresented in the digital findings. However, in the Community Mirror study, the research team learned that community assets that did not have a web presence were still discovered by analysing other people's comments on social media.

Next to social media platform Facebook, micro-blogging platform Twitter is another promising source of socio-spatial digital data discussed in this chapter, which can be analysed to identify social networks. Twitter's hashtags are digital devices that categorise and collect tweets according to the specific topic they relate to, such as #climatechange, #publicspace, or #genk (Bruns and Burgress 2011). Generally, people use hashtags to initiate or contribute to, a conversation around a specific topic or interest. Following Twitter hashtags can, therefore, be a valuable method to investigate online social formations. However, following hashtags alone will not provide sufficient information to generate a detailed understanding of a social network. Science and technology sociologist Hine (2015) stresses the importance of triangulating outputs from quantitative online data analysis with insights from traditional offline qualitative techniques (such as face-to-face interviews or surveys). Nonetheless, exploring the virtual representation of a physical realm by studying socio-spatial digital data is a very resource-efficient way to identify key participants and topics to investigate further through qualitative offline techniques.

Conclusion

This chapter began by examining several design practices that aimed to facilitate sustained citizen engagement in their public realm projects, yet failed to do so. The reason for this shortcoming lies in practices that either create networks around themselves, and therefore place the wrong actor at the centre of a network, or fail to establish a network around their project at all. Two approaches were introduced to resolve these shortcomings: analysing socio-spatial digital data prior to entering the participatory process, and working in multi-disciplinary teams to bring in expertise from various relevant professions. Rather than acting as untrained social workers, designers could then re-engage with their own expertise. Some of the other professionals on the team could stay involved in a project for a more extended period to cultivate ownership and establish a strong social network, allowing designers to step out of a participatory public realm project without risking the social network and project disintegrating. While this approach would be desirable in any participatory design project in a public space context, such projects often come with limited budgets that do not allow for multi-disciplinary teams with external expertise. The alternative digitally-informed method could therefore help designers identify local community networks, key players, or active community members, by analysing socio-spatial digital data from online social media data sources. These data could help designers gain insights into the often invisible social layer of a local context.

One of the examples presented in this chapter is the DAM project, in which the design team aimed to create a lasting outcome and sustained public engagement by establishing a Living Lab and carrying out numerous design interventions. The DAM design and research team identified the subject of labour as a problem within the recent developments in the region and created a space that could facilitate an ongoing dialogue between the city council, local businesses, and residents. By organising various interventions and events, the team aimed to bring together interested community members to construct a public around the issue of work in Genk. However, this project was unsuccessful in maintaining sustained community engagement and action beyond the initiators' involvement. The DAM project is an example of a participatory project where the initiators created a network around themselves, rather than incorporating existing community networks. The 596 Acres project demonstrated that a multidisciplinary team of lawyers, information technology professionals, artists, and social workers succeeded in establishing long-term engagement of a local public and were able to empower citizens to appropriate local public spaces through their project. Designers addressing societal issues in participatory projects aimed at generating a social impact would do well to collaborate with professionals who are trained to work with the public, or at least expand their sources and skills to become better equipped in operating in socially sensitive contexts.

Analysing social media data could also help participatory designers who adopt the Living Lab (LL) method. LL initiators often fail to bring about sustained engagement and real and lasting (social) impact (Hillgren 2013). Identifying and involving key players who are already embedded within a local community could be the missing component these Living Labs need to move beyond (a series of) one-off interventions. Local key players could become agents who would safeguard long-term collaboration between the various stakeholders involved (both those at the top, i.e. actors in positions of power who can facilitate change, and the so-called 'powerless', i.e. the general public or local community), who are needed in order to bring about social innovation (Bjorgvinsson, Ehn and Hillgren 2011).

Several participatory public realm projects were reviewed where practitioners either failed to construct or engage a network, constructed a network around themselves and acted as central nodes within these networks, or stayed involved for a long period to establish a stable network containing (socially) active agents. Rather than advocating for designers to act as central nodes within a project's social network, or to stay involved in a project for an extended period to build a network from the ground up, this chapter proposed that SSDD can help designers identify existing active social networks and/or key players in local communities to involve in their projects, in order to facilitate and safeguard long-term citizen engagement. Moreover, designers working in multidisciplinary teams could use SSDD to identify local social workers or civil servants and place these actors at the centre of their project's social network. This proposed approach could change the way designers position themselves in their participatory projects.

Earlier in this chapter, the notion of 'infrastructuring' was introduced as a new role for designers in participatory projects that aim for citizen appropriation. Infrastructuring aims to create an environment that goes beyond delivering a completed design, where adoption and appropriation by a public is encouraged to sustain a design over time (Le Dantec and DiSalvo 2013). Therefore, rather than focussing on design skills, the designer's ability to create an environment that encourages collaboration and reflection is foregrounded. Infrastructuring champions argue that a designer's role should take place in the background, as a less active actor who can fade away while leaving a project intact (Merkel et al. 2004). This notion is echoed in this thesis; rather than positioning themselves front and centre, designers could place local agents at the centre of their project, while their design actions could take place in the background. This way designers could help form new alliances to create strong social networks and step out of their project without jeopardising its afterlife.

Finally, designers who adopt this approach could act as de-centred facilitators of community-driven projects to create more responsive and socially sustainable designs that cater to the requirements and needs of existing local communities. In order to create such socially sustained projects, it is essential to seed ownership within a local community early-on in the process. This requires designers to find ways of working with community groups that go beyond eliciting their needs and calls for a different set of skills and expertise (Merkel et al. 2004). By learning to conduct simple digital data analysis, designers could map out local social structures and lay the foundation for further research into the social context for their projects using very few resources.

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Chapter 5 – Data to facilitate the design process

The previous chapter explored how socio-spatial digital data could help designers facilitate the participatory process in their public realm projects. Although most examples were directed at improving (the quality of) the public realm, the outputs of these projects were not always defined at the outset. In these participatory design projects, such as the Living Lab examples, designers often act as facilitators who rely on exchanges between the different stakeholders involved to (co-)produce a design proposal. The participatory process in this open-ended approach allows designers to co-develop a project and produce a proposal that answers to the needs of locals. While the examples in the previous chapter can be classified as participatory- or co-design, this chapter concentrates on a different approach for developing designs that answer to people's needs, which I will refer to as design for participation (see Chapter 1). In this chapter, I will look at architectural practitioners who lack the resources to facilitate long-term participatory design processes, yet still aspire to generate public space designs that will benefit the local community as well as the general public.

The previous chapter analysed projects that were publicly funded, often by arts funding or research councils. These projects were all self-initiated by the designers, artists, or design and research team, which allowed for a considerable amount of freedom to experiment with different strategies to engage citizens. This chapter explores an alternative context, which is a more everyday reality for most architectural practices: public realm design projects commissioned by a client, either from the public sector (such as a city council), a private entity (such as a property developer) or through a public-private partnership

(PPP)[52]. Architects in these projects often operate under different conditions and with fewer resources than the examples in the previous chapter. They often have a clear task to fulfill (e.g. developing a public space design or a public realm strategy), and therefore do not have the same amount of freedom to leave the outcome undefined or open-ended. Examining two such public realm design projects identified what problems the architects encountered, and how SSDD could help them address these issues, proposing a bespoke approach for each situation.

The first case study is a public realm strategy for the redevelopment of a neighbourhood in Whitechapel, London by muf architecture/art. The second is a public space design by OKRA landscape architects for the Afrikaander-square in Rotterdam. Both examples raised questions and required a different use of, and approach to, digital data to address their respective issues. In the first case study, design guidance aimed at safeguarding good quality public space had already been developed by the architects. Architects at muf architecture/art expressed difficulties, however, in arguing for the importance of the qualitative aspects of their design over quantitative features (such as a return on financial investments). Section 5.1 explores how analysing socio-spatial digital data (SSDD) helped these architects consolidate their design intentions with empirical evidence. While this example demonstrates that analysing SSDD does not necessarily have to be part of an initial exploration of the design context and design brief, and can come after the act of designing, the chapter argues that a digital data analysis *prior* to developing a design could be considerably more effective, both in developing more sustainable designs and in getting clients and other stakeholders on board earlier in the process.

The second case study in section 5.2 demonstrates how such an early analysis of SSDD in an initial phase of the design process could inform the development of a more sustainable public realm strategy and public space design, analysing the Afrikaander square, a neighbourhood public space that has gone through an extensive period of continuous

52 A public-private partnership (PPP) is a collaboration between two or more public and private entities. Urban development has increasingly become a process of co-production between these two sectors. Also, currently there are virtually no private urban development projects that occur without any form of public regulation or intervention (Carmona et al. 2010).

redesign and redevelopment. Due to a history of ill-suited designs, and a dynamic local demographic, this neighbourhood public space has long been subject to regeneration plans that did not always align with the needs of the local community. The latest design aimed at revitalising this area has resulted in an underused, desolate, fenced-off 'public' space in the heart of the neighbourhood. SSDD analysis is used to explore the effects of spatial design on social behaviours, such as movement patterns and pedestrian circulation.

5.1 Public realm strategy for Whitechapel

In November 2015 muf architecture/art were commissioned by the London Borough of Tower Hamlets as lead consultant[53] to develop guidance for the redevelopment of the public realm in Whitechapel, London. Muf's Whitechapel Public Realm and Open Space Guidance (muf 2016) was intended as one of the layers of the design guidance for the Whitechapel Vision Masterplan Supplementary Planning Document (SDP), which was adopted in 2013 and described the need for high quality, well-functioning public realm and open spaces in the neighbourhood (muf 2016). For this report, muf conducted an in-depth study of the existing morphological and socio-spatial context of the public realm in Whitechapel, including an analysis of local cultural hubs, major development sites, green open spaces, key arteries, heritage assets, social housing and daylight (muf 2016:84) (fig. 5.1-5.5).

53 Working with landscape designers J+L Gibbons, structural, civil and transport engineering firm Civic Engineers, heritage consultant Robert Bevan, engagement consultant Daisy Froud, and cost consultants Artelia.

Figure 5.1
Analysis of existing urban fabric and programme of project site in Whitechapel

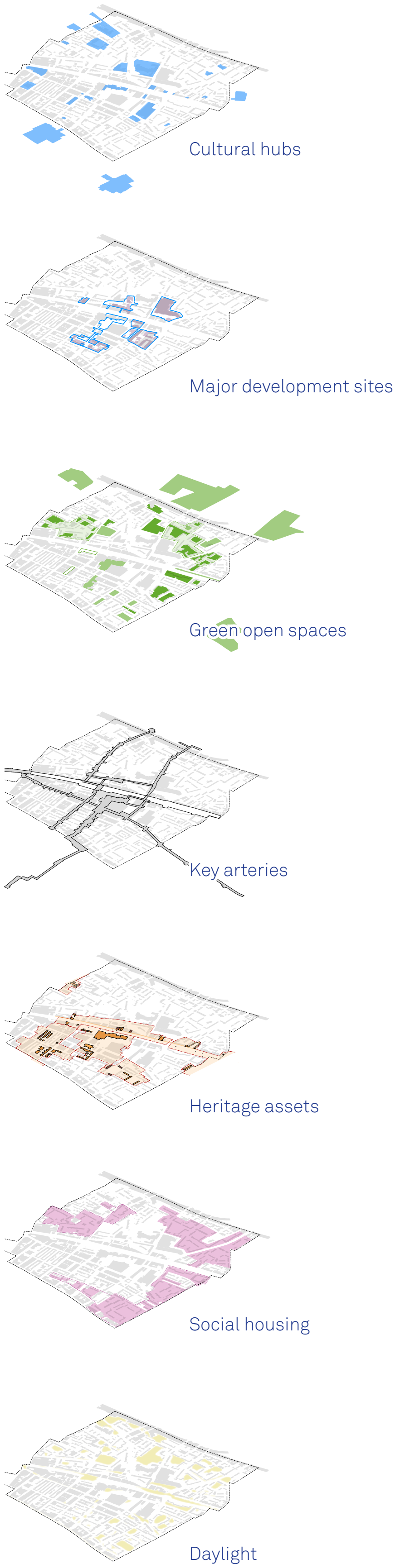


Figure 5.2
Analysis of existing open spaces in project site in Whitechapel

Above average and performing well

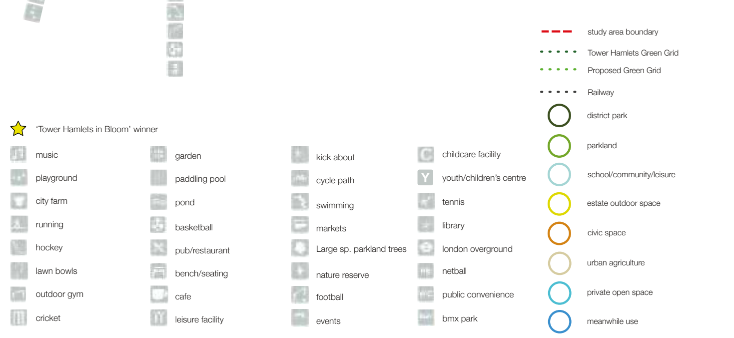
↓

Below standard with a higher priority weighting for future investment*

* Rating criteria based on LBTH study found in 'An Open Spaces Strategy for the London Borough of Tower Hamlets 2006-2016' document

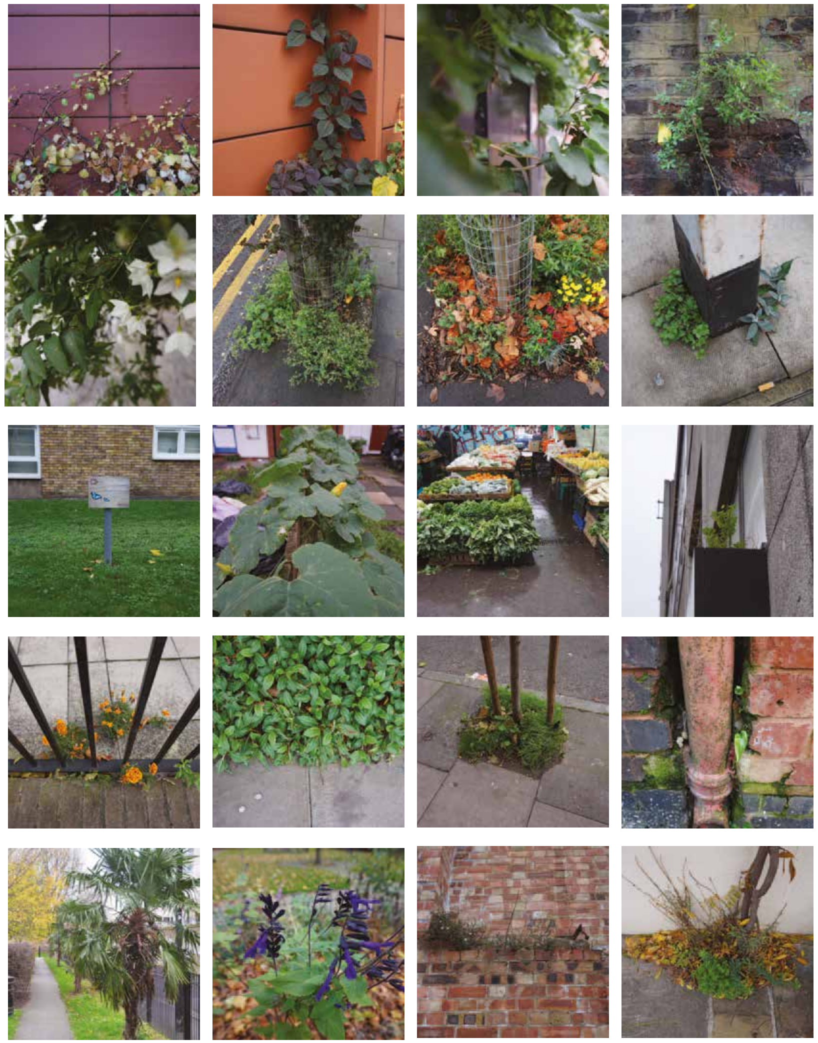
Existing open space performance rating

Figure 5.3
Analysis of existing open space provision and facilities in project site in Whitechapel



Existing open space provision and facilities

Incidental green infrastructure



Potential for strategic green infrastructure

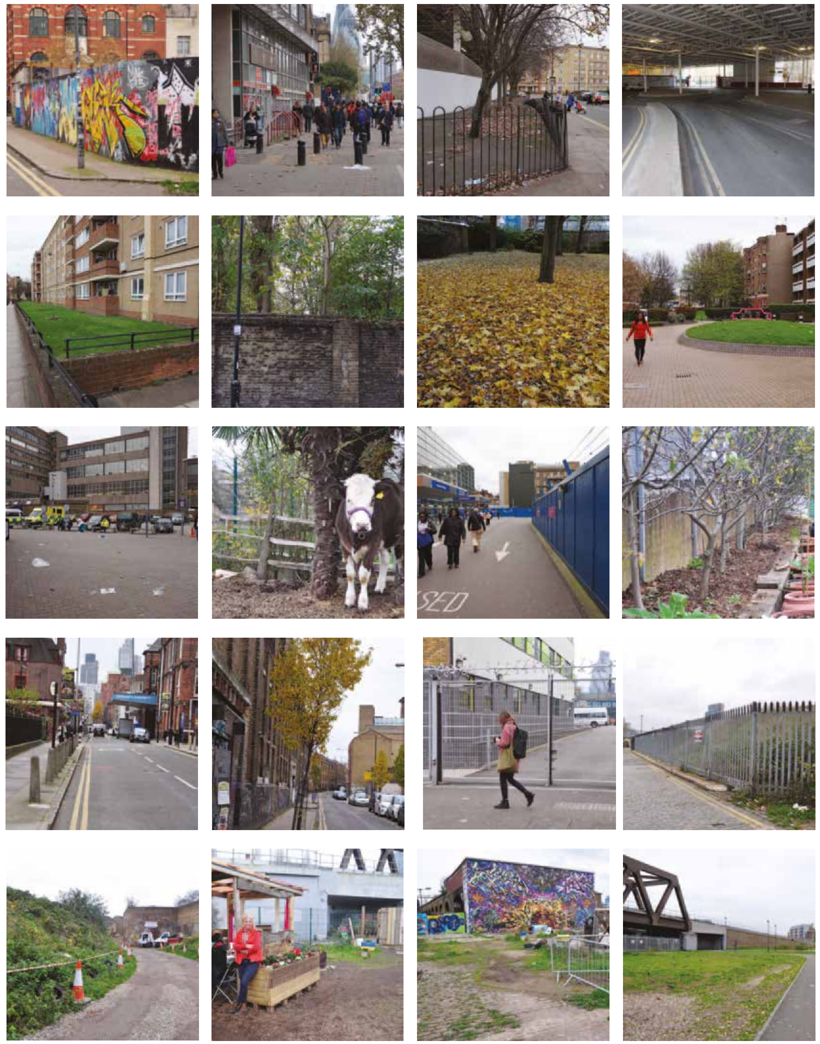
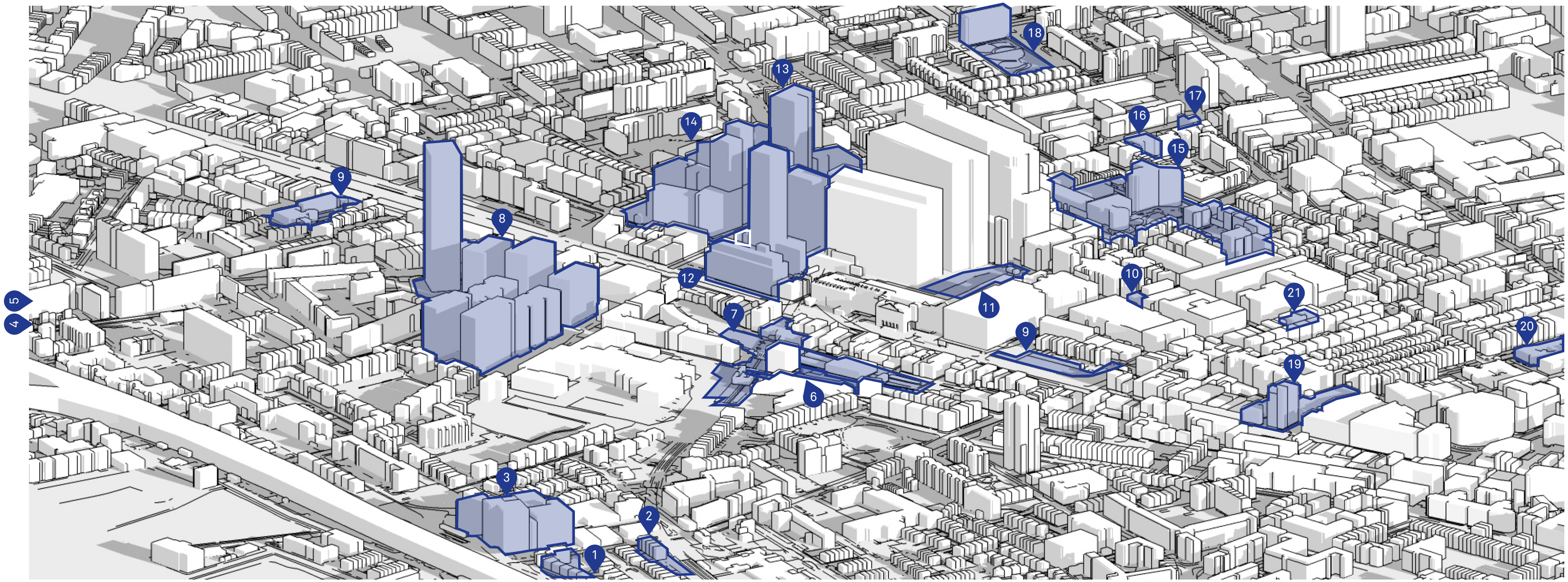


Figure 5.4 Photographic analysis of existing and potential green infrastructure in project site in Whitechapel

Whitechapel is going up – current development proposals

Figure 5.5
Current development proposals for Whitechapel



01 Pedley Street and Repton Street
PA/12/02228 – approved

02 Fakruddin Street
PA/16/01012 – in planning

03 Vallance Road and Hemming Street
PA/15/01231 – in planning

04 59A-63 Cudworth Street
PA/16/02251 – in planning

05 35-39 Buckhurst Street
PA/16/00356 – in planning

06 Whitechapel Crossrail
PA/16/00692 – in planning

07 Whitechapel Crossrail Station
PA/16/00338 – in planning

08 Sainsbury Foodstore
PA/15/00837/A1 – in planning

09 Barts and The London
PA/15/02774 – in planning

10 The Good Samaritan
PA/16/00988 – in planning

11 Temporary Staff car parking
PA/15/02987 – in planning

12 Post Office
PA/16/02287 – in planning

13 Cavell Street
PA/16/00784/A1 – in planning

14 L&Q Safestore
a. PA/16/00670 (demolition) – in planning

b. PA/15/01789/B1 (redevelopment) – in planning

15 London Newcastle
PA/15/02959 – in planning

16 London Islamic School and Mosque
PA/16/02142 – in planning

17 22 Cavell Street
PA/16/01682 – in planning

18 Jubilee Estate
PA/16/02296 – in planning

19 Tyler-Parkes
PA/16/00929 – in planning

20 105-107 Fieldgate Street
PA/16/01945/A1 – in planning

21 Empire House – New Road
PA/14/00754 – approved

Note:
Information updated as per September 2016.

Muf architecture/art specialises in public realm projects that address both the physical and social fabric of the urban environment. The practice aims to deliver qualitative and durable designs that 'inspire a sense of ownership through occupation' (muf.co.uk, Profile). The practice was established in 1994 by architects Juliet Bidgood and Liza Fior together with artist Katherine Clarke. In their projects, the architects and artists aim to establish 'effective means of consultation, negotiation, and collaboration' in the exploration of a local context and the development of a design proposal (muf.co.uk, Profile). Whether their client wants a participatory process or not, each of muf's projects starts with an analysis of existing initiatives, (local) stakeholders (including landowners, politicians, schools, residents, and the client), and their interests. These conversations with locals form input into the design brief, which is then translated into a spatial design (Fior 2010). In a project in Barking, UK where the office was commissioned to redesign a public square, for instance, there were no requirements for public consultation or participation. Rather than directly initiating the design phase for this town square, muf decided to first organise dialogues with different community members (including younger and older age groups) to learn how they perceived and experienced the existing public space. The practice used this input to question and adapt their client's brief, which, ultimately, helped them develop a design that would better meet locals' needs and desires.[54]

Co-founder Liza Fior (2010) argues that a meaningful design and development strategy can only emerge out of an in-depth understanding of a local context. Only through careful examination, she explains, can one reveal and begin to understand a situation's complexity, which is needed to develop a strong and accurate proposal. In their projects, the artists and designers always attempt to expand opportunities in the public realm by redefining the brief, questioning the budget, and seeking alternatives. In their projects around the London Olympic Park, for instance, the architects were able to challenge existing master plans for the area by highlighting what is already there and demonstrating how these local assets could be amplified. In one of their earliest projects from the mid

54 http://morethanonefragile.co.uk/barking-town-square/, accessed 3 July 2018

1990s, “Borrowed Pleasures”, the practice was able to expand the project brief and budget to develop decorative paving through a run-down neighbourhood (to lead tourists to a newly renovated museum in North Hoxton, London) to one that allowed them to regenerate school playgrounds and open spaces along this route, which would benefit the local community.

Muf defines the physical public realm as a place where different members of a community can visibly take part in activities alongside each other. The architects argue that in a rapidly changing neighbourhood, such as Whitechapel, the local public realm can become the site that remains reassuring, in which community members can recognise themselves and their community. At the moment, the parks and open spaces in the area are overcrowded and used intensely. Moreover, the lack of funding for maintenance of public spaces is clearly visible in the neighbourhood, evidenced by worn-out grass, clutter, and litter (muf 2016).

The Whitechapel Vision Masterplan includes the creation of 3,500 new housing units, the relocation of the Town Hall, an expansion of the medical campus, and the arrival of the Crossrail in the area by 2025 (fig. 5.6). The population in this area is forecast to continue to grow over the coming years, and property values are expected to increase, which will lead to higher house prices and rents. In developing this large urban regeneration plan, designers at muf seek to act as advocates for those who already live and work in the area, and argue that these groups need to be able to enjoy the neighbourhood’s increased popularity and affluence. Therefore, in the WPROS guidance, the architects emphasise the role the public realm can play in securing existing communities will also benefit from the investments.

As development will increase in the near future, so will the number of people without gardens, the architects at muf argue, which in turn increases the need for open spaces in the neighbourhood (muf 2016). In order to ensure that the plans for Whitechapel include sufficient qualitative green and open spaces, muf conducted several studies on the Masterplan’s proposed new public spaces. The architects argue that open spaces cannot be understood merely from a plan view; instead a valuable evaluation requires assessing various other features. Muf argues that public spaces should be assessed by 'what they contain, by what overlooks them or the activities which spill out into them' (muf 2016:84). While some of these factors are difficult to determine and measure and require physical observation, others can be analysed quantitatively, for instance, through daylight calculations. By conducting 3D/shadow studies of the Whitechapel Masterplan, the architects discovered that one of the proposed sites for a new open space would remain dark most of the day, and would likely suffer from wind turbulence due to the new high-rise developments. In their WPROS guidance, muf therefore propose an alternative site situated south of the new developments, where the square would receive more natural light and become a better quality open space (fig. 5.7).

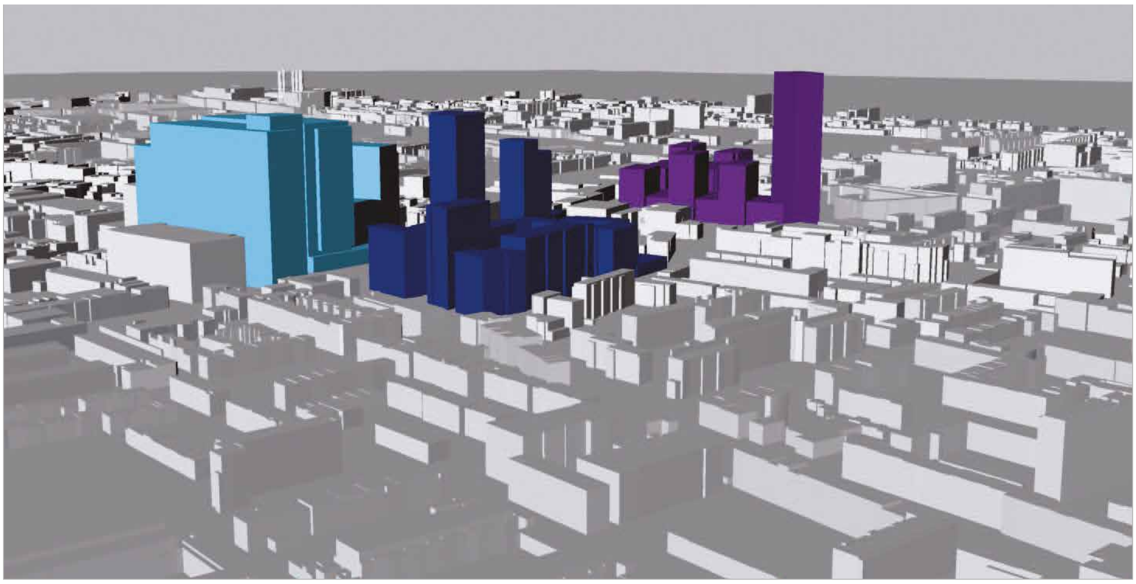


Figure 5.6
Image from the 3D model showing the existing hospital (in light blue) and the proposed developments (in dark blue and purple)

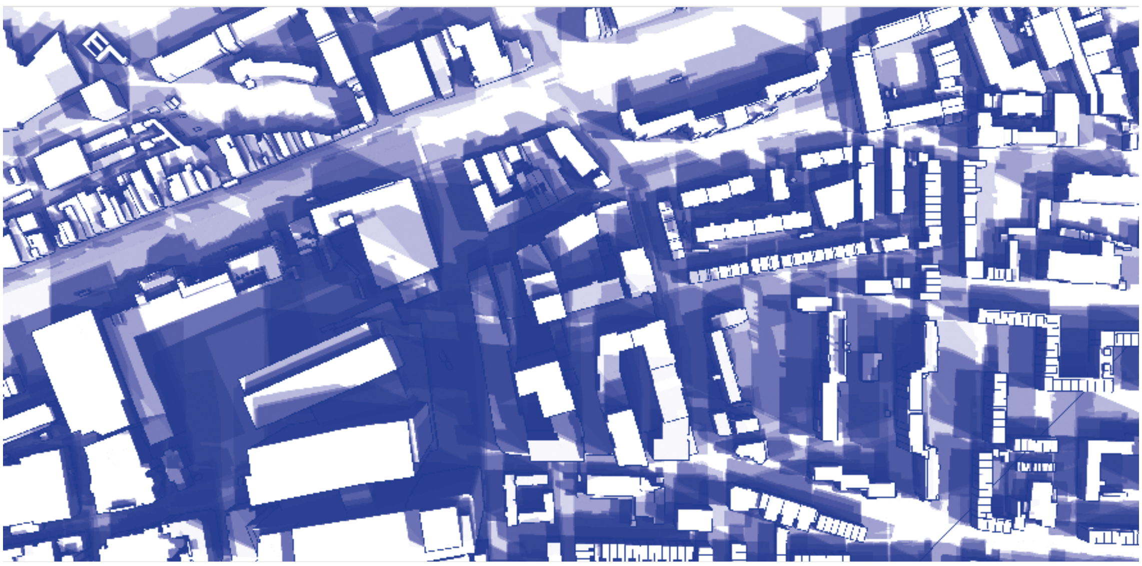


Figure 5.7
Shadow study of the effect of two of the major proposed developments South of Whitechapel Road

In their WPROS guidance, architects at muf argue for design strategies that aim to secure benefits of the new Masterplan for the existing community, and that aim to find opportunities to 'celebrate and enhance' these communities (muf 2016:151). To develop such strategies, the practice aims to learn in analogue ways, who these communities are, and what their specific needs and desires might be. The architects initiated this exploration by researching local existing and past activities to identify local community groups. An extensive list of these identified groups and networks (including residents' groups, business groups, educational establishments, leisure and amenity groups, community/citizen groups) is added to the WPROS guidance (fig. 5.8). The architects also propose various methods and strategies to engage these local groups in the project development, which include contacting the local groups to make them aware of the redevelopment plans, talking to users of Whitechapel's open and public spaces, phone and e-mail interviews, and targeted face-to-face interviews (fig. 5.9).

Groups and networks identified

We have assembled a preliminary list of groups that we suggest could be consulted during further development work related to the WPROSG. This list is not comprehensive and should therefore be cross-checked against the Council's community database to make sure all relevant parties are consulted.

Official/Statutory*

Group	Contact	Particular interests
Local Community Ward Forums for each ward	LBTH Localisation Service	General local interest – a good way to access concerned local residents.
Safer Neighbourhood Teams for each ward	Via the Met website	Community safety/ anti-social behavior – something that we know is also of concern to many local residents.

* It is not the proposed task of community engagement resource for this project to engage with council departments or statutory teams. However, both of the below are ways of accessingon-the-ground knowledge and experience about public realm in the area.
NB. KPT1 is really of direct interest to everybody.

Residents Groups

Group	Contact	Particular interests
Durward Street North Residents Association		Impact upon their homes of new buildings and public spaces (KPT3 in particular but also KPT6) Lack of focus on existing residents. Vallance Gardens.
Kempton Court Residents' Committee/ Association, Durward St	Secretary	Concerns around environmental and amenity impacts of KPT3. KPT6 also relevant. Prior history of concern re impact of Crossrail – appeared in front of Select Committee. Vallance Gardens.
Albion Yard residents	Secretary	Had some concerns re impact of KPT 6 in response to which Council made minor amendments. Quite a lot of them have concerns about the state and offer of the current market. Mile End Waste.
Sydney Street Tenants and Resident Association	Tower Hamlets Homes Neighbourhood Engagement Officers 2 Jarman House Jubilee Street, E1 3BL admin@sidneytra.plus.com	KPT5 Sidney Square, Ford Square, Cavell Street Gardens. Green space on their estate.

Figure 5.8
Sample of muf's assembled list of local groups, including residents groups, business groups, educational establishments, and more

Involving local groups in the project

Methods proposed

1. Awareness-raising

Complete and refine database in Section E. Contact all groups making them aware of the project and opportunities to participate. Determine which groups we want to invite to general events, and which we want to do targeted work with.

2. Talking to people about spaces in spaces

Continuing the work that was started for the drop in market stall event on 5 December 2015 by talking to users in Whitechapel's open and public spaces, asking the same questions and collecting anecdotal knowledge.

3. Phone and email mini-interviews about the spaces with all interested community stakeholders

Following Point 1 above, circulate the public space cards to all identified groups, using them as a basis for conversations about what spaces they use and how they perceive public and open space in Whitechapel.

4. Targeted face-to-face interviews/ conversations with identified groups

Identify groups from the stakeholder list to talk to in more detail, in order to particularly understand their specific perspective.

- These might be 'hard-to-reach' groups with specific experiences who would not be reached through traditional consultation e.g. youth, elderly, Bengali women, homeless shelter users or support staff.
- They might be groups who live in particularly close proximity to, or have a particular interest in one of the KPT sites.
  - KPT1: Market traders, community organisations and institutions based on or close to the road, all groups (as their High Street).
  - KPT2: Hospital users, local residents who cut through the hospital grounds.
  - KPT3: Residents of adjoining estates (Durward Street, Chicksand, Christchurch in particular), nearby schools, sports centre users, Osmani Centre.
  - KPT4: Nearby schools.
  - KPT5: Sidney Street Estate residents, The Mission users and staff, nearby schools.
  - KPT6: Nearby estates, particularly Collingwood and Cleveland, Albion Yard, Swanlea School.

5. Public value 'walking workshops'.

During design development stage, a series of investigative walks with local groups around key public spaces, collectively evaluating the public realm:
What is Whitechapel? Who is the Whitechapel's public? How is it visible and active in public and open space? What do we value? What is missing and might be introduced? What is nascent and might be nurtured? What is fading and needs strengthening? What are our priorities for the public realm?

6. Traditional consultation drop-in events to engage with the broader audience

The traditional stall/gazebo consultation on 5 December 2015 was the first of these.

7. Invite collaboration to deliver the vision

Deliver projects in conjunction with local groups who have the skills to help design, deliver, maintain or activate any of the long term or interim public realm proposals. They might be groups that by doing so, can display the richness and diversity that exist in the area.

Figure 5.9
Methods proposed by muf for involving local groups to engage in the regeneration projects

Fior (2010) argues that researching and identifying existing initiatives and interests and including them in a project helps designers establish viable long-term public realm designs. In their projects, the practice aims to connect the people active in the microcosm of a neighbourhood to the macrocosm where the strategic decisions are made (Fior 2010). For their project in Whitechapel, however, the architects had limited resources and were not able to conduct in-depth offline ethnographic studies to develop a proposal that would cater to the needs of locals. Therefore, instead, they included a list of local community groups in the WPROS guidance, and proposes how these groups should be consulted in the realisation of the neighbourhood development plans (muf 2016:208).

Since they lacked the resources to undertake more extensive public engagement and consultation activities for this project, muf invited me to conduct an online ethnographic study to find out which local community members are currently using the neighbourhood public spaces and in what ways. With such a digital exploration, the architects hoped to learn which local sub-cultures were present in the neighbourhood and how community members expressed themselves in the public realm. In their WPROS guidance, muf had already identified and assembled an extensive list of local groups and organisations. The digital exploration could form another layer to counter or validate their findings. While this is certainly possible through digital tools (as discussed in the previous chapter), such a study would not have been feasible for this project due to time limitations. The exploration would require an extended period of data collection and analysis (10-15 weeks) to achieve relevant results. Furthermore, as the architects propose in their report, at this stage the project would benefit more from offline ethnographic techniques (such as face-to-face interviews and 'public value walking workshops') to learn about the needs and desires of the local community. Since the strategic phase of the project was soon ending, I was interested in conducting a less time-consuming digital data study to help muf consolidate their public realm strategy.

In our conversations, muf had discussed the difficulties in arguing for their qualitative public realm strategy in which property developers would have to invest more in open spaces. In their earlier projects, such as the Barking Town Square redesign, muf was engaged for a more extended period (5 years), in which they were able to promote the importance of the public realm to those less familiar with its value (particularly to the client paying for the development), and to win the trust of their client, which allowed them to gradually adapt the design brief and proposal.[55]

In the larger and more complex Whitechapel project, however, the designers fulfilled a different role (developing a neighbourhood public realm guidance, rather than designing a public space) and had a different relationship with their client. For this exploration, I was interested in developing a digital data analysis method that could be easily adopted by spatial practitioners who have limited digital literacy and little to no familiarity with automated computational analysis. Therefore, rather than creating an analysis through computer programming, I explored whether it would be possible to conduct a manual analysis of visual digital data. I therefore looked at social media platforms that contain a photo-sharing feature and compared these services' popularity (i.e. which platform is used by the largest number of people). There are numerous popular social media services that include, or are built around a photo-sharing feature, such as Facebook, Flickr, Picasa, Pinterest, and many more. The social media platform where most photos are uploaded, however, is Instagram (see Chapter 4). The platform has 800 million monthly, and 500 million daily active users (Smith 2018). Over 40 billion photos have been shared on the platform so far, and according to Instagram an average of 95 million photos and videos are shared per day (Mathison 2018). Users can add a geo-location and hashtags to their uploaded photos, and a search function allows users to look for content based on this information. These (geo-)tagged photos form an unparalleled source of digital data to uncover new insights into socio-spatial dynamics in urban environments.

Instagram posts consist of a photo along with a username and caption. There have been various projects by numerous researchers who have explored the possibilities of analysing Instagram data. These efforts include studies by Silva et al. (2013) who aimed to discover places of cultural activity through Instagram data; numerous interdisciplinary collaborations between art historians and computer scientists who aimed to visualise

55 http://morethanonefragile.co.uk/barking-town-square/, accessed 3 July 2018

different rhythms in, and between cities (Hochman et al. 2012, 2013; Schwartz and Hochman 2014); and a research on self-portraits ('selfies') on Instagram led by Lev Manovich (Computer Science Professor at the City University of New York who specialises in digital art and culture)[56]. While these studies are diverse in range and cover various topics, in-depth research on the possibilities of Instagram data has been limited, particularly when compared to Twitter data (Boy and Uitermark 2016). Furthermore, while various researchers from different fields (including social sciences, computer sciences, and so on) are exploring different ways to conduct quantitative analyses of Instagram data, I was interested in developing an alternative qualitative approach that requires less digital know-how, which designers would be able to adopt in their projects. Therefore, rather than conducting a quantitative analysis of (meta-)data, I developed a method for visual analysis of the photographic content of Instagram data.

I aggregated Instagram data containing the geo-tag or hashtag 'Whitechapel' for a one-week period (20-27 January 2017) and created a visual analysis of these data. By manually examining the image content, I filtered out photos of or in public spaces in the neighbourhood (deleting photos of food, 'selfies', pets, and so on). I then filtered out the pictures of public artworks, such as wall paintings and graffiti, which I left out of the analysis. This resulted in a subset of 48 photos of the public realm in Whitechapel posted by Instagram users.

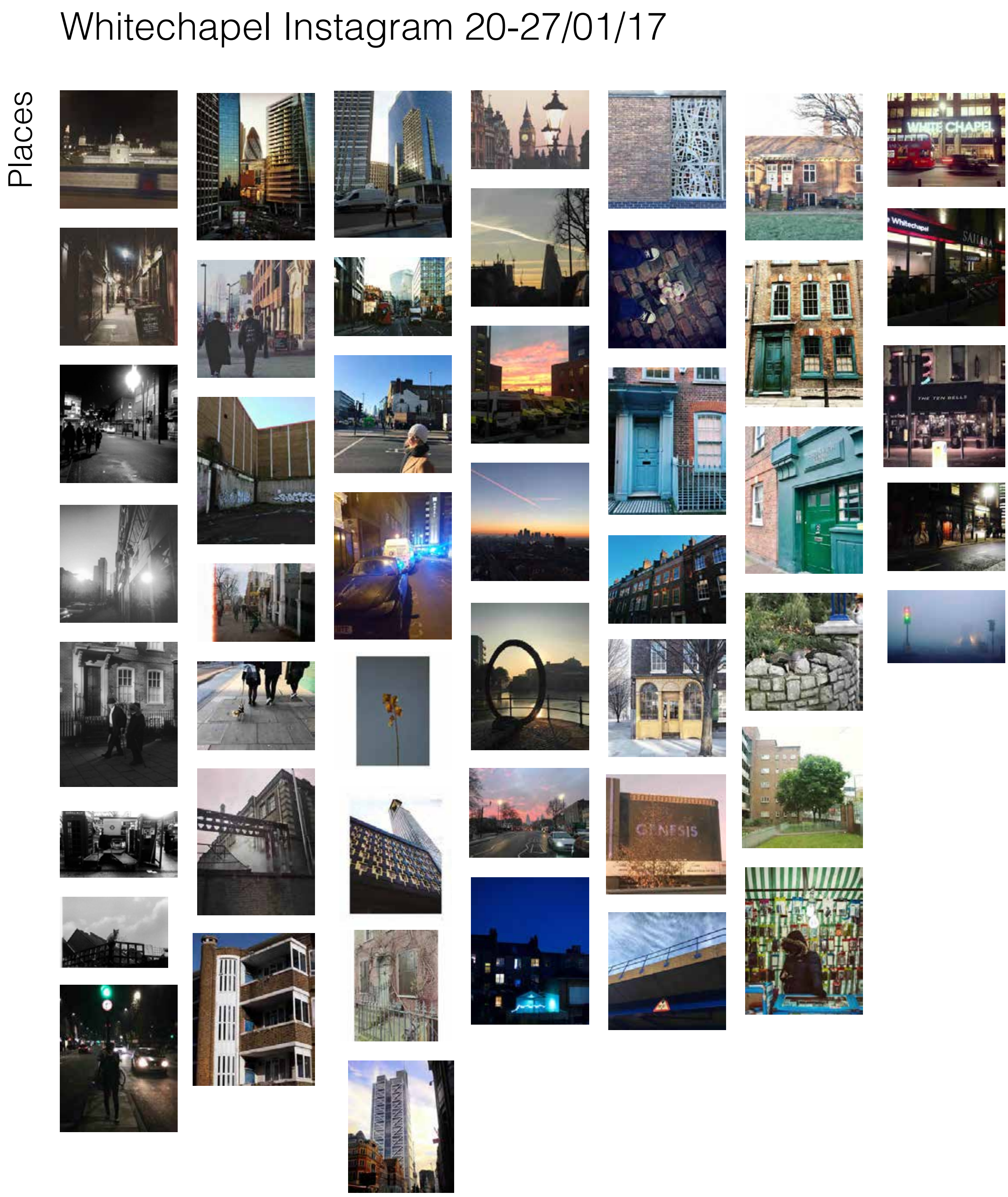
I was interested in how many of these photos could be categorised as 'green spaces'. In order to analyse this objectively, I created colour abstracts of the original photos. I first extrapolated the most prominent colours in each photo and then abstracted these to one-tone images. By re-arranging these images by colour, a colour-code for the neighbourhood of Whitechapel became visible, which demonstrated minimal green colours and a large number of grey-tones (fig. 5.10).

This colour-code could function as an abstract representation of the neighbourhood

56 http://selfiecity.net

spaces that are available to the public, and that people are able to frequent. The Whitechapel colour-code demonstrates a skewed relationship between the built fabric and open green spaces in the neighbourhood, which muf could use to support their green public realm strategy. Moreover, this method could be used to analyse the colour-code of other surrounding neighbourhoods compared to Whitechapel, which could help demonstrate the lack of green in comparison to these neighbourhoods.

Figure 5.10
Instagram study of public realm in Whitechapel



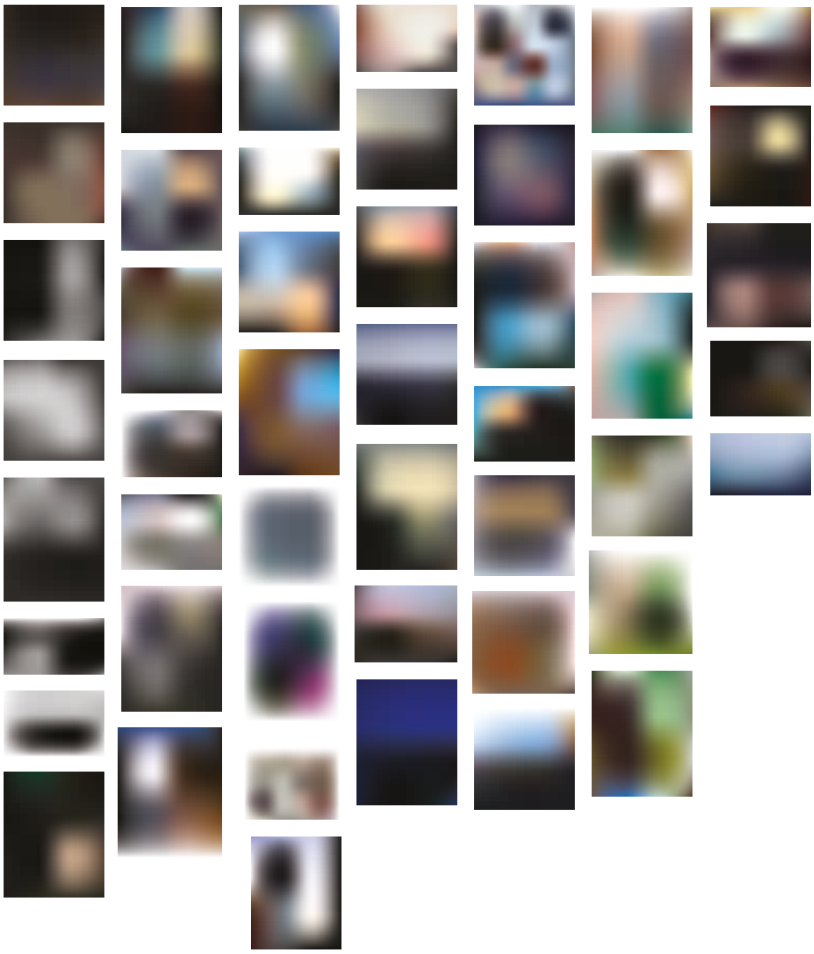
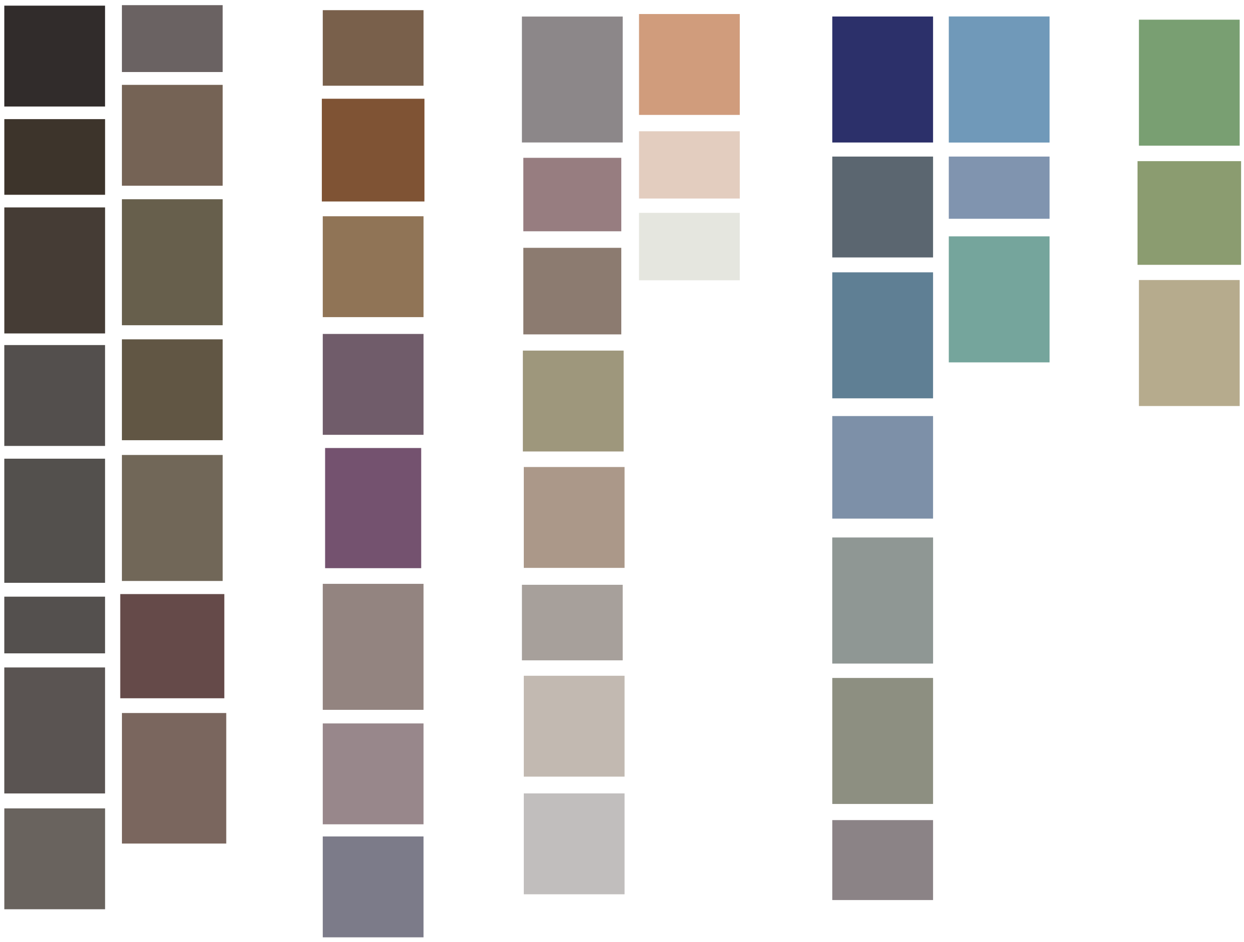


Figure 5.10/a
Colour blur of Instagram photos for Whitechapel

Figure 5.10/b
Colour abstracts of Instagram photos for Whitechapel

Figure 5.10/c
Colour code of
Instagram photos
for Whitechapel



The Instagram study demonstrates that a straightforward method of analysis, which is easily replicable by design firms, could provide valuable information. To explore whether this method of analysing Instagram data is valid, I conducted another study for a different neighbourhood in London. This second exploration tested whether the findings for Whitechapel did in fact indicate a lack of green space, or whether Instagram users prefer to dwell in and document urbanised spaces. In order to compare the Whitechapel findings to a colour-code for another neighbourhood that has more green spaces, I analysed Instagram data containing the hashtag 'Stoke Newington'.

For this second study, I aggregated Instagram data for a one-week period (July 27th to August 3rd) for Stoke Newington. I again examined the image content to filter out photos of or in public spaces in the neighbourhood. This resulted in a subset of 128 photos that users posted on the public realm in Stoke Newington, and the following corresponding colour-code (fig. 5.11).

Stoke Newington Instagram 27/07-03/08/18

Places

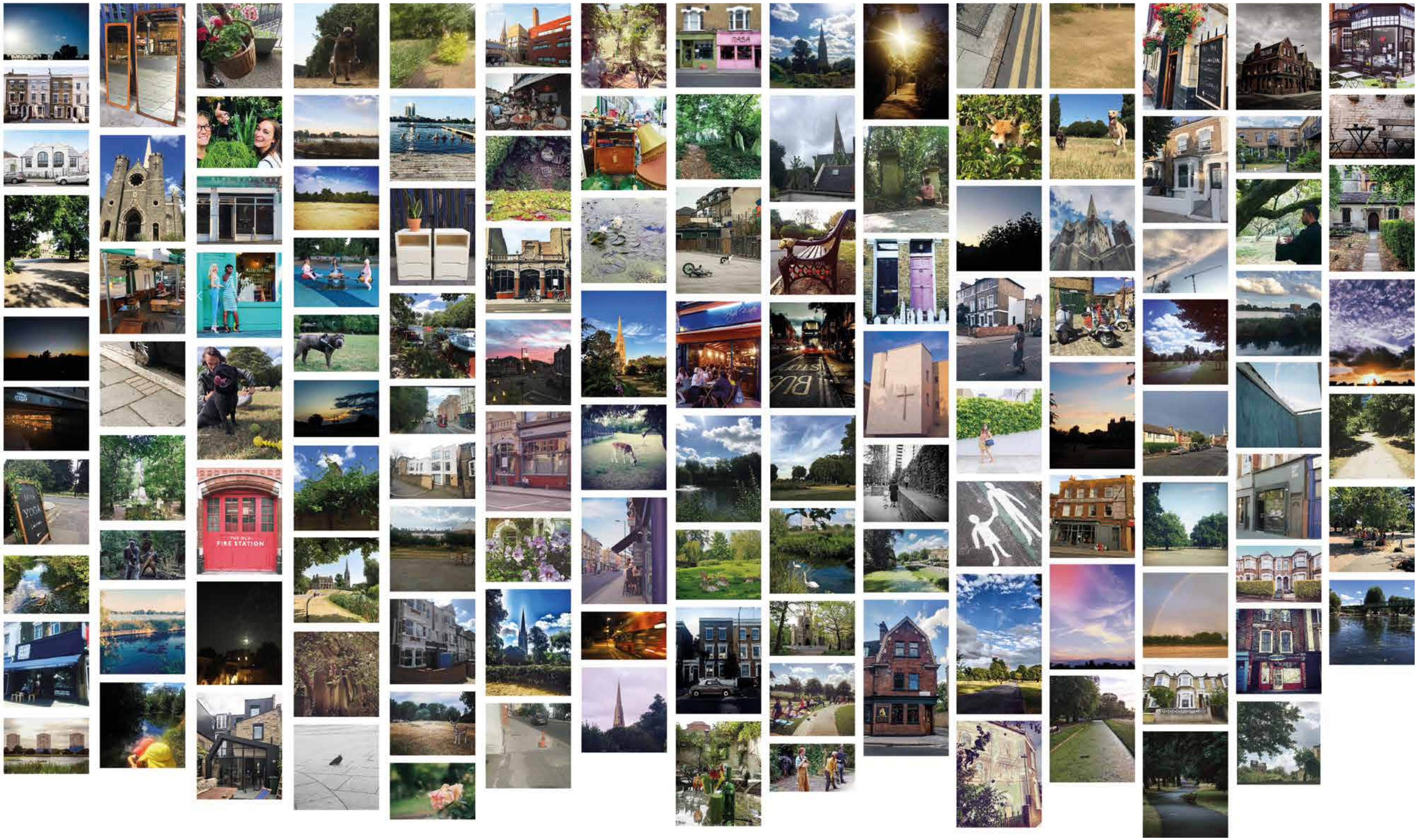
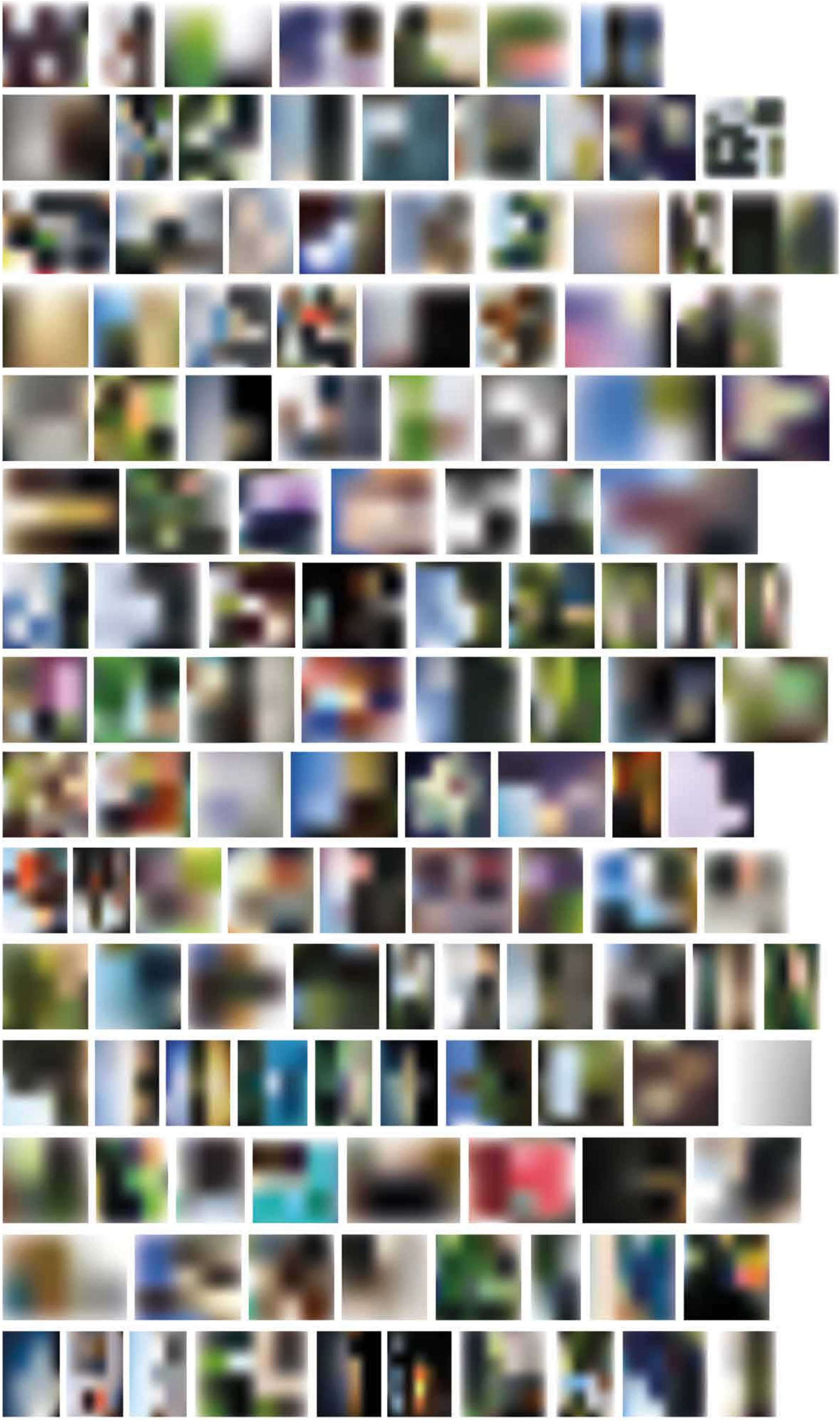
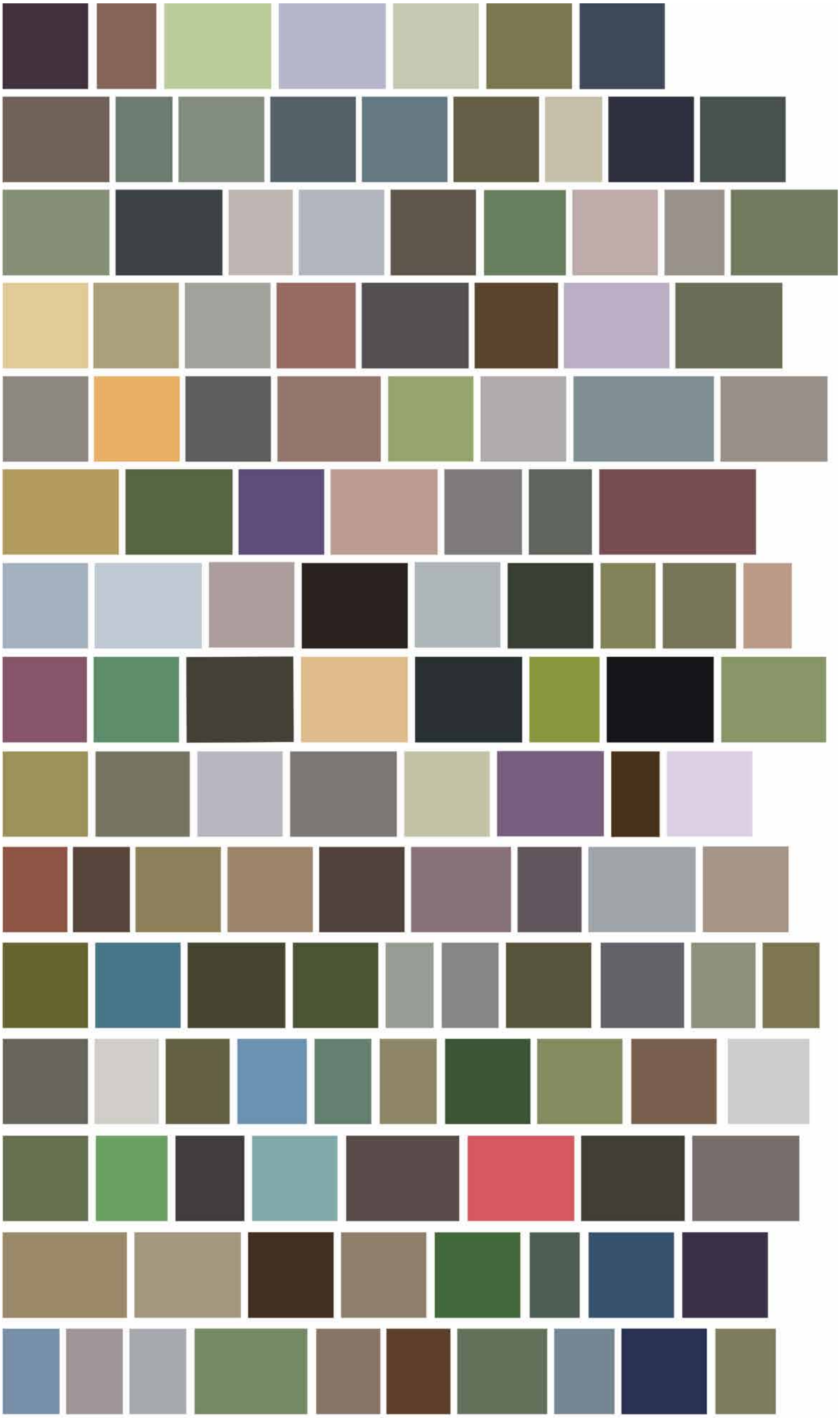


Figure 5.11
Instagram study of public realm in Stoke Newington





The colour graph for Stoke Newington included more green tones than that of Whitechapel. These findings could indicate a greater availability of green spaces in Stoke Newington. However, the Instagram data for this second study is of a different date. The difference in green tones could therefore also be a result of photographs taken in winter (as in the Whitechapel study) or summer (as in the Stoke Newington study). In order to explore whether the timing of the study skewed the results, I conducted another Instagram study for Whitechapel with data corresponding to the dates of the Stoke Newington study (27 July – 3 August) (fig. 5.12).[57] The second study for Whitechapel demonstrates that even with photos from the summer period, far less green tones come up than in the Stoke Newington study.

Finally, in order to empirically demonstrate the availability of green spaces in these two neighbourhoods more data were needed. These data could have come from mapping: Stoke Newington has many green pockets and large green open spaces, including Clissold Park and Abney Park, whereas Whitechapel only has a few accessible green open spaces that are also considerably smaller, such as Allen Gardens and Vallance Gardens. Mapping the neighbourhoods' green spaces is therefore a useful tool to consolidate the results of the Instagram colour-code studies.

57 The choice for conducting another study for Whitechapel, rather than repeating the study for Stoke Newington, is determined by the availability of data: Instagram data for (winter) 2017 was not available anymore at the time of this study. This is also the reason the Stoke Newington study was conducted with Instagram data from summer 2018.

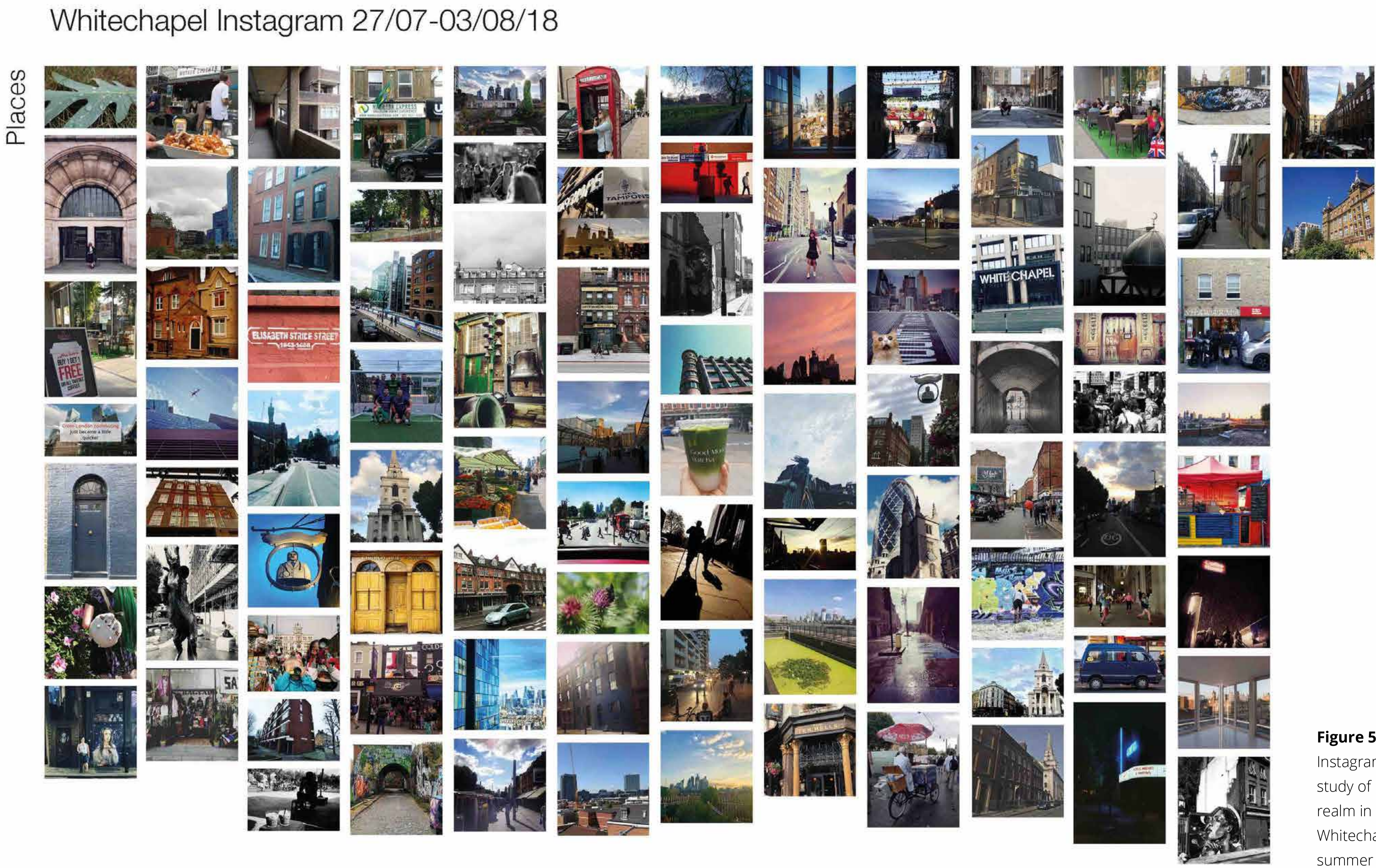
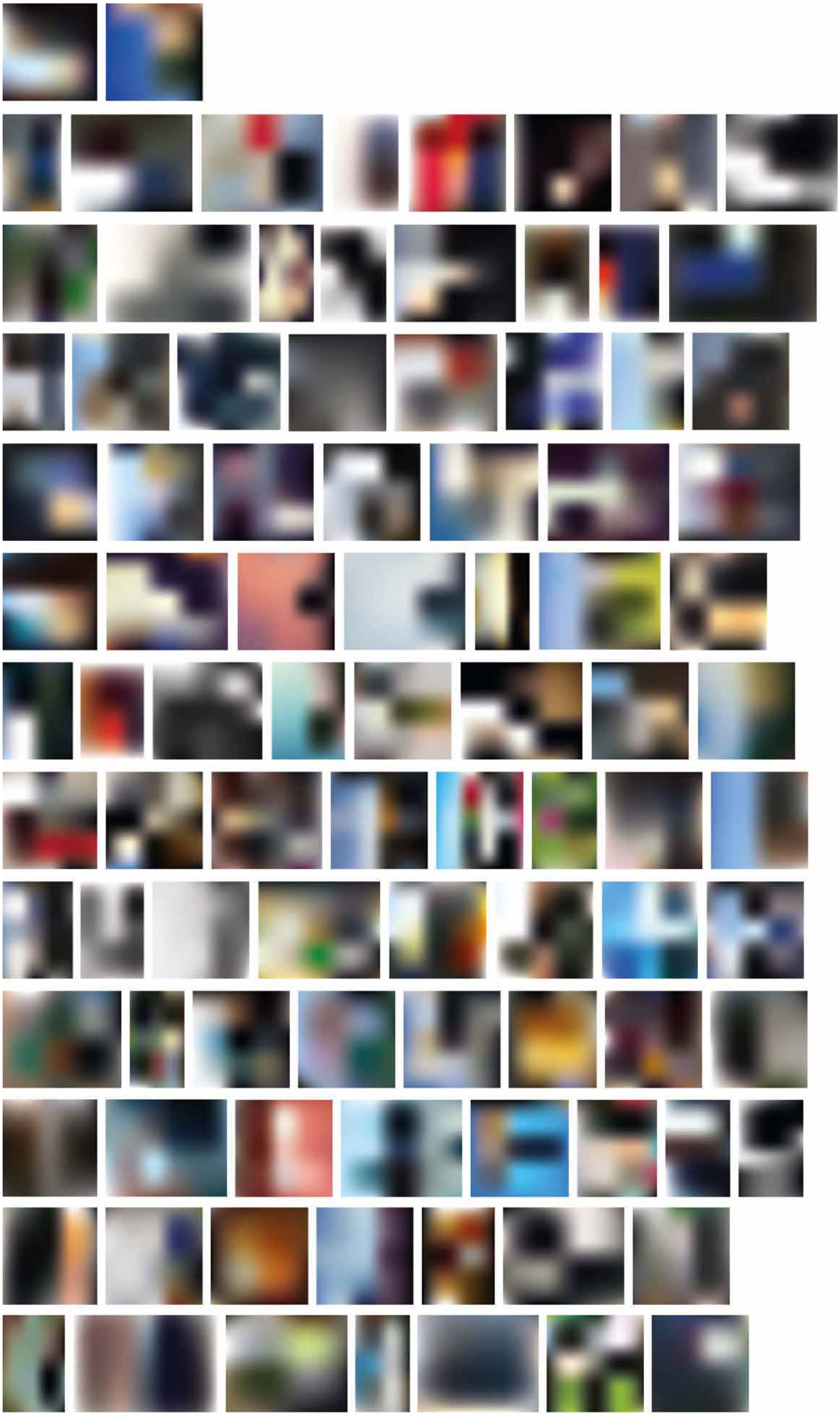
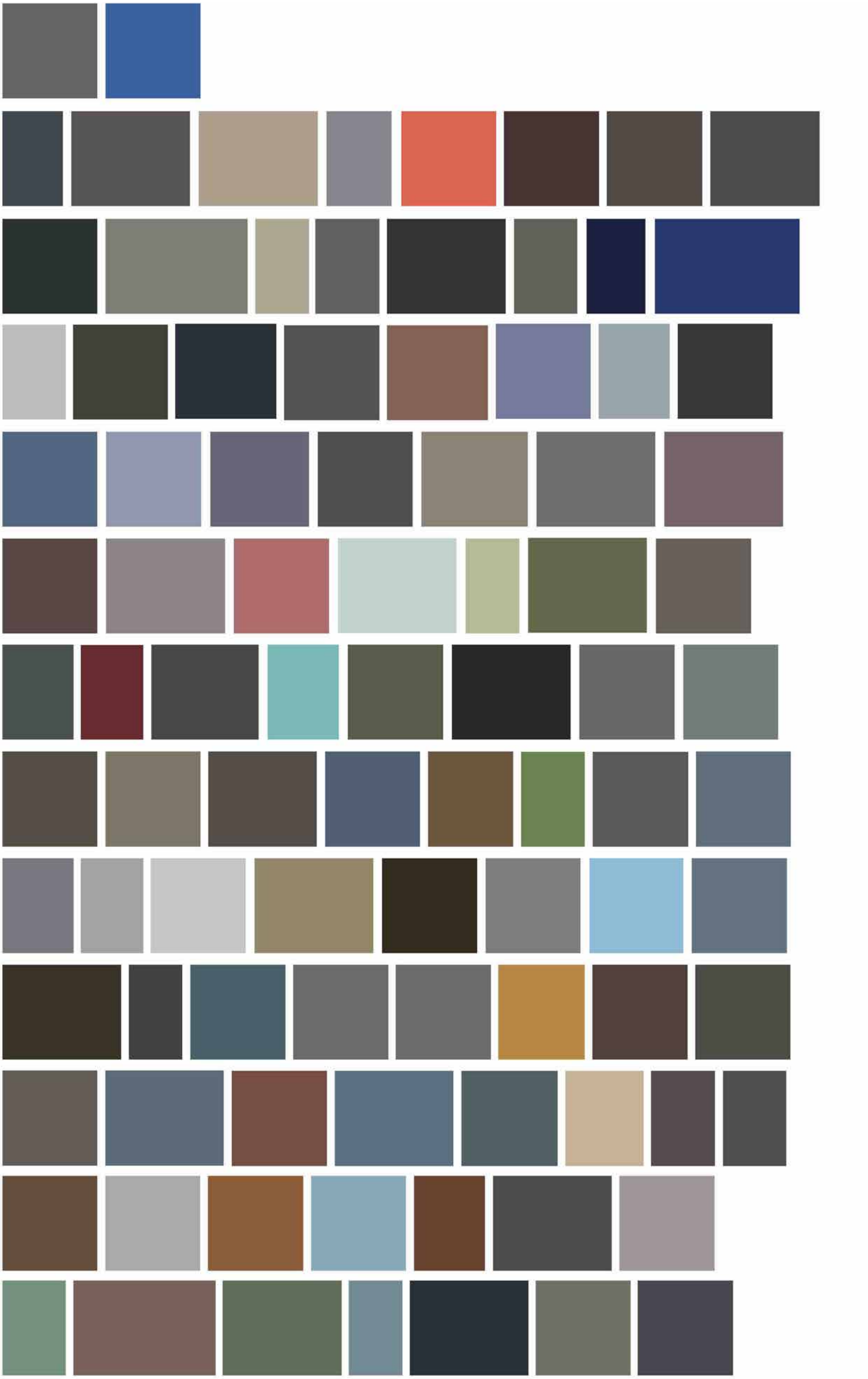


Figure 5.12 Instagram study of public realm in Whitechapel in summer





As with any study based on a single (digital) data source, there are limitations to explorations that solely rely on Instagram data. Instagram's user demographic largely exists of younger age groups (60.4% of all users are aged between 18 and 24) and are predominantly male (Smith 2018). Moreover, data from social media does not always authentically reflect a user's activities. This is especially true for Instagram data, where users showcase a curated representation of their life worlds by selectively sharing images on the platform (Boy and Uitermark 2016). This selective sharing also affects the images users choose to share of their (urban) environments; typically, users will share images of themselves with friends and of special places, rather than reporting on daily activities, such as their commute to work or supermarket visits (Bourdieu 1996). These limitations of data from social media therefore need to be considered in digital data studies. Nevertheless, data from social media platforms such as Instagram still form a rich source of information that could bring about new insights and function as another layer of investigation into the socio-spatial dynamics of an urban environment.

Finally, while the analysis of Instagram data in this study was conducted manually, computer algorithms would have been able to conduct a similar exploration in an automated way. The Open Source Computer Vision Library (OpenCV.org) for instance, is an open source tool for machine learning and computer vision and contains over 500 algorithms that can be used to detect and recognise faces, recognise sceneries, identify objects from photographs, and more. There are also numerous face recognition software programs available for analysing photographic data, such as Liuliu (liuliu.me). Finally, various algorithms have been developed to detect and recognise objects which could be used to identify photographs of green spaces, such as 'Leaves Recognition' (lrecog) a neural network based application that allows users to recognise a tree species with a photograph of its leaf and to identify an unknown leaf image and specify the species it belongs to (https://github.com/jens-maus/lrecog). While I have not found an existing algorithm that can detect and identify pictures of urban environments to create a subset of relevant images for my proposed method for analysing Instagram content, it is certainly possible to develop such an algorithm. It could, for instance, detect pictures with open spaces at the top of the image, which could indicate the presence of an open sky, and could therefore indicate a picture taken outside. However, rather than exploring the possibilities for algorithmic analysis in more depth, the purpose of this study is to demonstrate how a qualitative approach to analysing socio-spatial digital data, which does not require extensive knowledge of digital data analysis and can therefore easily be adopted by designers, could result in valuable findings.

While digital data analysis can be introduced at any stage in the design process, it would be more beneficial to implement such techniques at the start of a project. Muf used the digital data analysis to support their design strategy retrospectively, which included introducing more green into a neighbourhood. Private developers, however, are often less excited about plans that contain many green open spaces, since they require a lot of maintenance. If muf had incorporated digital data explorations earlier on in the project, they may have had fewer difficulties in getting their clients on board for their green strategy. Furthermore, together with their clients, the architects could have developed a more nuanced public realm strategy which could include spaces with hard surfaces that still offer the same kind of rewards as green spaces. Instead, digital data analysis was used more as a confirmation of a design than as guidance into the development of a design. Getting their clients on board by offering empirical evidence early on could have helped the architects secure more of their intended outcomes for the public realm in the urban regeneration plan.

5.2 Neighbourhood redevelopment plan and public space design in Rotterdam-South

In the previous section, muf co-founder Fior argued that an in-depth understanding of a local context will help develop a more meaningful design. This section demonstrates that introducing digital data analysis from the outset of the design process can help designers not only develop more meaningful and context-appropriate proposals but also more socially sustainable designs that allow for citizen appropriation. The public space design by OKRA landscape architects for the Afrikaander square in Rotterdam-South is particularly relevant in the discussion of socially sustainable designs: the Afrikaander neighbourhood, including its public spaces, has been subject to several urban renewal initiatives and significant shifts in local demographics over the years, resulting in numerous transformations of the neighbourhood's spatial and social configuration. These are strongly reflected in the neighbourhood's public realm: since the early twentieth century the Afrikaander square has been reprogrammed, repurposed, and redesigned almost every twenty years to 'answer' the local population's needs. Until today, however, designers have not been able to produce a sustainable neighbourhood square that is able to adapt to changing demands and cater to a dynamic demographic.

Due to its enormous size, 7 ha, the Afrikaander square has historically been more of an empty terrain or an open 'multifunctional emptiness' (Crimson 2007:103) rather than a coherent public space. The latest design for the Afrikaander square was completed in 2002 by OKRA landscape architects, the result of an eight-million-euro investment from the local government. Except on market days two days a week, which take place around the borders of the square, it has failed to attract locals and remains deserted on most days, fenced off to prevent vandalism (Crimson 2007).

At the same time, the Afrikaander neighbourhood is once again on the brink of urban redevelopment which will affect both the spatial and social configuration of the neighbourhood. While the renewal plans do not include a redevelopment of the neighbourhood's existing public spaces, this section proposes that the plans could potentially improve the local public realm through some adjustments and minor strategic interventions. The programmatic and spatial analyses of the square which have informed previous designs have, so far, primarily concentrated on the local surroundings (e.g. buildings enclosing the space and the neighbourhood communities). Such a large-scale open space, however, could benefit from a more extensive exploration of the urban network it is part of and connected to.

This section therefore explores issues of connectivity on two different scale levels:
(1) the neighbourhood in relation to the city; and (2) the square in relation to the neighbourhood. Each exploration discusses different levels of connectivity: the larger scale, or city scale, concentrates on fast connections (i.e. car and bicycle mobility) and explores how the neighbourhood could be better integrated into the city's network to enable more through-movement by people from outside (section 5.2.2.2); the local scale, or neighbourhood scale, explores how the Afrikaander square could be better integrated into the neighbourhood's network to enhance slow connections and improve pedestrian circulation in the square (section 5.2.2.3).

This section proposes that enabling a positive socio-spatial mix in the neighbourhood requires revitalising its public spaces. These existing local spaces, particularly the Afrikaander square, are potential sites for facilitating and encouraging culturally and socio-economically diverse encounters. Uplifting these impoverished public spaces, however, requires a better understanding of the morphology and connectivity problems at both scale levels to enable mutual reinforcement and synergy between the two (i.e. city and local scale). This section therefore explores the effects of urban form and connectivity on social life and investigates how digital data analysis could help designers gain new insights into the local urban fabric of the neighbourhood as well as its greater urban context (fig. 5.13, 5.14).

Figure 5.13
From left to right: South-Holland province in the Netherlands, the city of Rotterdam in the province, and the location of the Afrikaander-neighbourhood in the city

Figure 5.14
The borders of the Afrikaander neighbourhood and the location of the Afrikaander square within the neighbourhood

5.2.1 Case study: Afrikaander square

The Afrikaander neighbourhood has a triangular shape, which is divided into blocks that follow the original polder pattern (fig. 5.15). Some of these blocks have been left open, resulting in the Afrikaander square (Crimson 2007).

Figure 5.15
Historic map of the original urban development plan of working class neighbourhoods around the industrial port, including the Afrikaander-neighbourhood, with street patterns following the polder pattern of the underlying landscape (Crimson 2007)

Partly due to its size, the square does not dictate one particular function. It has over time changed from a football field for Rotterdam's football club Feyenoord, which met every Sunday and attracted many supporters, to an open-air theatre in the 1970s. The square has also served as the place to answer to immediate needs of the local community. During and following WWI the space was used for allotments to cope with food shortages, and during the urban renewal period in the early 1970s, several temporary homes were placed on the square to house locals whose apartments were being renovated (fig. 5.16).

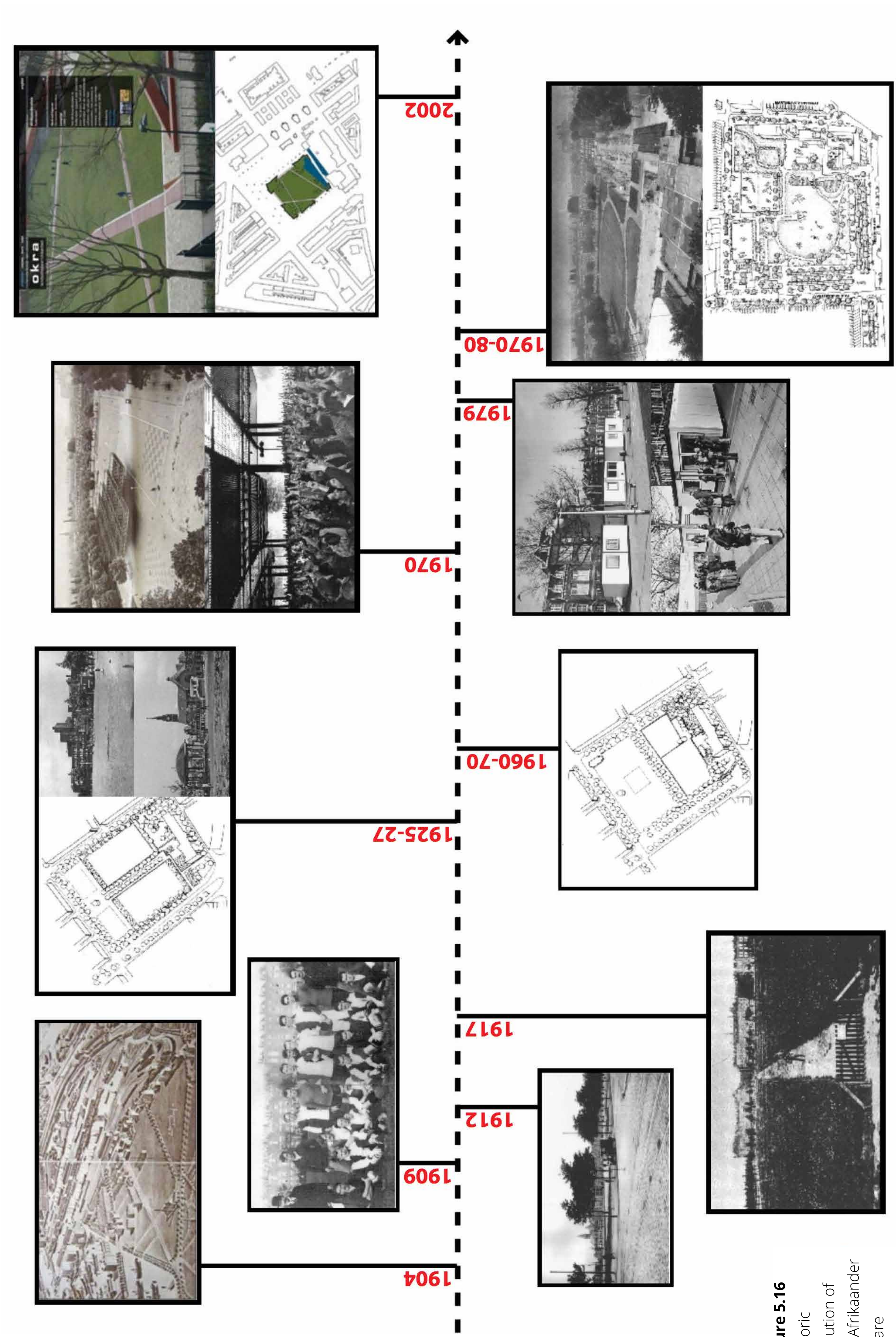
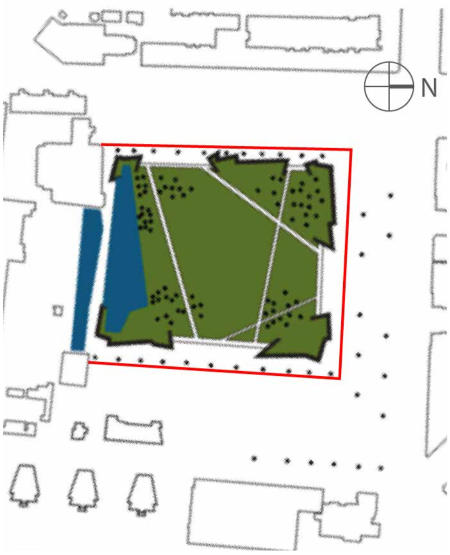


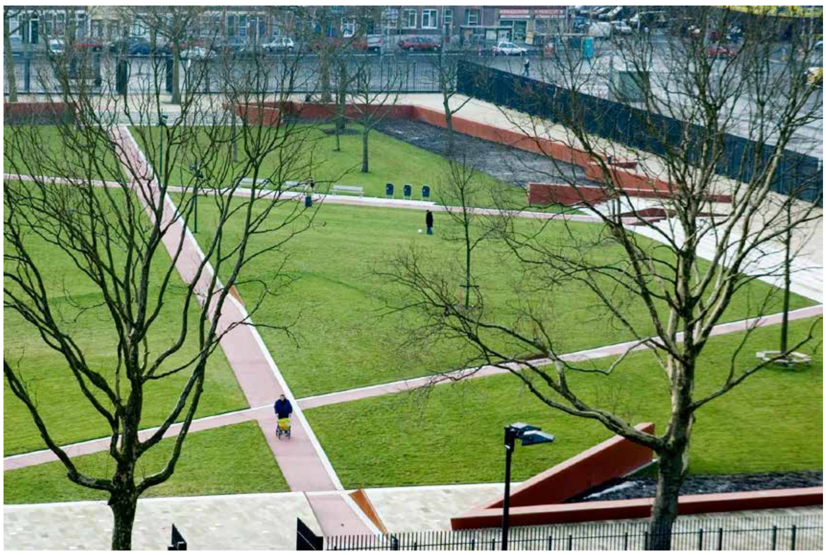
Figure 5.16 Historic evolution of the Afrikaander square

From the 1960s onwards, more users started claiming a piece of the Afrikaander square to host their programmes, including a sports hall, a library, a clubhouse, and a school, resulting in a fragmented and dispersed public space. In the mid-seventies, between the two waves of urban renewal, the city council reignited discussions on the layout of the square. This time there was a general consensus that the open space was unsuccessful as a square and should therefore be transformed into a park. With the famous Sarphatipark in Amsterdam as a precedent, a new design was developed by the local council's landscape architect.

Although a new park was designed for the central area, between the 1970s and 1990s the Afrikaander square still did not serve as a coherent park and remained an underused space consisting of different physically divided functions. In the late nineties, the square had become a deserted and decayed area and the central green open space fell prey to vandalism. In 1999, the local council commissioned landscape architecture firm OKRA to develop a new design in which the park atmosphere would be maintained, albeit in a more modern form. Again different stakeholders and programmes, including a playground, sports fields, and the market had to be accommodated, which the landscape architects situated at the edges of the park. The south side of the public space was planned as a 'green oasis,' which included a botanical garden, a large mosque, and a pond

Figure 5.17
OKRA's design for the Afrikaander square, fence indicated in red on map





(Crimson 2007:72). High slat fencing around the entire park was intended to complete the space by marking its boundaries while protecting it against vandalism (fig. 5.17).

Failing to provide adequate attractions, amenities, and connections to existing spatial, social and economic networks resulted in a sterile, uninviting place that locals avoid passing through, let alone taking ownership of (Crimson 2007). Furthermore, OKRA's redesign and redevelopment of the square has primarily focused inwards; local programming and surrounding buildings have all claimed their own piece of space with little to no relation to the central public square.

The future urban renewal plans for the area will not only affect the social composition of the neighbourhood but also modify the urban configuration. How will this transformation affect the relationship of the neighbourhood with its wider context? How will these changes influence social life in the public realm of the neighbourhood? Could the urban renewal plan be leveraged to revitalise the Afrikaander square? Finally, how can digital data help develop a more extensive and appropriate analysis of the existing situation, which in turn could help inform the design of a more sustainable neighbourhood public space?

5.2.2 Research method: Space Syntax

Space syntax is a set of analytical, quantitative tools and methods reliant on computer techniques that, supported by a social theory of space, can be used to analyse the configuration of spaces in buildings (i.e. floor plans) and cities (i.e. urban networks) (Hillier and Hanson 1984; Hillier 1996). The technology can be used to study the effects of spatial design on the social, organisational, and economic performance of buildings and urban environments, and can therefore help designers and urban planners generate a better understanding of the relationship between spatial design and its effects on social life. The central premise in space syntax research is that space is a key and necessary resource for societies to organise themselves. By inhabiting a space, people 'configure' it, which space syntax recognises as the creation of a connected set of places, or discrete units, from one continuous space (Bafna 2003). Social structures are seen as inherently spatial, and, conversely, the configuration of space is understood to be based on a fundamentally social logic. This rationale also suggests that some spatial configurations allow for a higher rate of unplanned encounters between members of a public, while others offer a higher degree of privacy (Penn et al. 1998; Karimi 2018).

Space syntax was established in the 1970s by Bill Hillier and his colleagues at The Bartlett, University College London and has been developed further in the following decades at the university's Space Syntax Laboratory, and at its numerous affiliates around the world (Ratti 2014). Initially, the space syntax method was only used to analyse patterns of pedestrian movements in cities. Nowadays, the computer models can also simulate urban traffic, predict air pollution levels, assess burglary risks in neighbourhoods, and predict the opportunities for retail development on different streets (spacesyntax.com). Over the years, space syntax has become an increasingly well-known method for urban analysis to support experimentation and inform architectural and urban design. Digitally testing and comparing various design options can provide valuable feedback to designers. Architects such as Richard Rogers and Norman Foster, for instance, have used space syntax to simulate and evaluate the likely social effects of their design proposals, and compared them to the effects of design alternatives (Ratti 2004; Fiorino et al. 2013; Gehl and Svarre 2013).

5.2.2.1 Space syntax to explore socio-spatial configurations on different scale levels

Precedents and critiques of Space Syntax

Space syntax computer models consist of simple geometric elements (i.e. lines of sight and movement), which together form a network of spatial elements. This network can be translated into a graph that represents a pattern of relationships (Freeman 1977). The graph can then be analysed quantitatively to explore the role each section plays in the configuration of the larger system. Such an analysis can be used to generate a better understanding of complex spatial systems, which can provide analytical evidence that could help designers develop more effective design proposals (Karimi 2018). However, results of a spatial analysis with space syntax tools can only be interpreted through its associated theory of space (Netto 2015). This socio-spatial theory can be traced back to the 1970s when ideas on people's appropriation of spatial settlement structures were turned into a theory of spatial organisation of societies by Hillier and Hanson (1984). These ideas on architecture and cities as social concerns were inspired by French sociologist Henri Levebvre's understanding of city-making as the production of social space (1974). The theory consists of a reaffirmation of the central role of cities in human development and of the significance of urban spaces for social reproduction, thereby reinforcing ideas of several prominent urban thinkers such as activist Jane Jacobs (1961) and urban theorist Edward Soja (2000).

This thesis also relies on Stephen Read's theory of urban movements patterns (2005), a researcher specialised in urban modelling and urban form in Dutch cities. He argues that while space syntax's theory treats all movements through space equally, in reality different physical spaces belong to different classes, or 'hierarchies', which correspond to different scales and different social dimensions of a city (Budiarto and Read 2003). Read suggests that people's primary way of navigating and moving through the city involves stepping in and out of different hierarchic layers. He therefore introduces an alternative model, the 'vertical ecology', in which he differentiates between two spatial scales: the 'super grid' of a city, which provides the larger circulation within the city at a higher speed and with a greater reach (connecting the city to the region, country, and further), and the 'local grid', which enables movement within local areas such as the neighbourhood (Read 2005:346).

According to Read (2005), more affluent communities frequently use the 'super grid' of the city for their daily circulation, while less affluent populations more often depend on the 'local grid' of their neighbourhood. Affluent populations will commute over greater distances to travel to their offices, drop off or pick up their kids from school, go to the gym, do their groceries, and so on. Less affluent communities, on the other hand, are more dependent on their immediate surroundings, their daily routines often taking place in and around their neighbourhood.[58]

Read also argues that interactions and interrelationships between communities can be established in any space that is well-connected between hierarchic levels: a space that is part of the local network as well as the super grid of the city. This connectivity can be measured by space syntax to determine whether a neighbourhood is part of a larger system ('centred') or whether it is isolated ('de-centred') within a city (fig. 5.18).

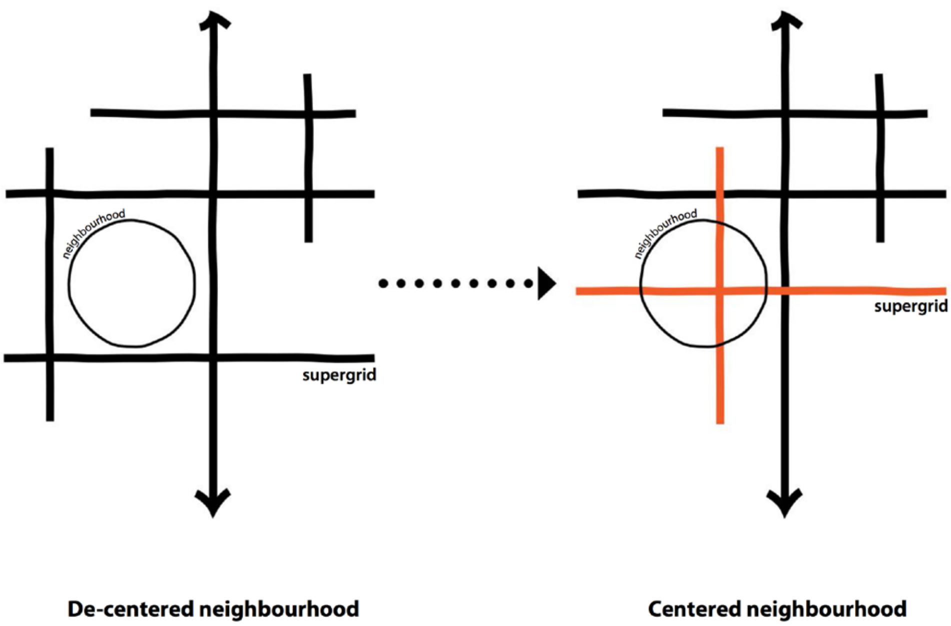


Figure 5.18 Diagrams illustrating a so-called 'de-centred' neighbourhood in the super grid of a city (left) and a neighbourhood that is embedded within the super grid of a city and therefore, according to Read (2005), can be referred to as 'centred'

58 Read's understanding of human movement is shared in the work of various other scholars, including Rapoport (1977) who developed a theory on daily movement patterns of different communities, and introduces various aspects that influence these movements, such as gender and religion. This reinforces Read's ideas on movement patterns of populations with different socio-economic profiles.

Read's ideas on connectivity (i.e. 'centrality') emerged from his 1998 research on the urban networks of 36 areas in five cities in the Netherlands. Through these space syntax studies, Read concluded that the relationship between the local area and the city are particular to the Dutch context. The way Dutch cities have grown over time was largely influenced by water engineering and land reclamation technologies. The expansion of cities and development of new neighbourhoods often followed historic polder patterns, such as the working class neighbourhoods in Rotterdam. As a result, neighbourhoods are physically separated from each other. This separation is also often reinforced by drainage canals that enclose neighbourhoods, and have a limited number of crossings since they require bridges. Another consequence of the particular conditions of urban expansion in Dutch cities is that existing routes in and around the city have been less influential in establishing the axes and networks of new urban development, which often takes the shape of relatively autonomous pockets. As a result, cities in the Netherlands tend to have fewer long roads in the network, such as Oxford Street in London or the major boulevards in Paris, which join a diversity of neighbourhoods – and their inhabitants - to the larger urban scale (Read 1998).

Space syntax's connectivity measurements can be used to assess whether the particular urban configuration of a neighbourhood allows for a positive socio-spatial mix. Such measures at different scale levels (the city, the neighbourhood, and the public space) are explored below in relation to the 'Parkstad' urban redevelopment plan. The axial map is the most commonly used format for urban analysis in space syntax. An axial map is a simplified representation of a city's street network, consisting of interconnecting lines. From this line matrix, different measurements can be made and simulations undertaken. A valuable use of the space syntax technology is exploring the 'integration' value of a line. According to space syntax co-founder Hillier (1996), the integration value strongly influences the activity and movement on a line, and are therefore crucial for understanding the functioning of urban systems. The integration value serves as an indicator of how well integrated a line is in the overall system (i.e. in a neighbourhood, a city, or the region); higher integration of a segment indicates more connectivity to the network (i.e. spaces connected by a minimal number of changes of direction). Various studies have verified a correlation between space syntax integration measures and the number of people observed in real urban spaces in a number of cities, including Kings Cross, Barnsbury and Golders Green in London (Hillier et al 1987; 1993), and in various cities in Greece (Peponis et al. 1989).

The 'global integration', a space syntax term for total or complete integration of a city's network, is calculated by measuring the integration of all axes in the city based on their relationship to all other axes in the city. Rather than repeating this measurement for each line in the network manually, space syntax can automatically assign an integration value to each line, resulting in a so-called 'global integration' map (fig. 5.19).

Next to the 'global integration' measure, there are also 'local integration' measures to analyse the connectivity of streets within a neighbourhood. This local integration measures the integration of a space with respect to all other spaces within a limited amount of changes of directions (often two to four changes) from the space concerned. Space syntax co-founder Hillier argues that public space occupancy rates can be predicted through the correlation between local and global measures of integration, which he refers to as 'intelligibility'. Hillier et al (1987) verified the correlation between these two factors in several studies for London, and Read (1998) found correlations between predictability and intelligibility for two cities in the Netherlands (Amsterdam and The Hague). These studies reinforce Read's theory on connectivity, and increased public space occupancy and pedestrian circulation in the places where global and local integrated streets meet.

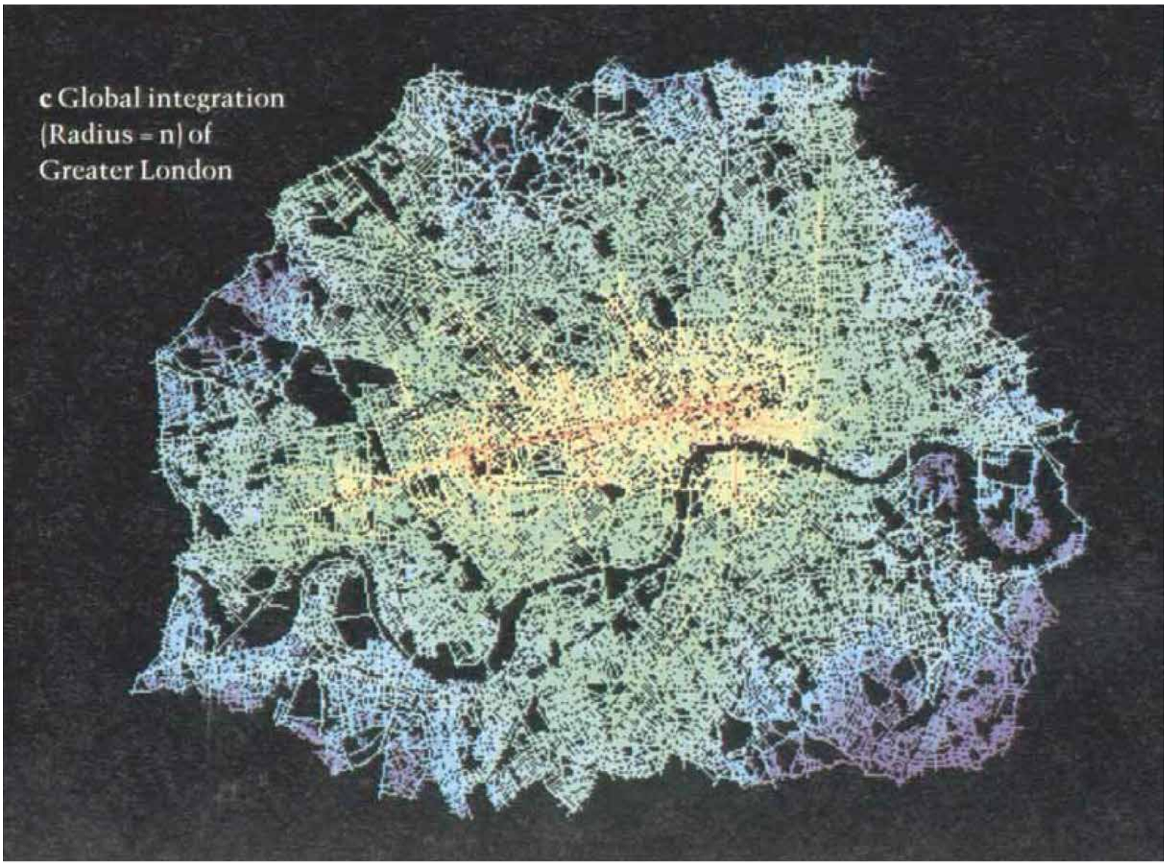


Figure 5.19
Global integration map of Greater London - the warmer the colour, the more integrated the line or segment is in the overall network of the city

5.2.2.2 The city of Rotterdam using Space Syntax

In my study, I used space syntax to examine the effects of the 'Parkstad' urban renewal plan on the levels of integration of the Afrikaander neighbourhood in comparison with the existing condition. These analyses were conducted with the UCL Space Syntax Lab's Depthmap program (the original space syntax software), and an axial map of Rotterdam developed by research students of Delft University of Technology. The axial map is created by taking an accurate map of a city and drawing a set of intersecting lines over its street network, resulting in a vector map of the urban grid of the city. This axial map forms the base map which is imported into the Depthmap software to run the analysis. To explore the relationship between the city-scale network (i.e. 'super grid') of Rotterdam and the network of the Afrikaander-neighbourhood (i.e. 'local grid'), I used Depthmap to analyse their respective integration values.[59]

I applied these two integration measurements (global and local integration) to identify and analyse the super- and local grid of the city of Rotterdam (see graphs in fig. 5.21-5.28). The red lines in the first two graphs indicate the streets with the highest global integration values, whereas the blue lines in the third and fourth graph indicate the highest locally integrated streets. By overlaying the super grid with the local grid, another graph is created highlighting the streets where the super- and local grid meet and overlap. Following Read's theory of socio-spatial hierarchies (i.e. 'vertical ecologies'), these lines represent the places where different populations come together, which provides opportunities for social interaction, social mixing and inclusion, and where people can display their culture and identities and become positively aware of diversity. Read (2005) argues that such a heterogeneous place occurs where the super grid of a city meets the highest locally integrated streets in a neighbourhood.

59 The Depthmap software runs this analysis automatically and offers an option to reduce or increase the radius for each measurement. The default radius 'n' analyses the maximum possible direction changes (i.e. the entire urban network), which results in the so-called 'global integration' graph (representing the 'super grid' of a city). The 'local integration' of a network (i.e. the 'local grid') can be calculated by reducing the radius. The selected radius (e.g. 1, 2, 3, and so on) determines the number of path lengths that will be calculated in the integration analysis. A radius of three, for example, will result in a graph demonstrating how each street is connected to its surroundings when limited to three times direction changes.

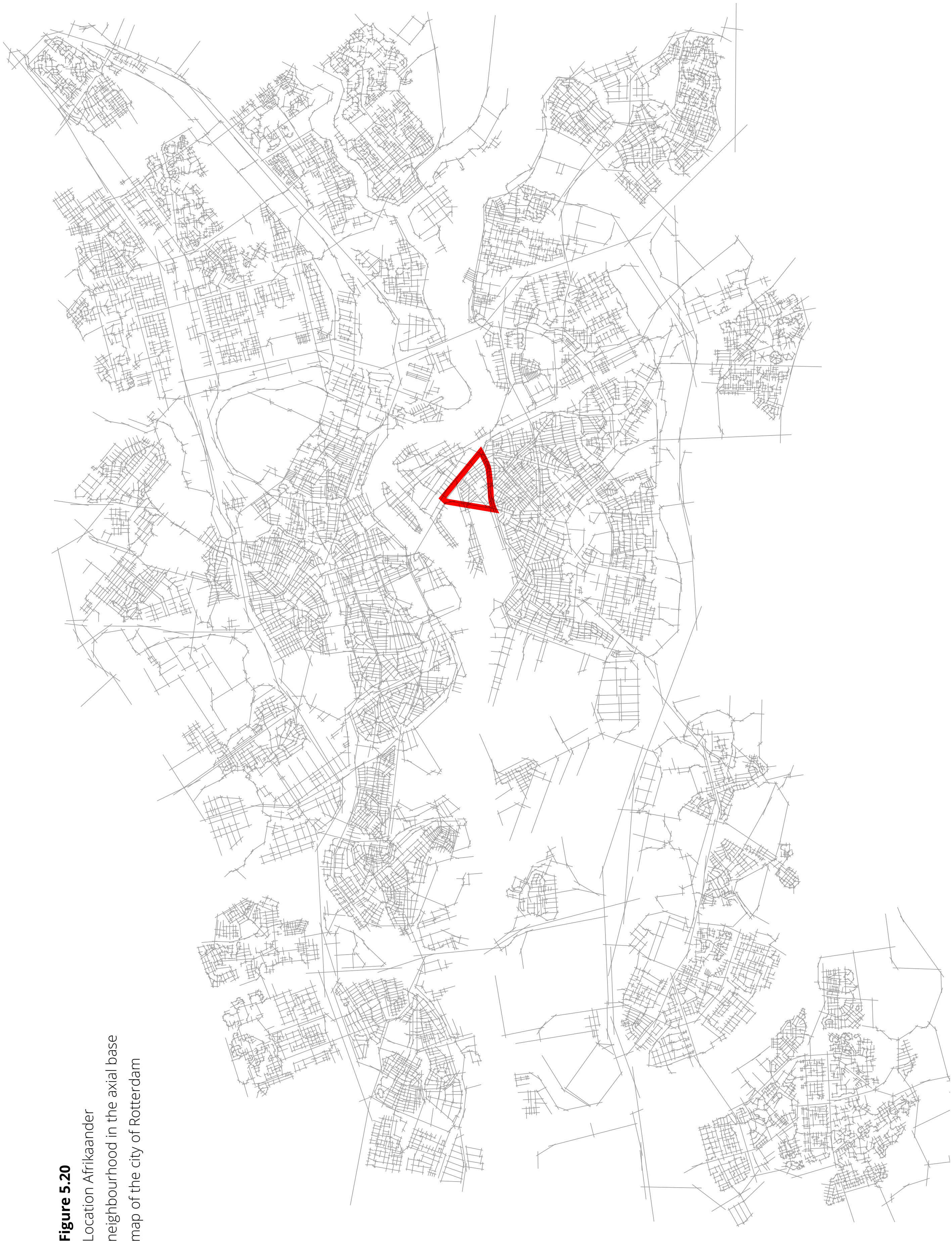
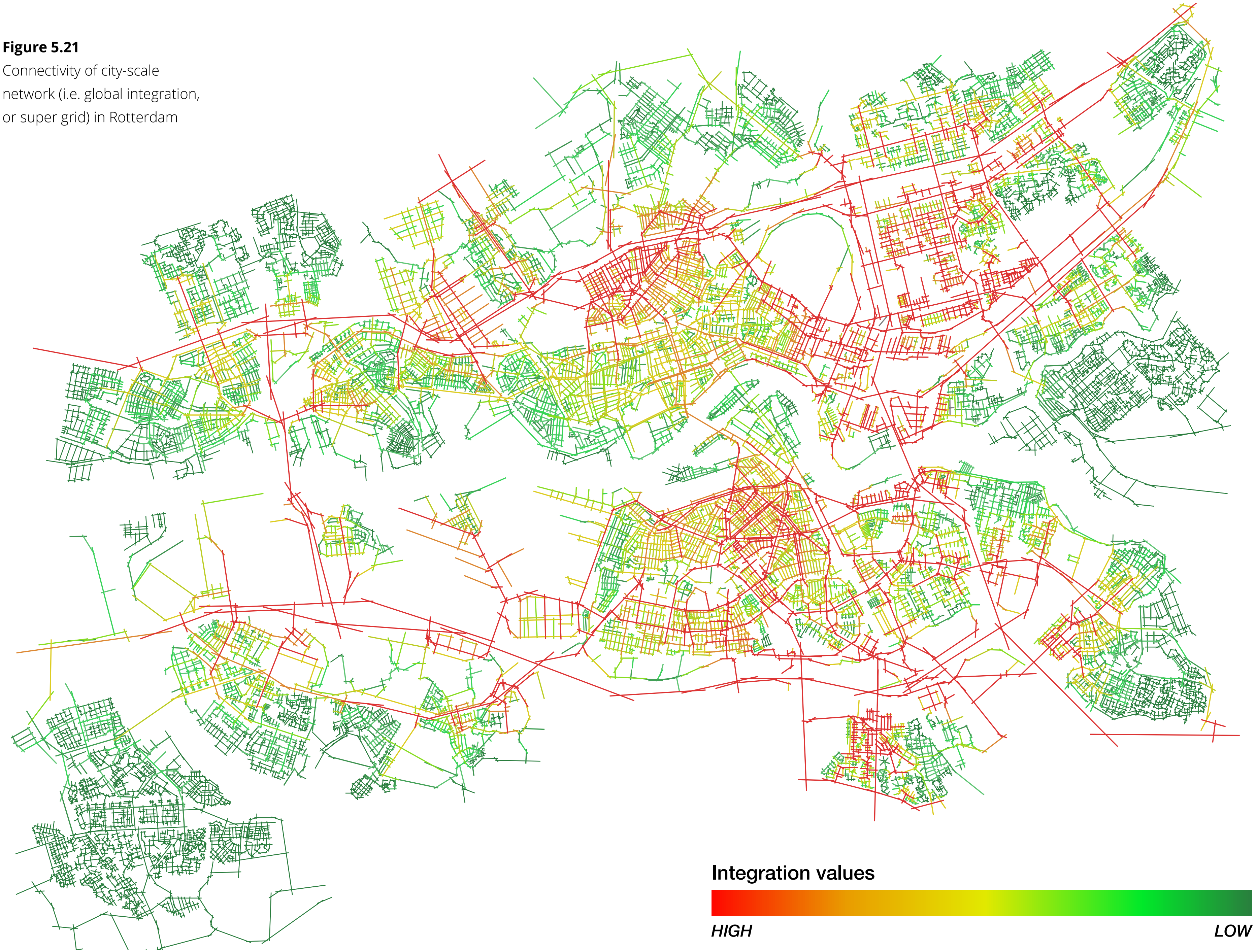


Figure 5.20
Location Afrikaander neighbourhood in the axial base map of the city of Rotterdam

Figure 5.21
Connectivity of city-scale network (i.e. global integration, or super grid) in Rotterdam



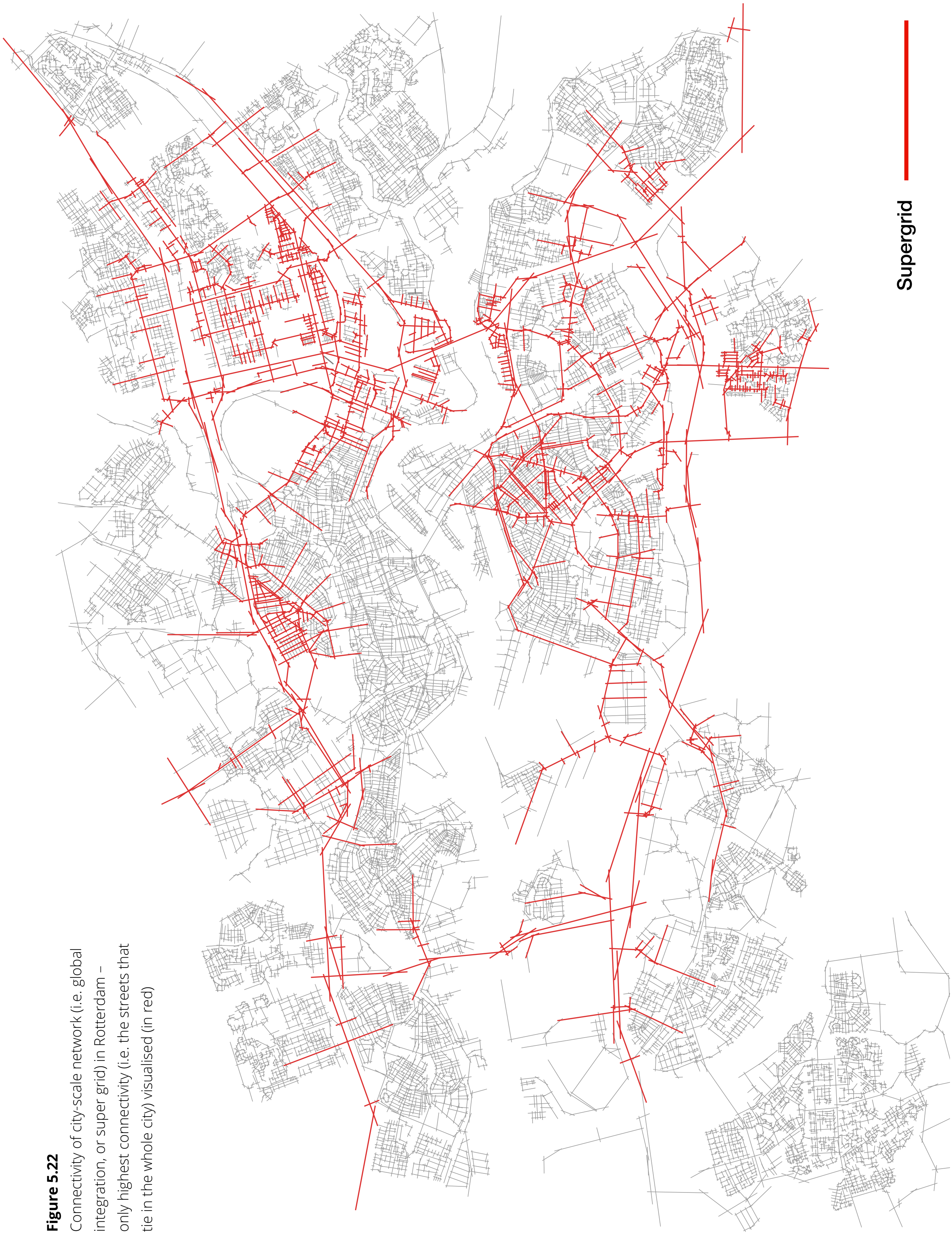


Figure 5.22
Connectivity of city-scale network (i.e. global integration, or super grid) in Rotterdam – only highest connectivity (i.e. the streets that tie in the whole city) visualised (in red)

Figure 5.23
Connectivity of neighbourhood streets (i.e. local integration measurement) in Rotterdam

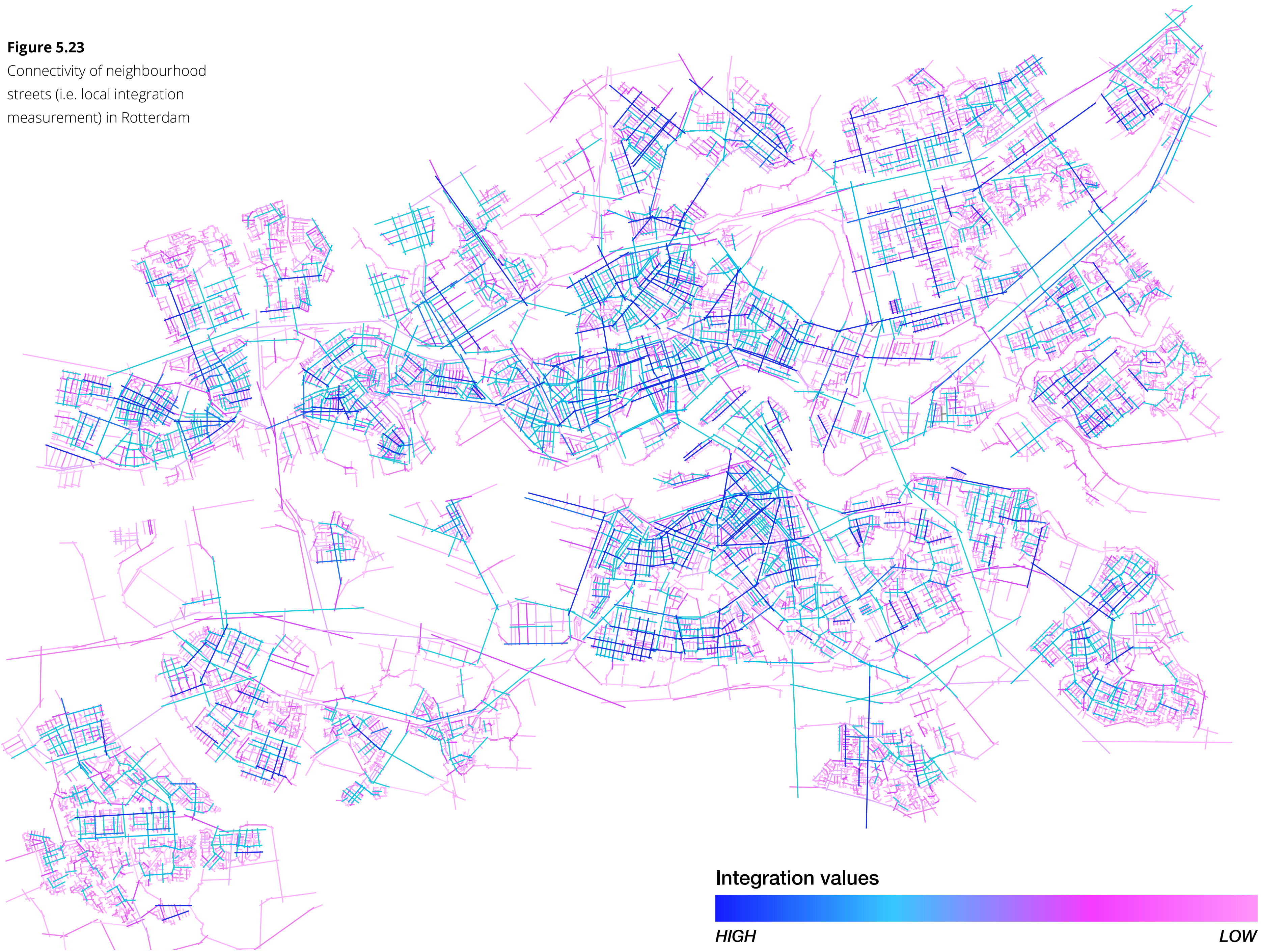


Figure 5.24
Connectivity of neighbourhood streets (i.e. local integration measurement) in Rotterdam – only best locally connected streets visualised (in blue) – with the Afrikaander neighbourhood highlighted

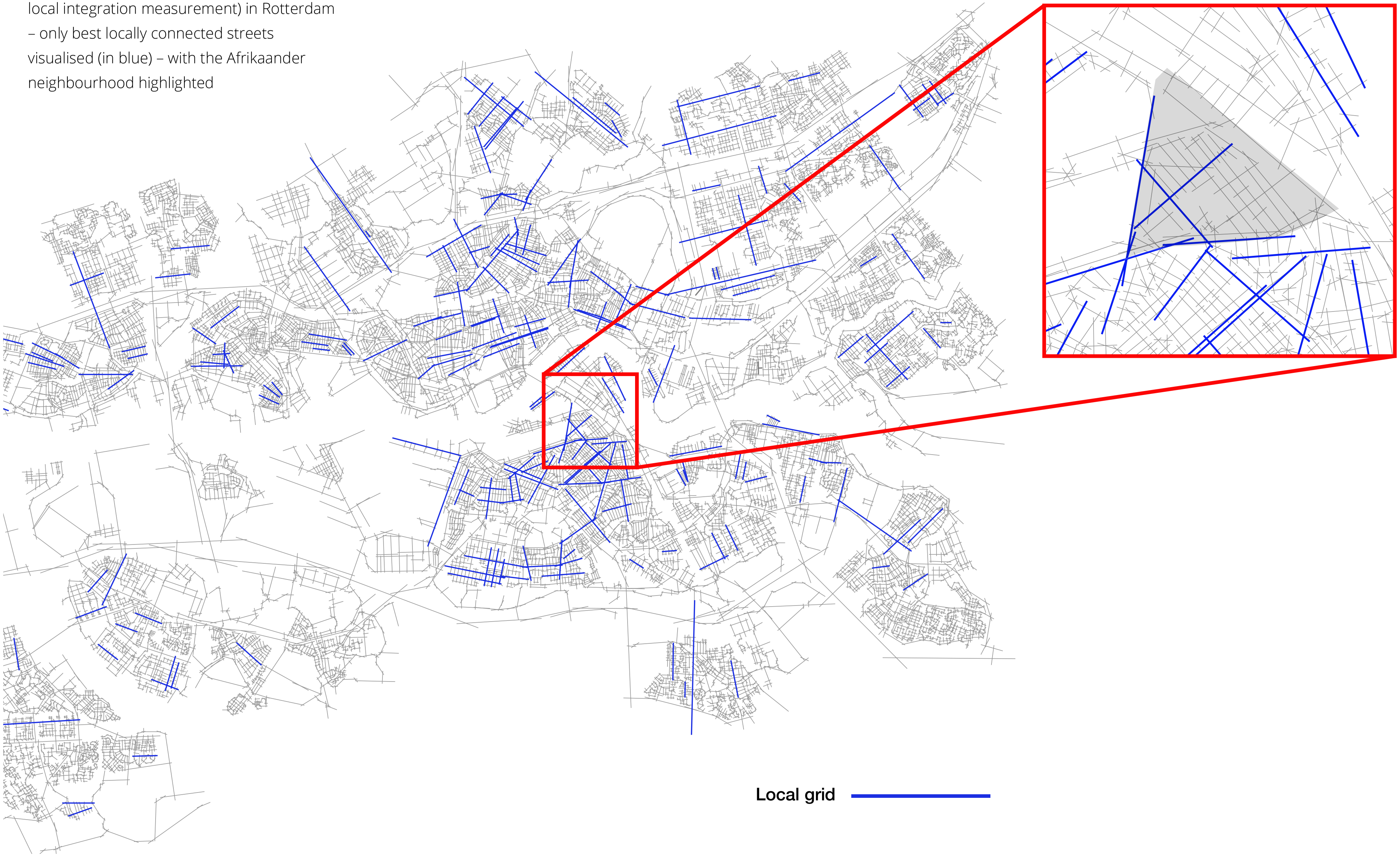


Figure 5.25
City network (red) and neighbourhood networks (blue) (i.e. highest integrated global (red) and local (blue) grids), with the Afrikaander neighbourhood highlighted

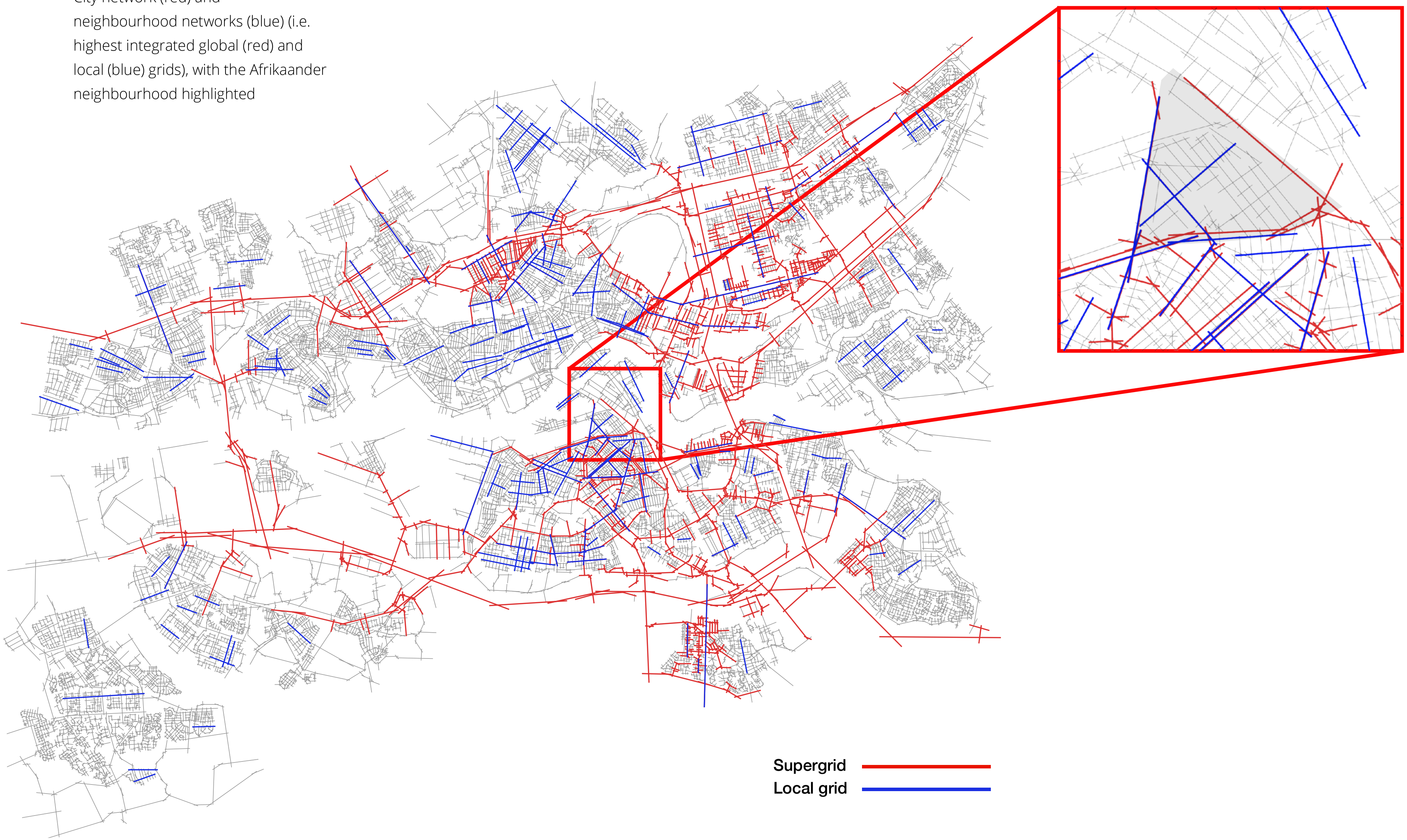


Figure 5.26
The streets where city and neighbourhood networks (i.e. super- and local grid) overlap

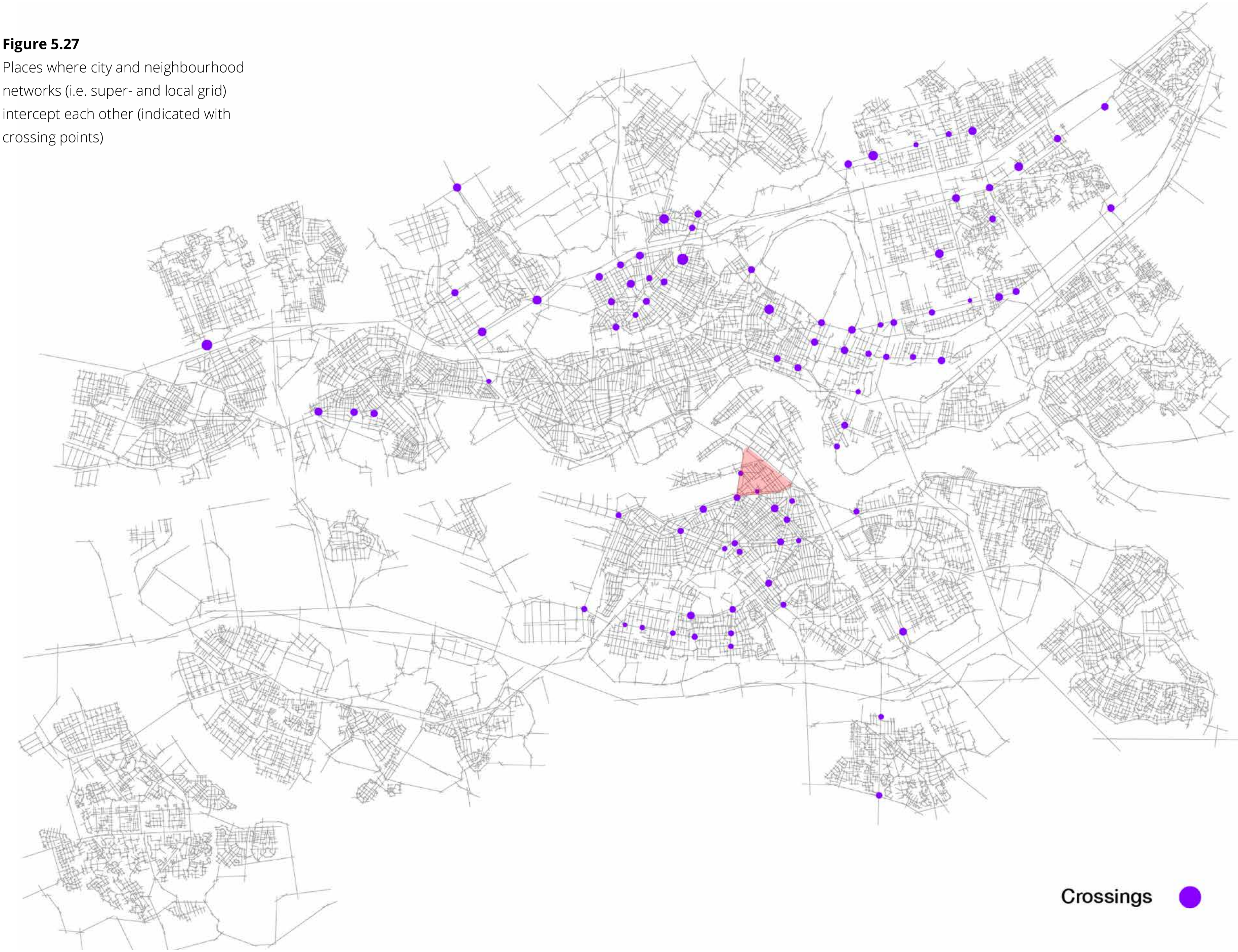


Figure 5.27
Places where city and neighbourhood networks (i.e. super- and local grid) intercept each other (indicated with crossing points)

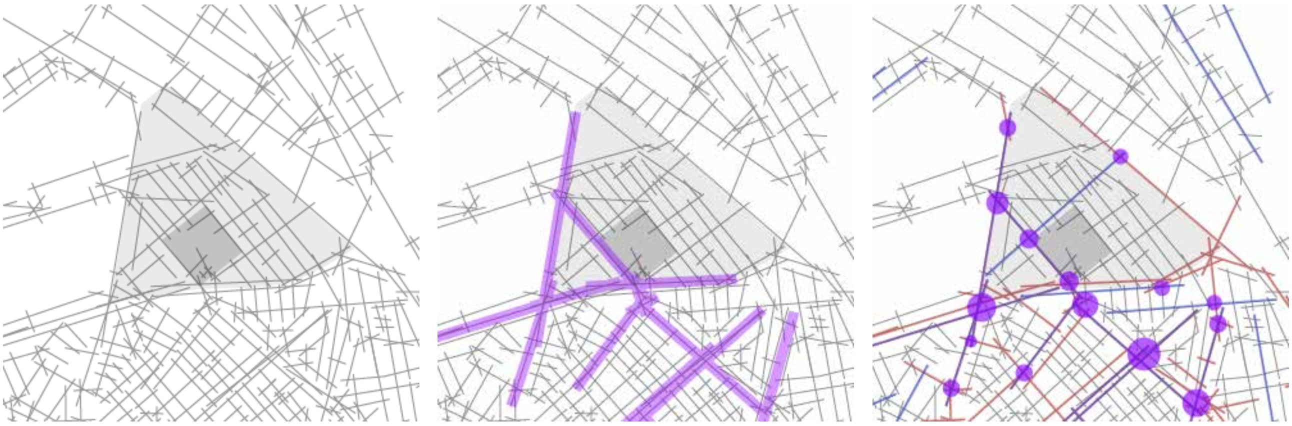


Figure 5.28
Close-up of Afrikaander neighbourhood. Left: base map the neighbourhood and -square. middle: overlay of super- and local grid, right: crossing points between super- and local grid.

The super grid analysis in figure 5.21 and 5.22 demonstrate that there aren't many global scale north-south connections in Rotterdam; the larger network of the city is predominantly connected through east-west connections. These connections are located close to the periphery, while the city's most highly integrated local streets are spread throughout the city and are mostly located in the more central areas of the city. Corresponding to Read's findings in his study on Dutch cities (1998), the super grid analysis demonstrates that the city of Rotterdam has a limited number long unifying roads that run through the city. In London, for instance, long lines are much more evenly distributed than in Rotterdam, where these lines mostly run east-west along the periphery of the city (Read 1998). The super grid mapping also demonstrates that the most highly integrated lines, particularly in Rotterdam-South, run along the border in between neighbourhoods. These lines demonstrate the divisions in the spatial network of the city. The spatial configuration of neighbourhoods in Rotterdam-South in particular seem to be physically and spatially separated from adjoining neighbourhoods. The mapping also demonstrates that the centre of the city is not very well connected to the city's larger network. While the connectivity of the centre is low for car mobility, it is well connected through a public transport network. Moreover, the concentration of diverse programming, including offices, shops, bars, restaurants, and so on, attract a lot of the public. This demonstrates that while connectivity can be an important feature to analyse pedestrian and mobility flows, it is not the only determining factor of public activity levels and pedestrian circulation in an urban area.

As discussed earlier, urban expansion in cities in the Netherlands generally involved the development of completely new living environments on what was former agricultural or waste land. Therefore, rather than following a pre-existing urban spatial pattern, the layout of these urban extension areas was either developed from scratch or based on the underlying polder pattern of the former agricultural landscape (as is the case in most areas in Rotterdam-South). While most urban extension areas in the Netherlands were carefully planned in the smallest detail (from architectural to social conditions), in some cases they nevertheless resulted in the production of empty and underused public open spaces, such as the Afrikaander square. Furthermore, the social dangers that accompany such underused and poorly supervised open spaces tend to occur in areas with low general rates of public space occupancy (i.e. in places with limited connections to the city's larger urban network) (Read 1998).

While Read's ideas on 'centred' and 'de-centred', or connected and disconnected neighbourhoods in Dutch cities can be used to explain the lack of movement flows and pedestrian circulation in certain neighbourhoods in Rotterdam, his theory does not apply to all neighbourhoods in this city. Some areas that have active public spaces are not located on the super grid (such as Rotterdam's central shopping district). Neighbourhoods in the north of the city also have a lively neighbourhood high street with many amenities, an active local economy, and lively public spaces, even if these streets are not part of the city's super grid.

What *is* missing in Read's theory is the distinction between activity levels in neighbourhoods with different socio-spatial hierarchies. The more affluent neighbourhoods in Rotterdam have fewer problems regarding underused, neglected public spaces and diminishing public programmes and shops. Neighbourhoods with a high concentration of less affluent inhabitants, such as the Afrikaander neighbourhood, on the other hand, rely on people outside the area for their local economy and revitalisation of the public realm. Therefore, being connected to a super grid is less of a determining factor of pedestrian flows and public space occupancy for the more affluent neighbourhoods than it is for less affluent areas, since local programmes and shops in these affluent areas are sustained by a more stable and socio-economically stronger population.

Furthermore, while it can be unrealistic to connect the super grid to the centre of each neighbourhood in a city, it is important to have enough connections between the two so that people in the local grid can easily get on and off the super grid. For the Afrikaander neighbourhood, however, the issue is not to get the local inhabitants onto the city's super grid - there are enough connection points between the two networks. Rather, on an external level, there is a lack of through-movement: that is, the difficulty for this particular neighbourhood is to draw people in from outside. On an internal level, the Afrikaander square forms an impediment to internal (local) circulation: circulation takes place around the periphery of the square, rather than through it. Section 5.2.2.3 elaborates on the local circulation issues in and around the square in more detail.

Car and bicycle mobility could play an important role to improve through-movement at an external level. At the moment, the fastest north-south and east-west connections run along the periphery of the neighbourhood, even if geographically the shortest route would be through the neighbourhood. The lack of fast car and bicycle connections results in little through-movement in the neighbourhood, which could help make outsiders aware of the programme in the neighbourhood (such as the market) and with that become a destination for a larger public.

5.2.2.3 The Afrikaander square and neighbourhood

Rotterdam has the highest concentration of so-called 'problem neighbourhoods' in the country: one-third of the city's population lives in one of these neighbourhoods.[60] The largest concentration can be found in Rotterdam-South, and the Afrikaander neighbourhood is one of the areas with the highest number of socio-economically disadvantaged residents.

The development of Rotterdam-South is strongly associated with the development of the port of Rotterdam in the late nineteenth century. Port industry boosted economic activity in the area and increased employment opportunities, which in turn resulted in an increasing demand for affordable housing and the development of a large number of working-class neighbourhoods (including the Afrikaander neighbourhood) around the port. In the 1960s and 1970s immigrants from southern countries were brought to the Netherlands as so-called 'guest-workers' to help restore the port industry and national economy after WWII.[61] This massive migration flow required a transformation of the housing stock and redevelopment of the neighbourhoods surrounding the industrial port. From the 1980s onwards, port activities started shifting outside of the city towards the coast. Furthermore, due to technological advances and increased automation in the port industry, numerous jobs became redundant. Migrant guest-workers were often poorly educated or uneducated and unable to adapt to a changing labour market. Therefore, as the number of jobs in the port industry declined, (long-term) unemployment among first- and second-generation migrants in Rotterdam increased.

60 On March 22nd 2007 Minister Vogelaar of the Ministry of Housing, Neighbourhoods and Integration (Wonen, Wijken en Integratie) announced a list of 40 'problem neighbourhoods' in the Netherlands, of which seven are located in Rotterdam. This is the highest concentration of problem neighbourhoods in one city compared to the rest of the cities in the Netherlands (https://www.volkskrant.nl/nieuws-achtergrond/vogelaar-kiest-40-achterstandswijken~b15f7245/, accessed 5 September 2018).

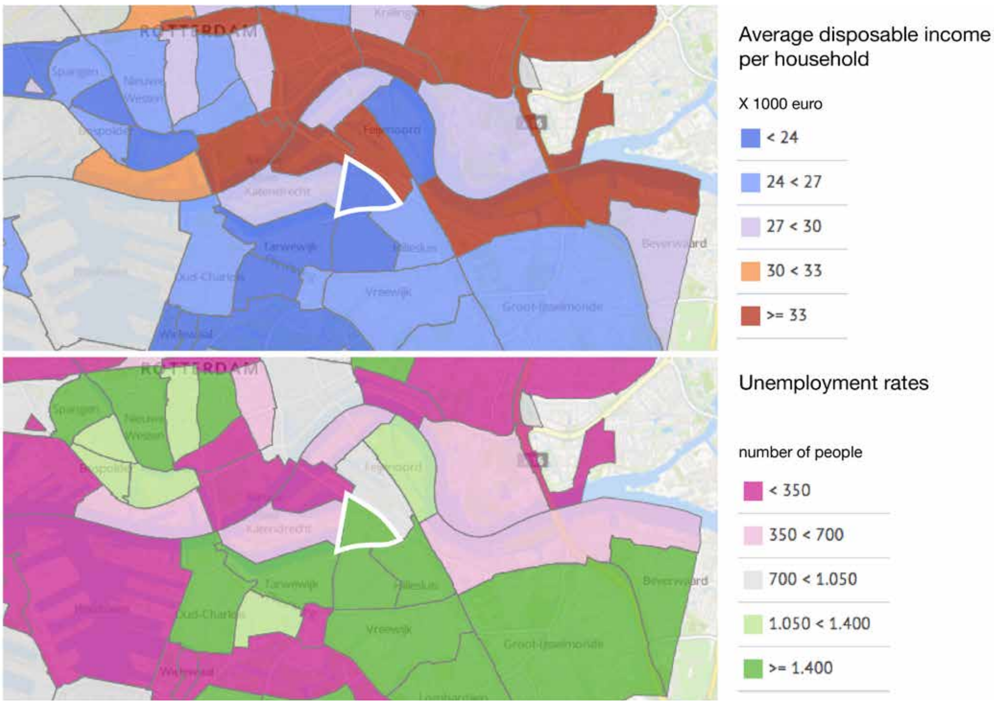
61 During the German invasion of the Netherlands in WWII, Rotterdam was severely damaged by aerial bombardments. After the end of the war, the industrial port was one of the first areas to be reconstructed in the city (van Meijel et al. 2008).

History

The demographic composition of the Afrikaander neighbourhood has changed dramatically over a period of four decades, from a densely populated working-class neighbourhood inhabited by Dutch dockworkers to a neighbourhood with a concentration of ethnic minorities (more than a third of the neighbourhood residents are from a Turkish background).[62] The neighbourhood has a high unemployment rate and a relatively young demographic. Furthermore, as a result of urban renewal, the total number of residents has reduced to almost half since the 1960s. Finally, the housing stock in the Afrikaander neighbourhood exists primarily of social rent housing; 85 percent of the total of 3,743 homes belong to the public rent sector, only 8 percent is privately owned, and 7 percent belongs to the private rent sector (Crimson 2007).

In the 1970s the Afrikaander neighbourhood was located in the middle of the industrial site around the port, with the shipping harbour to its west and a rail-harbour, railroads, and railyard to the east. Today, the neighbourhood is surrounded with working-class neighbourhoods to the south, and more affluent neighbourhoods to its north and east (fig. 5.29).

Figure 5.29 Demographic composition of Afrikaander neighbourhood and neighbouring areas, with income levels per neighbourhood (top) and unemployment rates (bottom)



62 While Rotterdam has a population of which 45 percent are from a non-Western origin, with 8 percent originating from Turkey, in the Afrikaander neighbourhood 84 percent of the population is from a non-Western origin, of which 34 percent from a Turkish background (Crimson 2007).

In the area in and around the neighbourhood, a sharp contrast is perceivable between the more prosperous and metropolitan residential areas and less affluent working-class areas (Crimson 2007). Until the 1970s, there was a rich and diverse system of work and facilities in the neighbourhood, with the port industry at the centre of economic activity, which expanded into a wide range of shops, a market, schools, a church, local industry, and numerous workshops. Today, there are only two street-ends with old shops whose owners have expressed their concerns about keeping their business running. Ongoing urban renewal in the area, the growth of large-scale supermarket chains, and decreasing income levels of the neighbourhood inhabitants have all contributed to the decline of small-scale retail in the area. Due to the homogeneity of the neighbourhood's socio-economic weak population, local shops were not able to survive off their local clientele. Hence, a lot of small-scale retail has moved out of the Afrikaander neighbourhood.

'Parkstad': new ongoing neighbourhood redevelopment

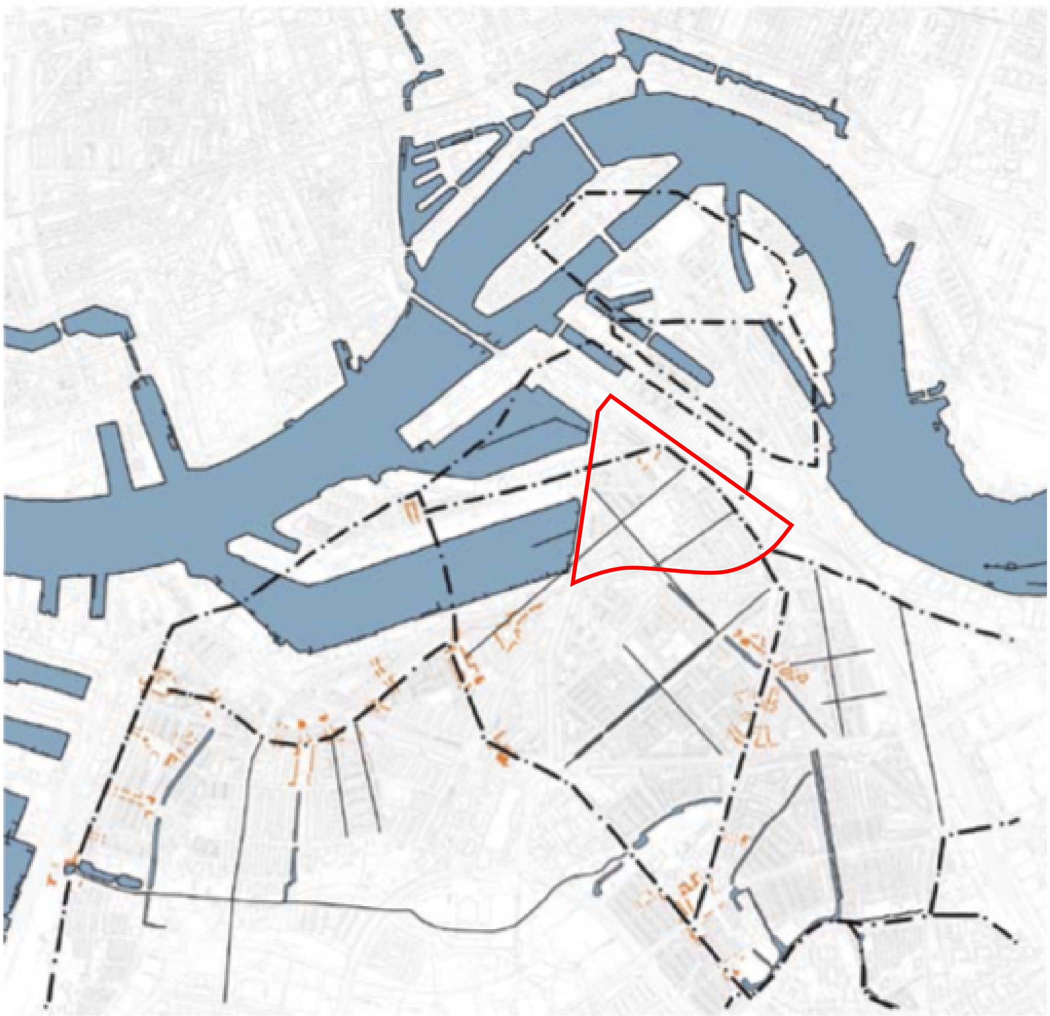
Although the Afrikaander square was redesigned in 2007, the surrounding areas in the neighbourhood were not. While the square sits within a spatially dysfunctional neighbourhood, its redesign and redevelopment took place in isolation. Partly due to this isolated approach, the square does not function well within the context. While a redesign of the square is not part of the 'Parkstad' scheme, this section argues that the neighbourhood redevelopment plan will not achieve a positive socio-spatial mix unless the local public spaces are improved, including the Afrikaander square. In a more holistic approach, this section first explores the spatial issues (including circulation and perimeter conditions) of the neighbourhood in more detail, before moving on to analysing the Afrikaander square.

The Afrikaander neighbourhood, which has been the object of ambitious regeneration plans for several decades, finds itself again in the midst of a new wave of urban redevelopment. Not only the Afrikaander neighbourhood, but the entire area of Rotterdam-South has been subject to numerous initiatives that aim to tackle existing social, spatial, and economic problems. These plans range from private to public initiatives, national to municipal schemes, and short-term interventions to long-term strategies. One of these plans is the ‘Parkstad’ proposal, which is the result of a closed development competition published by Rotterdam’s city council in 2016 for the development of 250 new dwellings, both owner-occupied and private rent, on the old railyard located at the eastern border of the Afrikaander neighbourhood (fig. 5.30).

Figure 5.30
The original 'Parkstad' proposal by urban and landscape design firm Palmbout in 2009 (top), and the current urban development plan for 'Parkstad' by the municipality of Rotterdam

The eastern border currently consists of a railroad slope which forms a physical and visual barrier and limits connections to the adjacent, more affluent, residential area located east of the neighbourhood. This barrier is reinforced by the northern and eastern embankments enclosing the neighbourhood, which were constructed in the 1960s and 1970s as part of the regional Delta Works. The embankments and the old railyard and tram depot have closed off the neighbourhood from its environment; natural routes have been cut, and visibility is limited both from inside the neighbourhood outwards, and from the outside in (fig. 5.31-5.34).

Figure 5.31
System of dykes and embankments in Rotterdam-South (Afrikaander neighbourhood highlighted in red)



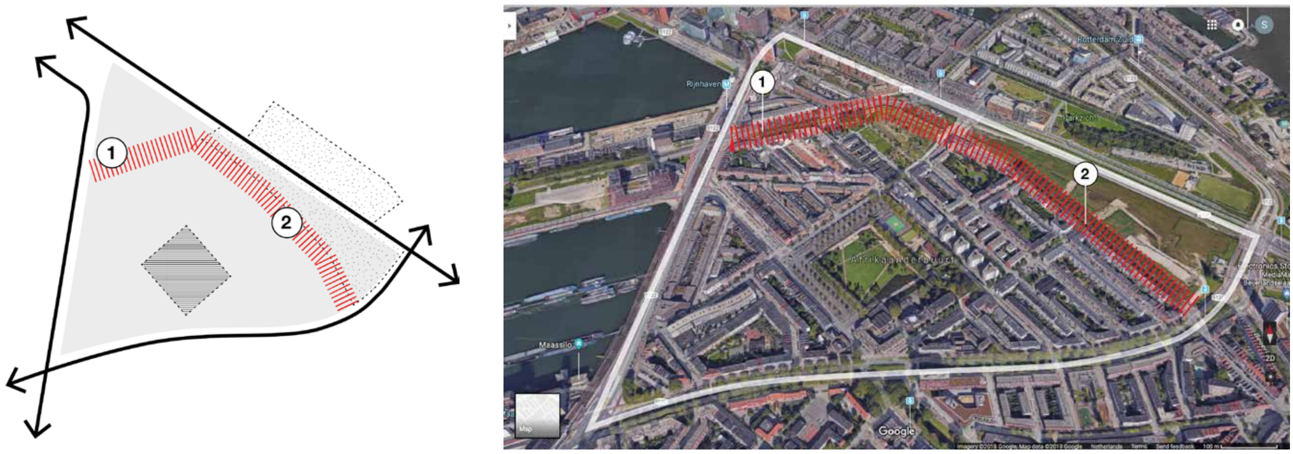
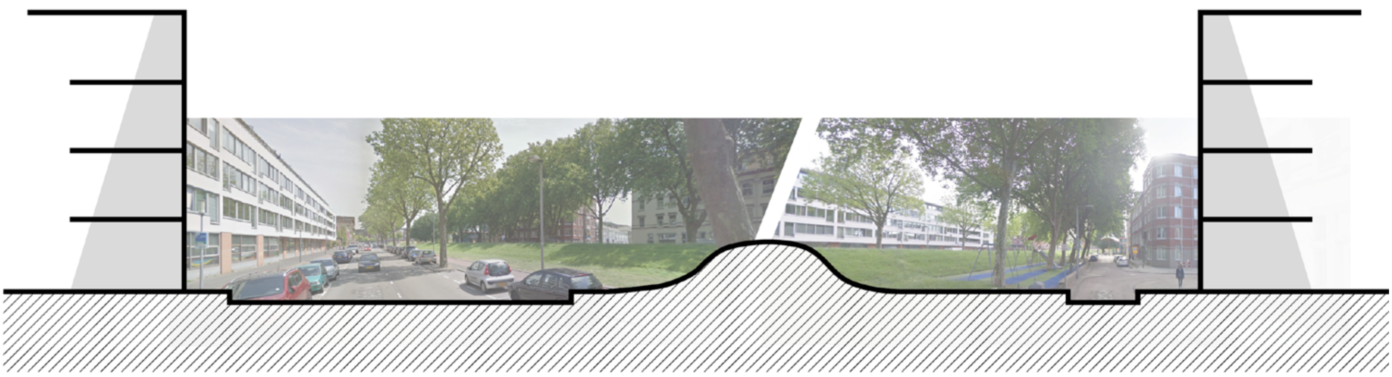


Figure 5.32
Diagram and aerial view of Afrikaander neighbourhood with embankments illustrated in red and numbers referring to the sections and street views in the following figures

① **northern embankment**

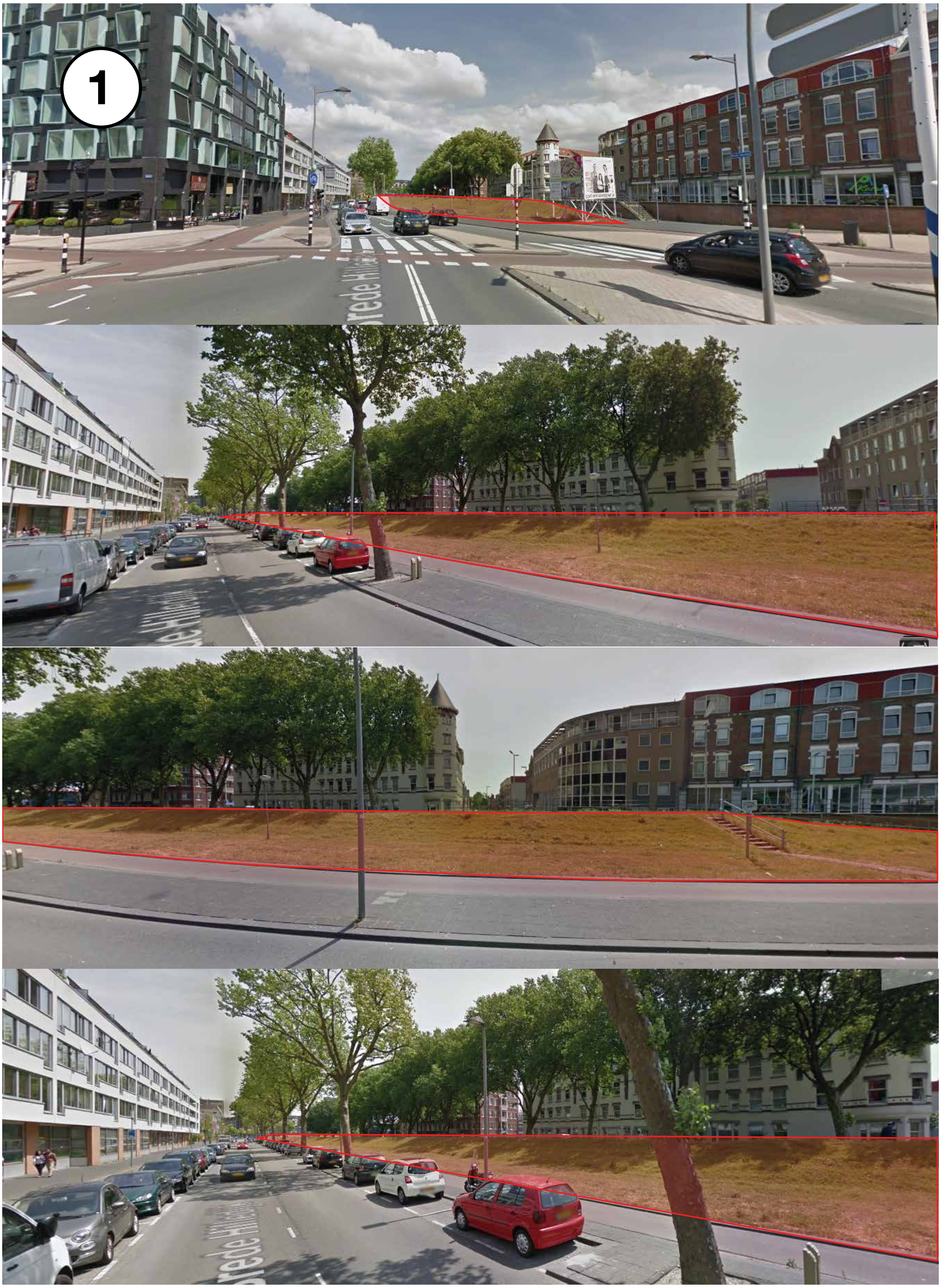


② **eastern embankment**

Figure 5.33
Street sections of the northern embankment (top) and the eastern embankment (bottom) forming barriers to entry to the neighbourhood and square

Figure 5.34

Street views of location 1 and 2 - embankment highlighted in red




2
Parallelweg
Brede Hilledijk

The ‘Parkstad’ plan aims to restore connections between the neighbourhood and its surroundings by transforming the eastern embankment and railway yard into a residential area, extending two neighbourhood streets through the new residential development and connecting them to the larger infrastructural network of the area (fig. 5.35), which is a good beginning to increase connectivity between the local and super grids.

By introducing new housing for middle- and high-income groups, the local council aims to diversify the housing stock and attract a new demographic to the neighbourhood. The council hopes that this strategy will help establish a socio-spatial mix and strengthen the local economy, which would also benefit the neighbourhood’s existing population. One could question, however, whether the demographic, ethnic, and socio-economic differences between the existing and new inhabitants will result in a beneficial situation for both groups, or whether the urban renewal will result in two populations that live in separate worlds, one closely related to the impoverished working-class areas in the south, and the other connected to the more affluent, metropolitan residential areas to the north and east. Existing public spaces in the neighbourhood, particularly the centrally located Afrikaander square, offer opportunities to bring these populations together.

Figure 5.35
‘Parkstad’ concept proposal by municipality of Rotterdam (left) and diagram of new connections (right)

By analysing socio-spatial digital data, this section explores whether the planned spatial interventions of 'Parkstad' are likely to bring about the desired social effects. Furthermore, by running different tests and simulations with digital data, an alternative intervention is proposed to increase pedestrian circulation in the neighbourhood and across the square, which could help revitalise existing public spaces and increase opportunities for different socio-economic populations to interact. Finally, this section demonstrates how digital data analysis could help generate new insights into the problems of a site, and argues that a digital exploration could help designers develop more socially sustainable designs.

Situation before 'Parkstad' intervention

To demonstrate the effects of the 'Parkstad' plan on the local urban configuration, the following maps demonstrate the integration of the city- and neighbourhood scale network (i.e. super- and local grid) in and around the Afrikaander neighbourhood before the 'Parkstad' intervention (fig. 5.36).

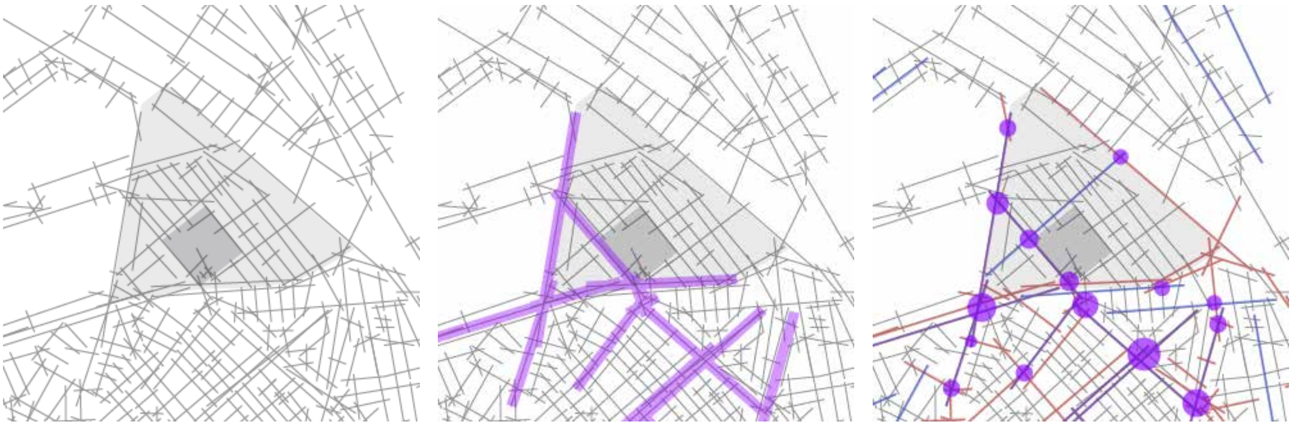
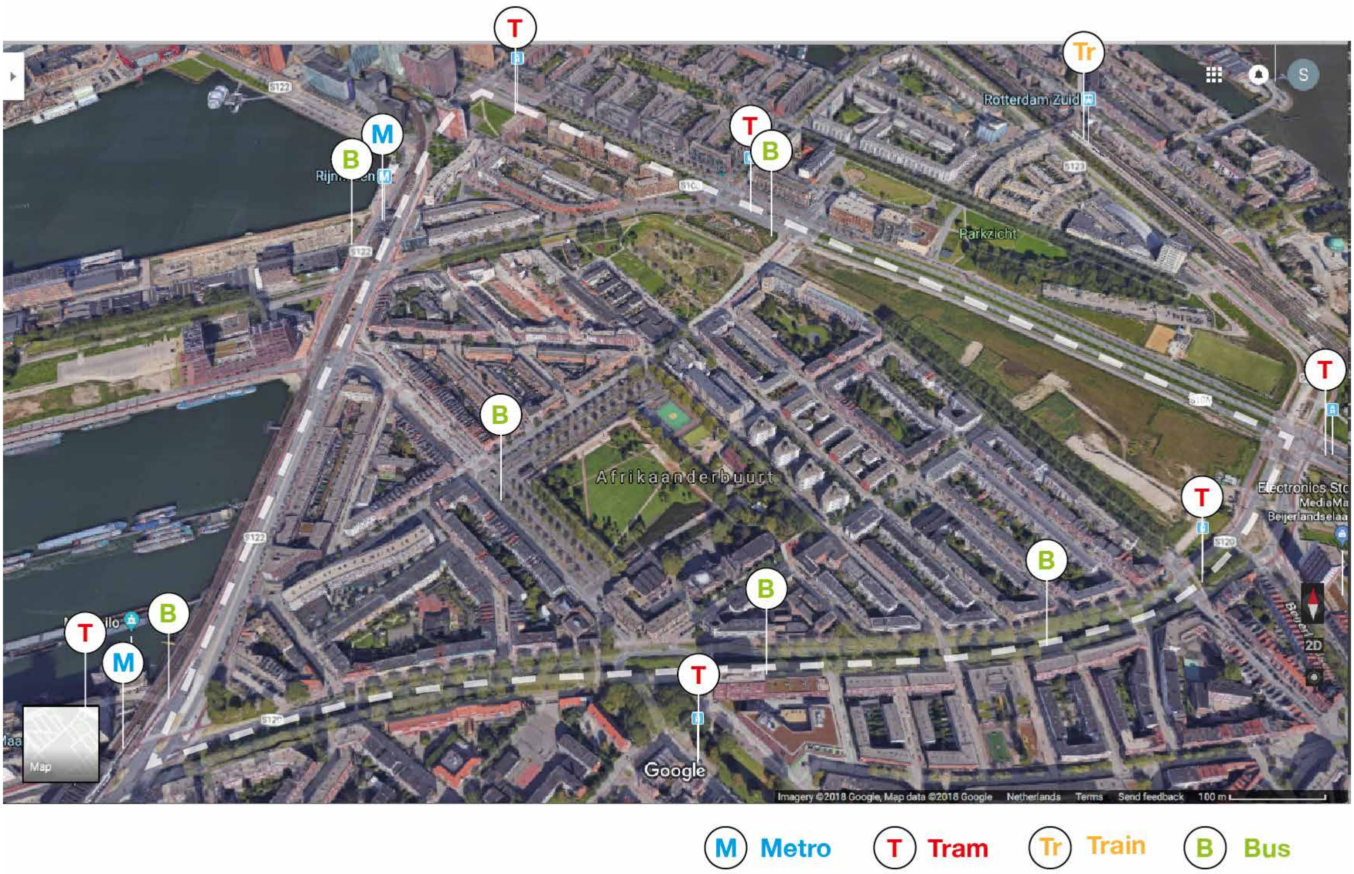


Figure 5.36
Situation before 'Parkstad'. Left: base map Afrikaander neighbourhood and -square, middle: overlay of super- and local grid, right: crossing points between super- and local grid.

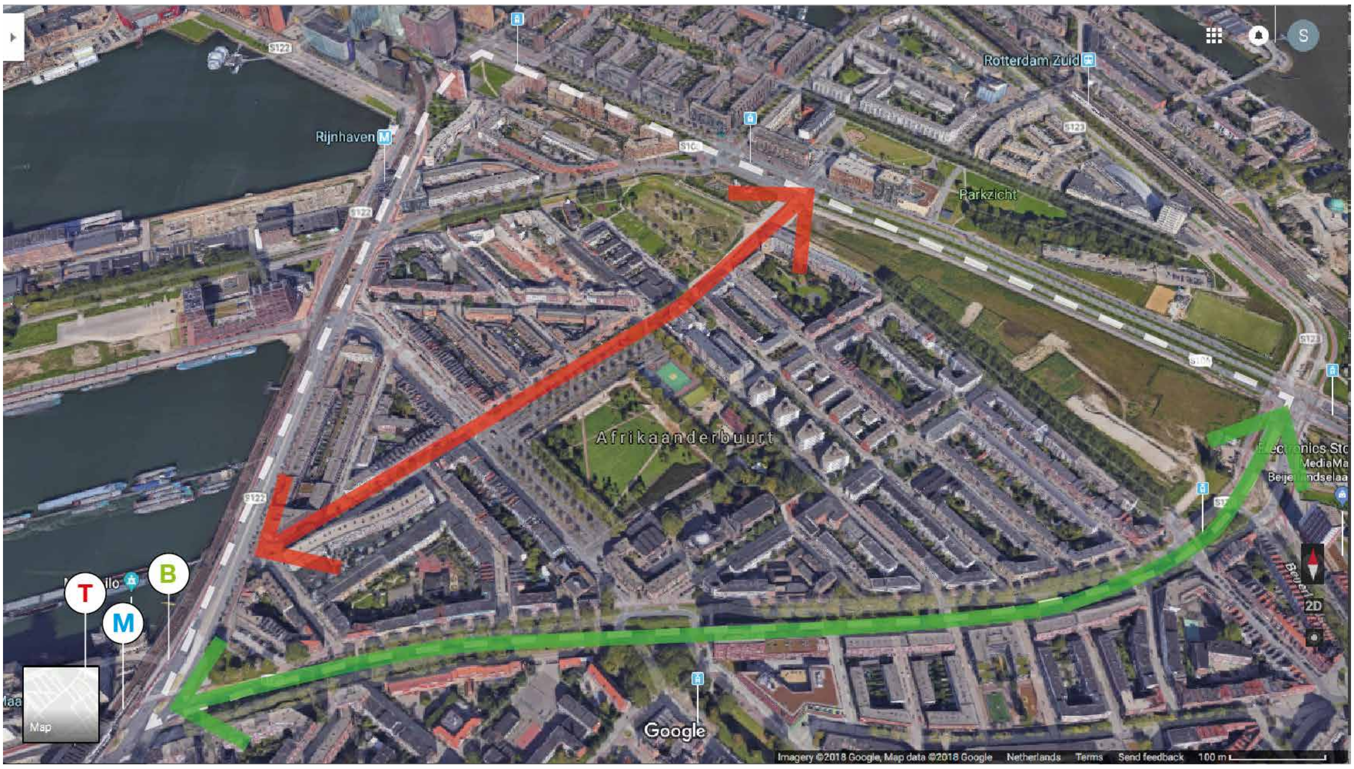
The maps demonstrate that the western area of the neighbourhood is quite well-integrated, while the eastern part is more isolated. Furthermore, the well-integrated east-west and north-south connections in the area mostly run along the periphery of the neighbourhood. There are three points west of the neighbourhood where the super and local grid cross, and where locals can get onto the city's larger network. Two of these crossing points are important public transportation nodes in the area, where metro-, bus-, and tram-lines come together (fig. 5.37). As figure 5.37 demonstrates, there are many public transportation options on walking distance from the neighbourhood, including a metro line, tram lines, a train station and bus connections, for locals to get onto the super grid of the city.

Figure 5.37
Locations of metro-, tram-, train-, and bus stops in and around the Afrikaander neighbourhood



As discussed earlier, these maps demonstrate that the problem of connectivity in the Afrikaander neighbourhood is not for locals to get onto the super grid of the city. Instead, the difficulty is getting people from outside into, or through the neighbourhood. There are few fast connections (for cars and bicycles) that run through the neighbourhood and connect it to the city's larger network. Those outside the neighbourhood currently have no particular reason to go into or through the neighbourhood to travel east-west or north-south. Particularly the east-west connection through the neighbourhood (which runs along the Afrikaander square) is a missed opportunity since geographically it would be the fastest route to get to the north-east area from the crossing point located south-west of the neighbourhood (or vice-versa) (fig. 5.38). In the existing situation, however, most of the car and bicycle movements take place along the south border of the neighbourhood.

Figure 5.38
Existing movement along the south border of the neighbourhood in green and missing fast car and bicycle connection through the neighbourhood in red



As for the slower (pedestrian) movements, the space syntax graphs point towards several hypothetical through-lines that would seem obvious, but aren't there. Next to the east-west connection through the neighbourhood, there are missing connections over the eastern embankment, which currently forms a physical and visual obstacle. A more detailed analysis of these barriers reveal desire lines materialised through informal routes over the embankments to enable a better pedestrian connection between the Afrikaander neighbourhood and the amenities located on the high street of the neighbouring area (fig. 5.39).

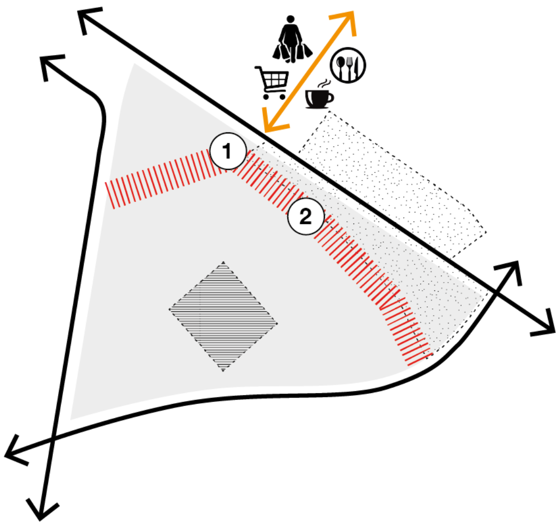
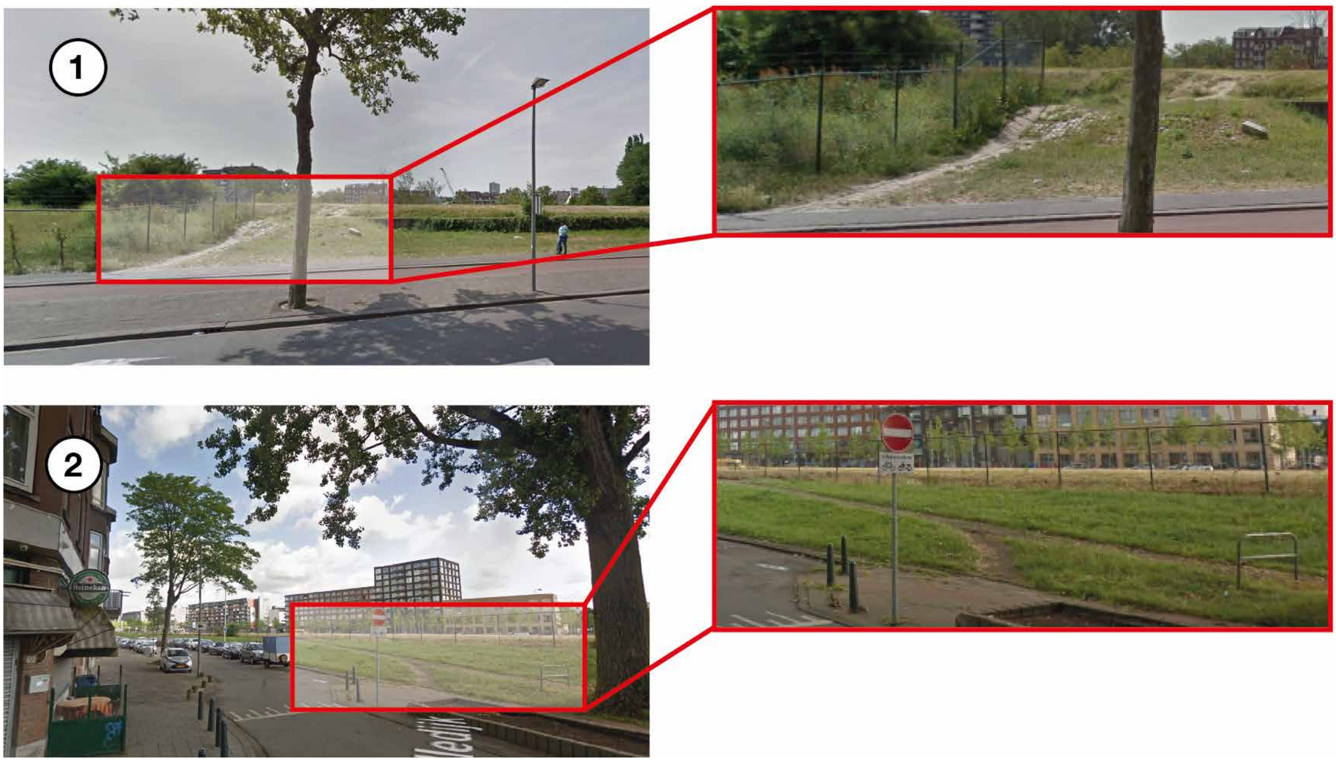


Figure 5.39
Informal pedestrian paths and routes over the embankment to reach commercial street (orange line in diagram) in neighbouring area



Effects of 'Parkstad' plan

The 'Parkstad' neighbourhood renewal plan intends to establish new connections between the neighbourhood and its surrounding context by extending two of the neighbourhood streets to a street within the super grid of the city running east of the neighbourhood (fig. 5.40). To analyse whether this proposed connection would benefit the connectivity of the neighbourhood within the city's larger network, I conducted another set of simulations with space syntax on the effects of the proposed 'Parkstad' intervention (fig. 5.41).

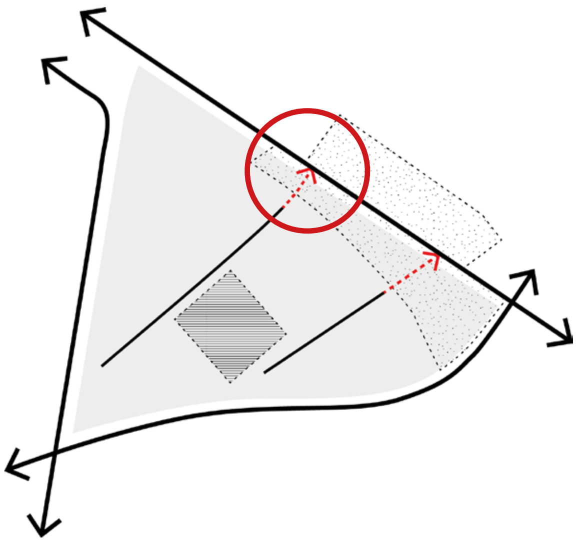


Figure 5.40
Diagram of the location of the 'Parkstad' infrastructure intervention

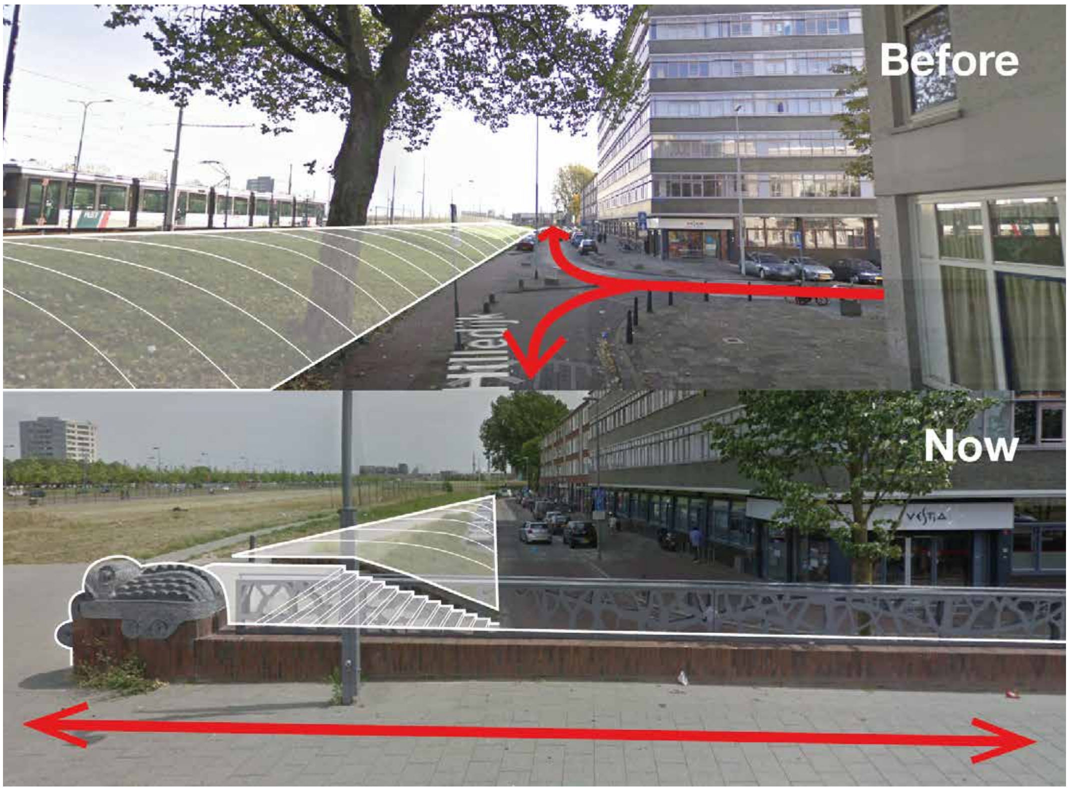


Figure 5.41
The central neighbourhood street is elevated over the embankment to establish a new connection with the larger scale urban network east of the neighbourhood

By comparing the situation before and after the 'Parkstad' intervention, the maps demonstrate that although the proposed interventions of the 'Parkstad' plan will have some effect on the connectivity of the neighbourhood (i.e. it will add a new crossing point on the eastern border of the neighbourhood), their planned intervention is not enough to stimulate car and bicycle movement through the neighbourhood (through a fast connection) (fig. 5.42).

A space syntax analysis reveals that the 'Parkstad' intervention (i.e. connecting a neighbourhood street to a city level (super grid) connection to the east) has little effect on the hierarchy of the neighbourhood grid. While a new crossing point between the two hierarchies (local and city levels) is established at the location of the intervention, the neighbourhood grid still only functions at a local level, and the city network still runs along the neighbourhood's periphery. As mentioned earlier, the problem of connectivity in this neighbourhood is not getting locals onto the city's super grid. The problem rather lies in offering a fast connection through the neighbourhood for people from outside. The 'Parkstad' intervention does not encourage such a movement flow, since the new connection fails to provide a better or faster car and bicycle route through the neighbourhood, and is therefore insufficient to adequately improve connectivity. Furthermore, while the 'Parkstad' plan's intervention is on the right track, it lacks empirical analysis and a detailed understanding of the particular context, resulting in an unrefined, inadequate plan that risks reinforcing the existing socio-economic divide and increasing polarisation between different populations in the South of Rotterdam. This section argues that the neighbourhood's existing public spaces are potential sites for enabling, stimulating, and encouraging social interaction and inclusion. Following a detailed analysis of the Afrikaander square, section 5.2.2.4 will explore how the existing 'Parkstad' proposal could be adapted and leveraged to transform this isolated area into a connected neighbourhood, and facilitate a more positive socio-spatial mix in the neighbourhood's public realm.

Before 'Parkstad' intervention *Result of 'Parkstad' intervention*

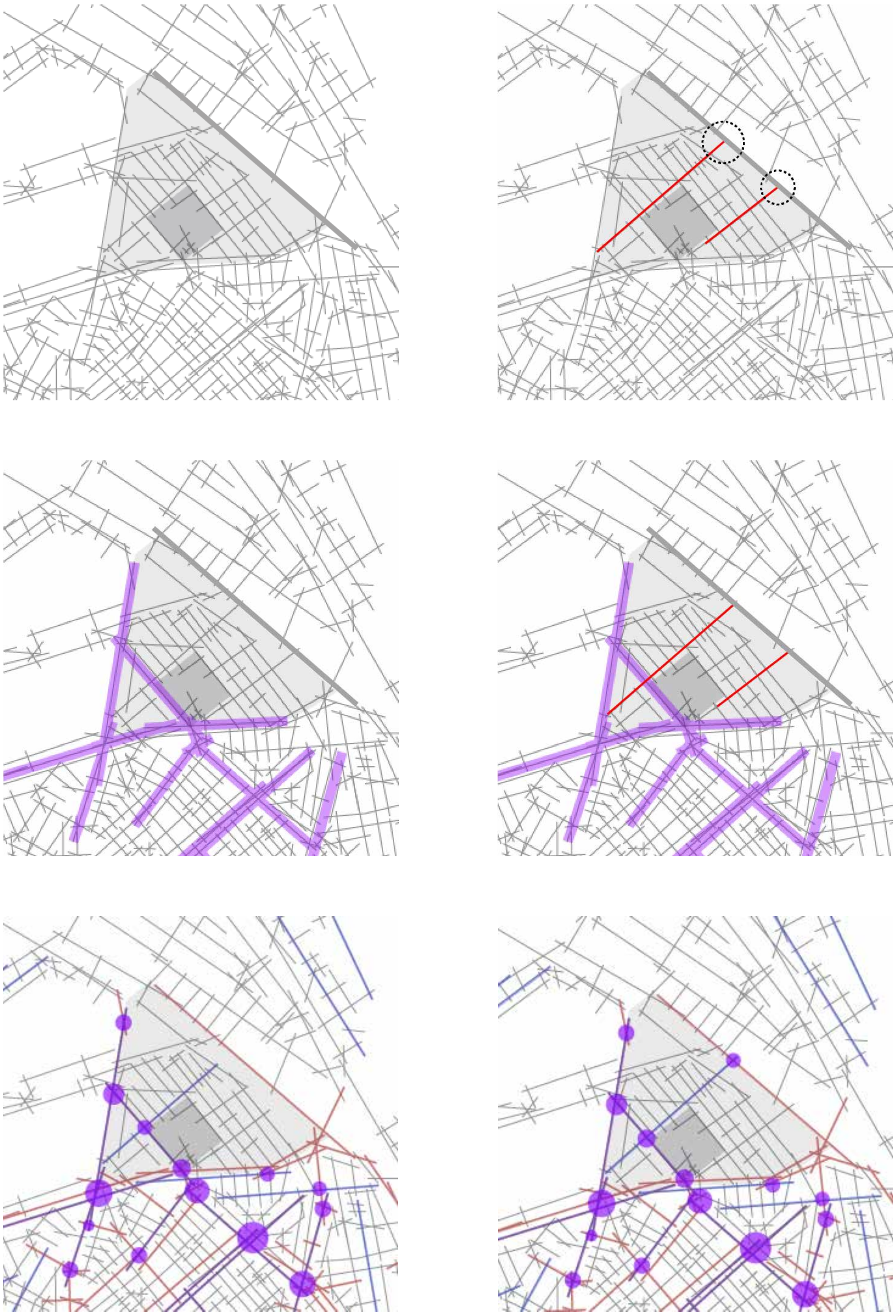


Figure 5.42
Effects of 'Parkstad' intervention: left is before, right is after. The neighbourhood street has not been integrated into the larger scale of the city. The intervention merely established another crossing point between local and super grid (bottom right)

The Afrikaander square

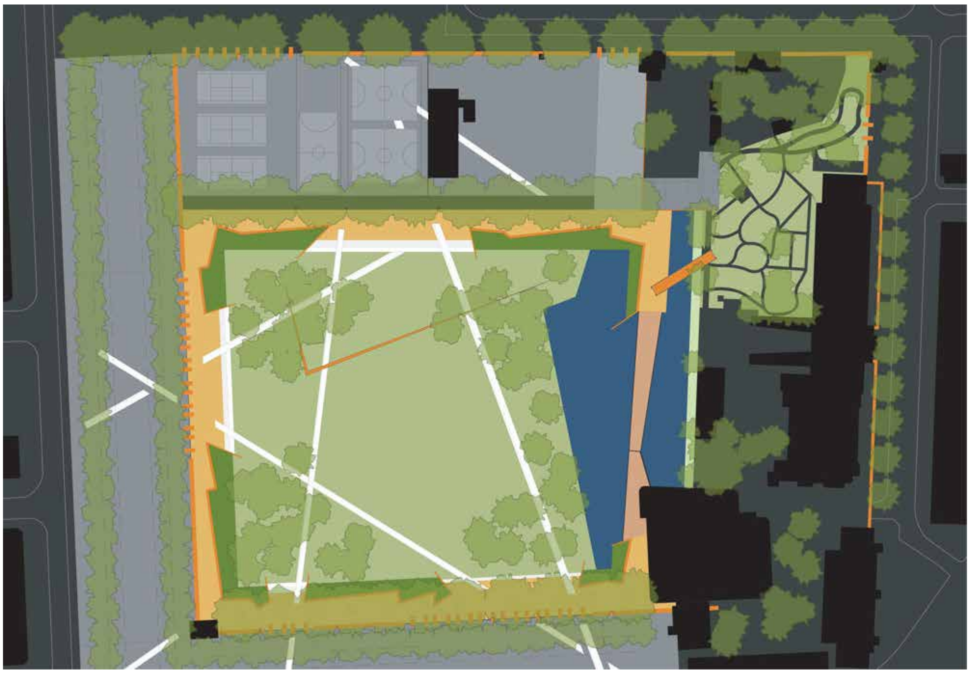
The previous section identified shortcomings of the 'Parkstad' scheme in relation to improving the connectivity of the neighbourhood with the city. The redesign of the Afrikaander square took place a few years before the 'Parkstad' plan was developed. At the moment, the square serves as an obstacle for pedestrian circulation and connectivity in the neighbourhood. The 'Parkstad' plan, however, does not take the deficiencies of this square into account. This chapter proposes that the ambitions of the neighbourhood redevelopment plan (i.e. achieving a positive socio-spatial mix between different socio-economic populations) will not be realised unless the neighbourhood and the square reinforce each other.

Analysing the accessibility of the existing programme in and around the square could help inform the development of a design that stimulates pedestrian circulation in the large open public space. Changing the orientation and entrances of the buildings enclosing the square could, for instance, increase movement flows through the large open area. One example of such existing programme is the large monumental building located south of the square. This old university, which was built in 1925, nowadays houses a mosque. Crimson Architectural Historians argue that the monumental potential and resilience of this building should become an example for the Afrikaander square (2007). The old university building has proven to be capable of outliving the functions it was designed for by being adaptable to changing needs. While this building's front façade faces the Afrikaander square, at the moment the layout, vegetation, and water feature in OKRA's public space design conceal the monumental building from the general public both functionally and visually (fig. 5.43).

The front square of the mosque is hidden from the park and therefore gives it an almost clandestine character. At the moment, the entry to the building is located on the west corner of the building, which is hidden from view and has no relation to the square. A study of the pedestrian movement could demonstrate the existing routes locals take to visit the mosque.

Figure 5.43

OKRA's design for the Afrikaander square, activating the perimeter only, and a photograph of the mosque located south of the square (bottom image)



At the moment, the programme in and around the square has little to no relation with the public space. Entrances to these programmes are mostly located outside the Afrikaander square (fig. 5.44). The programme located in and around the square does therefore not invite visitors to move through the open space. In many cases, the buildings are oriented towards the streets enclosing the square, with their backs facing the public space. People can easily arrive or leave these buildings without being confronted with the large open space. Furthermore, while from a plan-view hypothetical desire lines can be easily traced, the conditions of the existing design prevent these from happening. The lack of pedestrian connections and entrances/exits from and to the square limit possibilities for taking such short-cuts through this public space. Changing the orientation of the existing programme, and introducing new entrances and through-lines in the space, could help increase pedestrian circulation in the Afrikaander square.

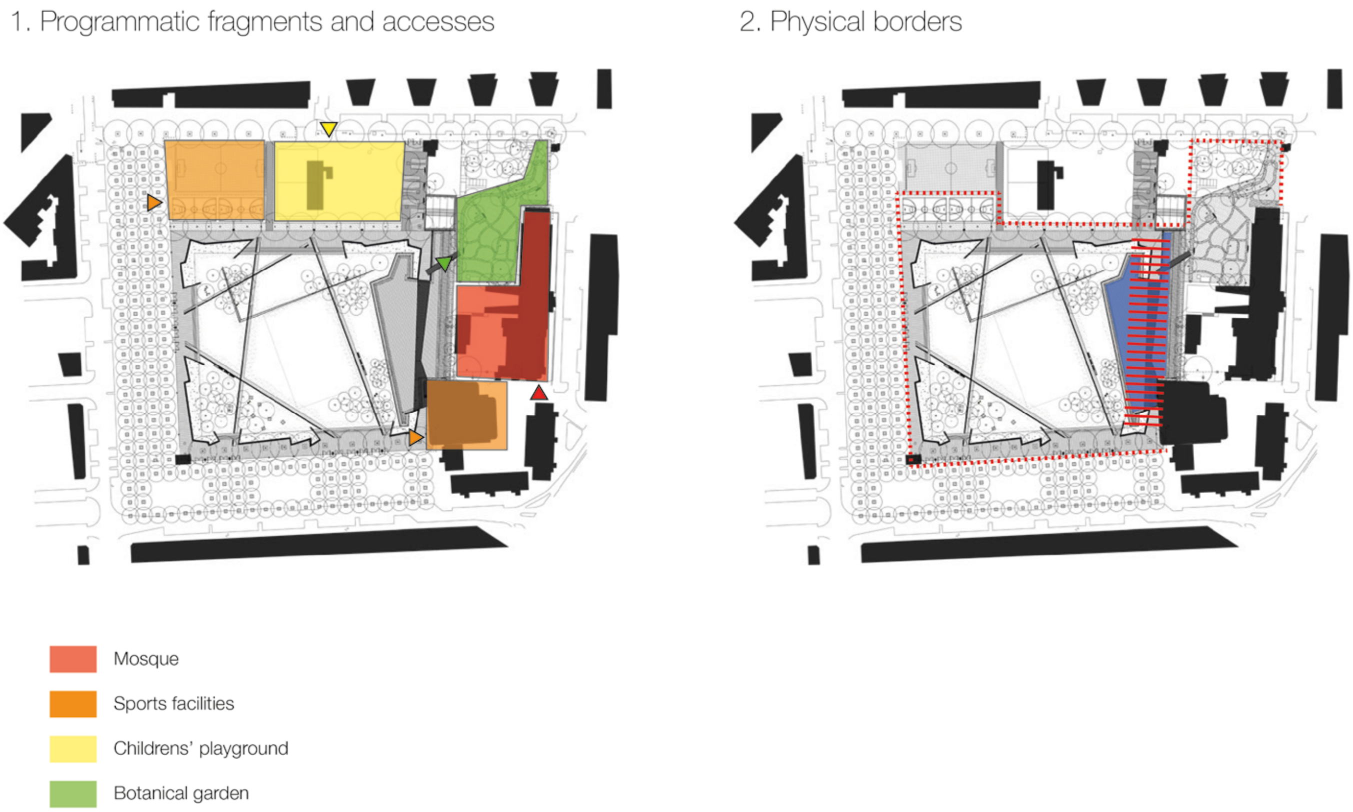


Figure 5.44
Analysis of the programmatic features in and around the square and the location of their respective accesses (left) and the physical barriers in and around the square, including the fence around the square and the pond separating the mosque from the public space (right)

5.2.2.4 Proposal: An alternative intervention to improve connectivity and revitalise the local public realm

Interventions in neighbourhood connectivity

I used space syntax to test various alternative interventions in the urban fabric that could transform the city-scale connectivity (i.e. car and bicycle mobility) of the neighbourhood. From these experiments, one particular intervention appeared to bring about significant change in the neighbourhood's connectivity on the scale of the city (see fig. 5.45). Connecting the existing central neighbourhood street (along which the Afrikaander square is located) to a street on the super grid of the city (located west of the neighbourhood) would transform the area from a so-called 'de-centred' into a 'centred' neighbourhood. This intervention would increase car and bicycle mobility along this street, which could stimulate public life in the neighbourhood, and, in turn, could have positive effects on local economic activity.

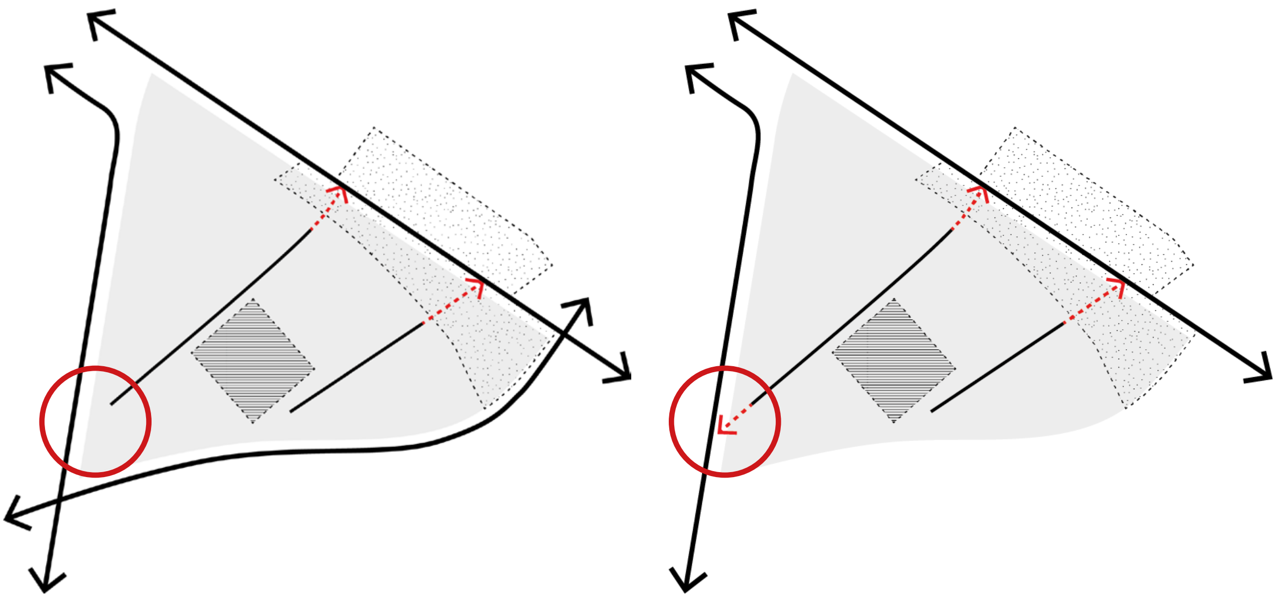


Figure 5.45
Left: Parkstad's proposed intervention – leaving neighbourhood street unconnected to the east (red circle), right: location (red circle) of proposed intervention - connecting neighbourhood high street to city level hierarchy (i.e. super grid)

The diagrams demonstrate that while the ‘Parkstad’ intervention (the middle diagrams) have little effect on the connectivity of the neighbourhood, the proposed intervention (on the right) would activate the central neighbourhood high street and allow for several new crossing points on the eastern border of the neighbourhood (fig. 5.46). Establishing a connection on the proposed location would allow for the neighbourhood to become better integrated into the city’s ‘global’ network, and activate pedestrian circulation on the neighbourhood central street, and potentially its surrounding public spaces, including the Afrikaander square.

In his study on public space occupancy of several areas in different cities in the Netherlands, Read (1998) discovered a typical pattern. By comparing different spaces in one area, he found that there are relatively few spaces where a higher amount of public space occupancy takes place. These places tend to typically link the global and local scales of a city. Read argues that the high occupancy rate of these spaces are often more a result of their global function in the city (and the city-scale movement pattern through the space), rather than their local function. Following this logic, one could assume that the low occupancy rate in the Afrikaander square might be a result of its missing relationship to the global network of the city. The proposed intervention would enable the neighbourhood street to function on a different, more global (i.e. city scale) level, and with that potentially increase movement flows and public space occupancy rates along this street. However, connectivity is just one of many factors that play a role in public space occupancy rates. Another important factor in improving pedestrian circulation in the area, for instance, is providing attractive programming (such as shops, cafes, and so on).

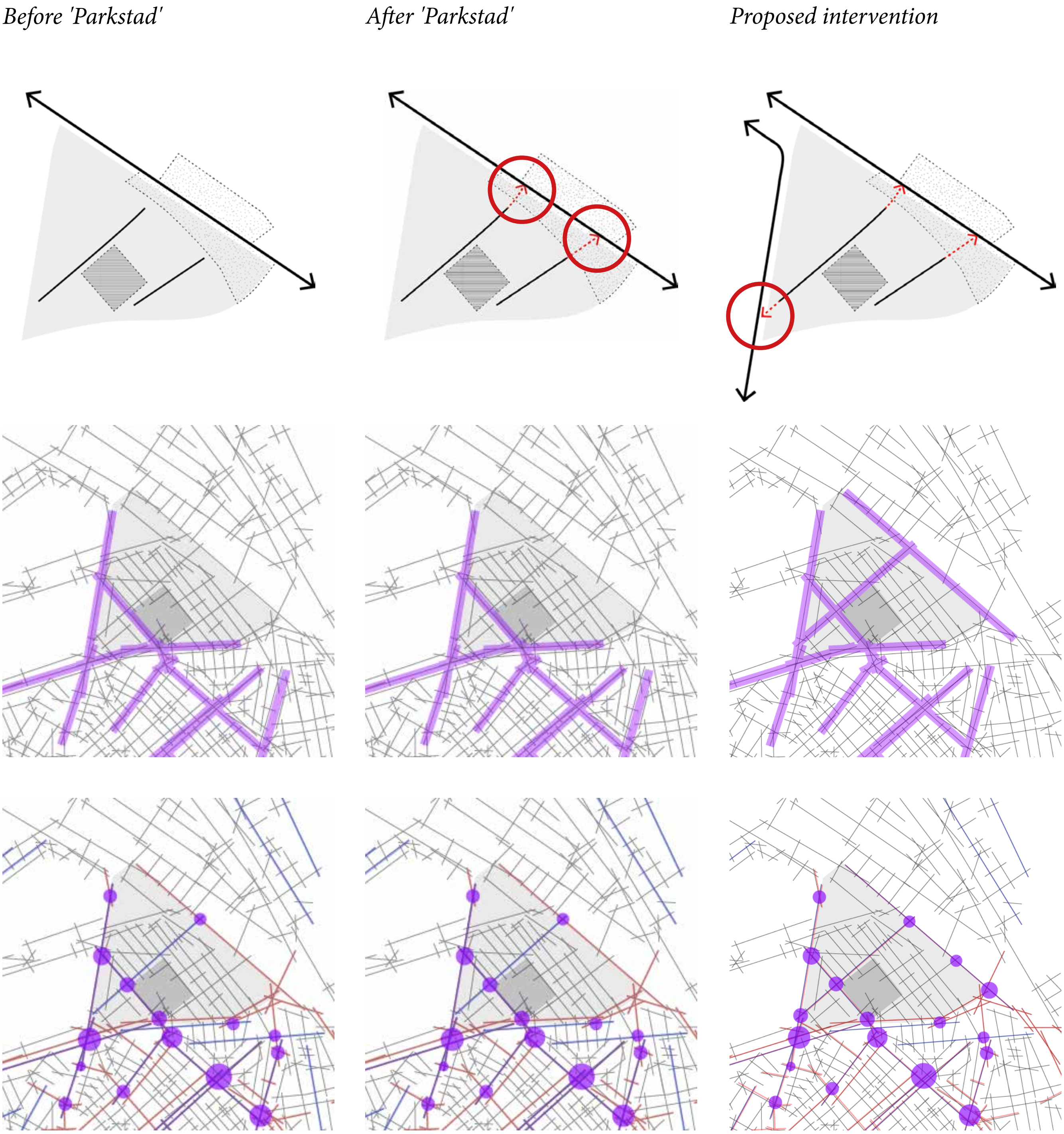


Figure 5.46
The global-local integration measured for the three situations (the situation before the 'Parkstad' intervention on the left, the effects of the 'Parkstad' intervention in the middle, and the effects of the proposed intervention on the right)

While this proposed intervention seems rather straightforward and uncomplicated in the conceptual space syntax diagrams, a more qualitative and perceptual analysis of this site offers some insights into the particularities and possible issues of this location (fig. 5.47).

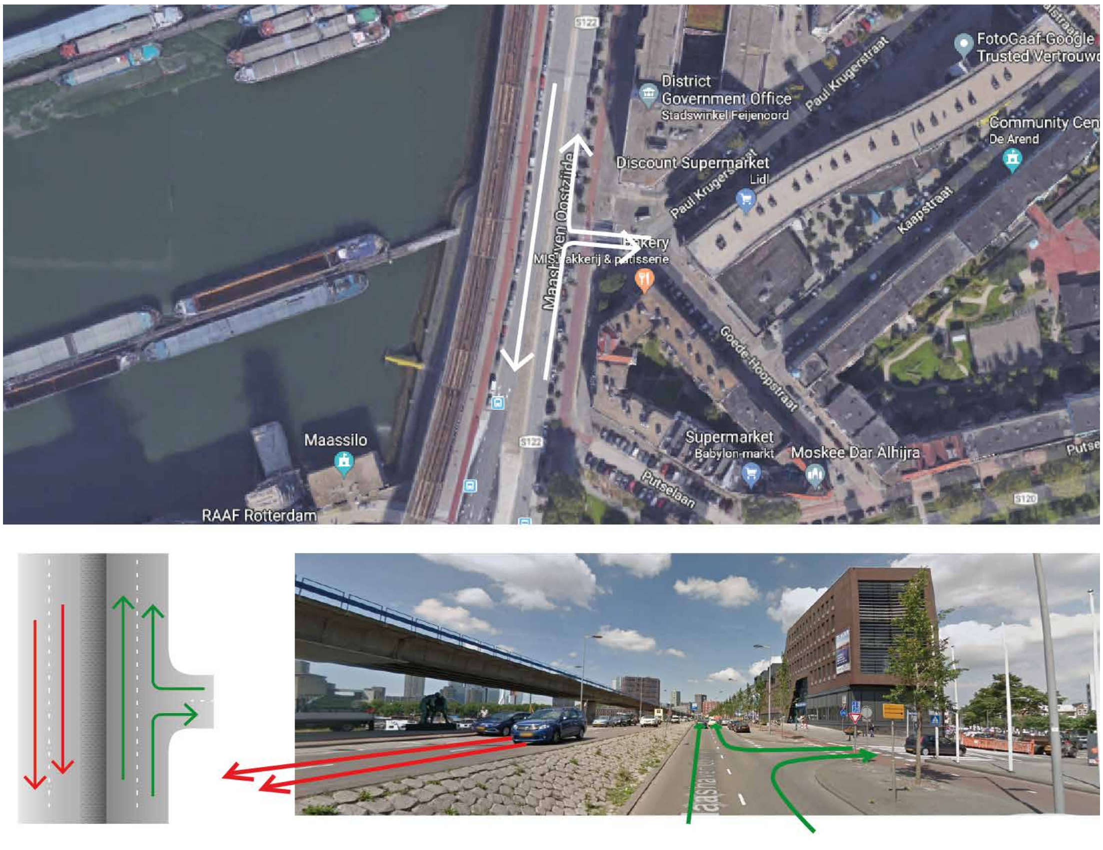


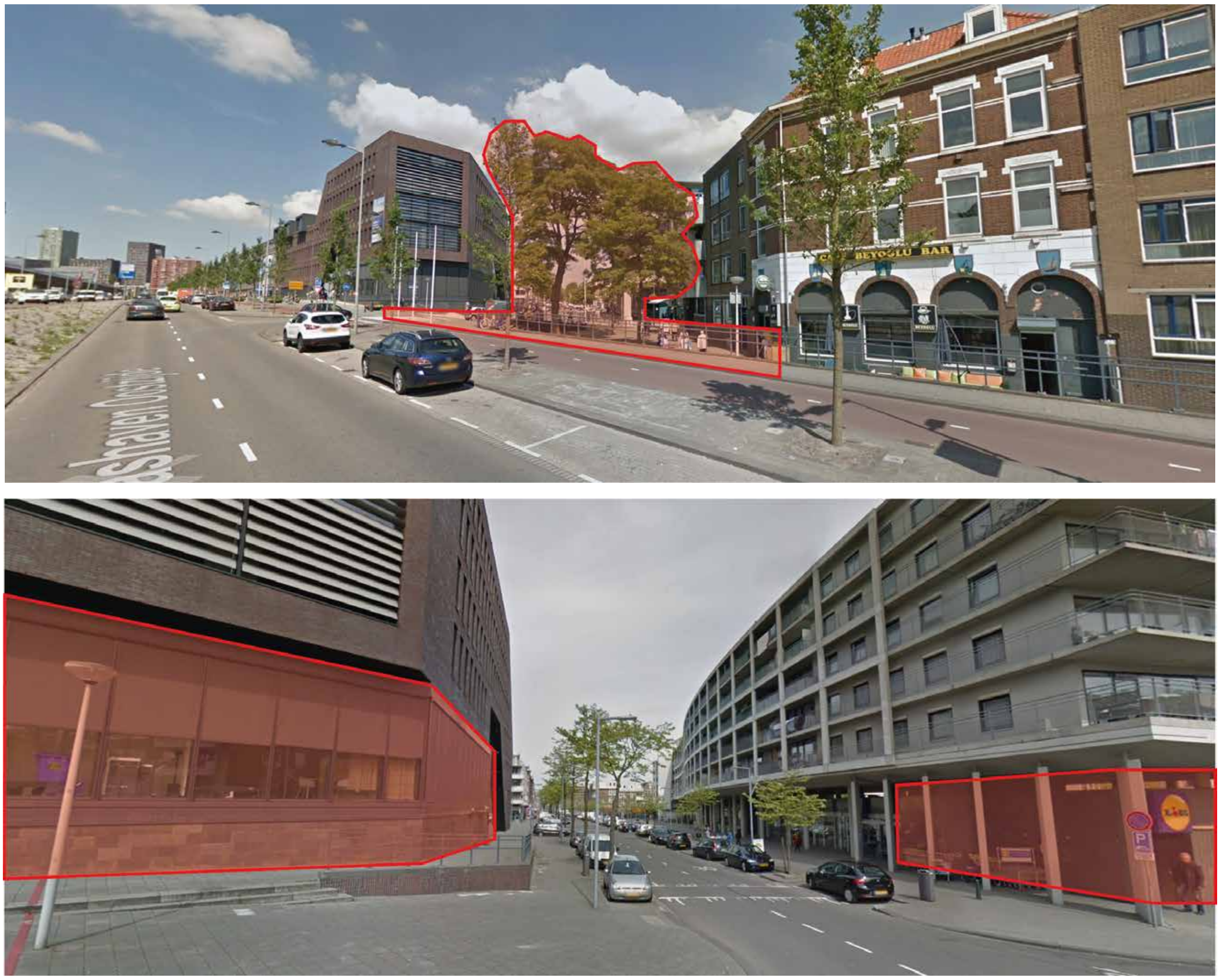
Figure 5.47
Plan- and street view of the site with the existing traffic situation

The street running west of the neighbourhood provides a fast north-south connection on the super grid (i.e. higher hierarchic level) of the city. This super grid street only shares a second-rate connection with the local street network of the Afrikaander neighbourhood: only the two lanes in the north-direction of this street enable vehicles to enter or exit the neighbourhood (fig. 5.48).

Figure 5.48
Street section of the site demonstrating the height differences between the metro-line (left), car lanes, and the Afrikaander neighbourhood (right)

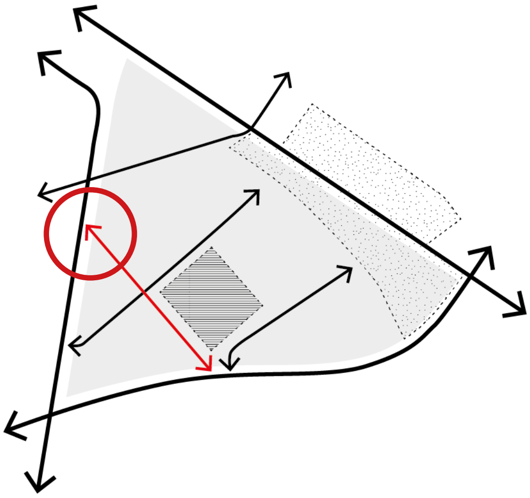
The street section illustrates the height differences on this west border of the Afrikaander neighbourhood, which, next to the physical barrier of limited connectivity, form a visual barrier for views from inside the neighbourhood outwards. This elevation, on the other hand, also provides opportunities to create views from this highly frequented city-level street into the neighbourhood to make passers-by aware of the programme and activities the neighbourhood has to offer. At the moment, however, this view is obstructed by street infrastructure, including a railing and some trees (fig. 5.49). Furthermore, the ground floor level of the buildings situated along this neighbourhood entrance have closed façades, which give them an uninviting look (fig. 5.49).

Figure 5.49
Street view of the western entrance of the neighbourhood, with trees obstructing views (top) and closed ground level façades (bottom)



To activate this neighbourhood street and create an inviting space that could attract visitors (i.e. non-locals), next to the intervention in the street infrastructure, interventions into the programming and openness of these façades are of equal importance. An example of a different crossing in the neighbourhood is demonstrated below and functions as a precedent for my proposed intervention (fig. 5.50).

Figure 5.50
Location of proposed precedent



This crossing demonstrates how better infrastructure connections, unobstructed views, and visible programming along the street provides a more inviting character to draw people into the neighbourhood (fig. 5.51).

Establishing and maintaining sustainable and stable communities require regeneration plans that seek to develop socially mixed neighbourhoods with basic social infrastructures, such as schools, shops, public transport connections, and public spaces that function as a site for connection (Worpole and Knox 2007). By bringing in high- and middle-income groups to the area, the local council hopes to bring about a positive socio-spatial mix in the neighbourhood. The council argues that introducing socio-economic stronger groups will benefit existing neighbourhood residents and local businesses.
My space syntax/Read study, however, demonstrates that the planned interventions of the 'Parkstad' proposal are unlikely to stimulate interaction between the two different populations intended to live here. The urban renewal plan seems to primarily concentrate on social engineering intended to attract more affluent home-buyers to the area, rather than revitalising and consolidating existing community facilities, networks and local economies.

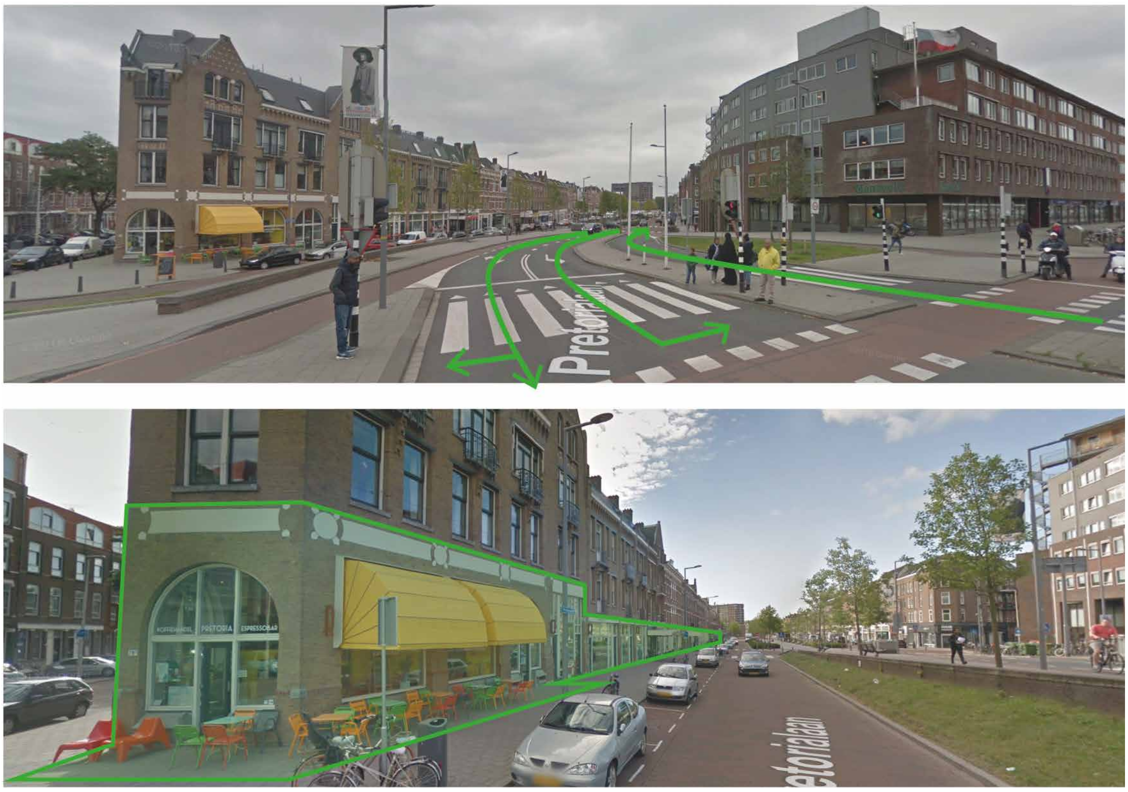


Figure 5.51
Street views of crossing demonstrating the two way connection between super grid and local grid streets, the open character that allows views from and into the neighbourhood, and the 'open' façades along this street (bottom) with commercial programme, including cafés and shops inviting people into the neighbourhood

Interventions for Afrikaander square

The local mosque located south of the Afrikaander square is an important social landmark and community space in the neighbourhood. At the moment, the entrance of this building is located at the street south of the mosque, and the mosque has no physical (and a limited visual) relationship with the square. Restoring the orientation of the mosque by bringing the main entrance back to the front façade would allow for a new relationship between the Afrikaander square and the mosque. Establishing a pedestrian connection from the entrance of the building to the main entrance of the Afrikaander square could activate pedestrian flows and increase movement through, and activity in this large open space (fig. 5.52). These pedestrian flows could also function as informal surveillance through use and circulation, and could increase the perception of safety for others to dwell and socialise in the space.

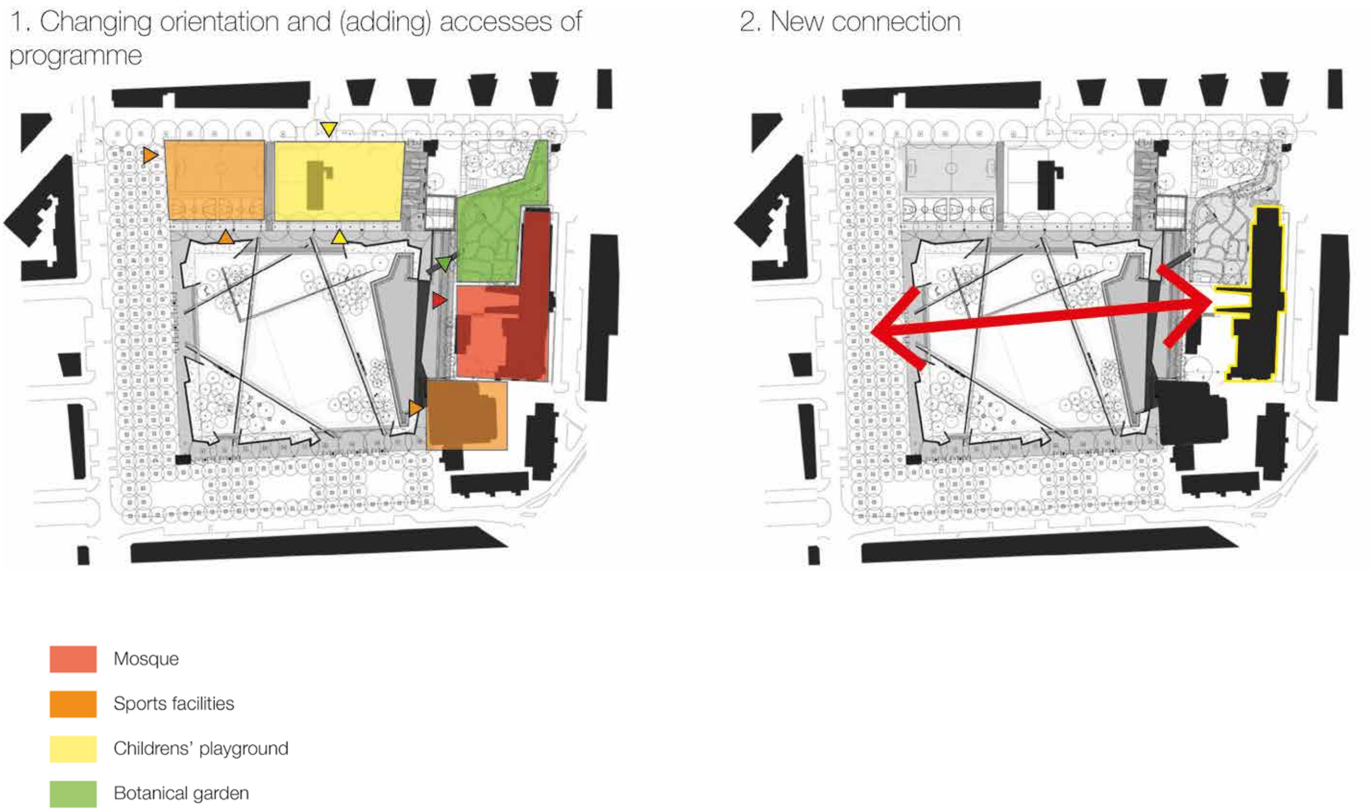


Figure 5.52
New (or additional) accesses and changing orientation (left), and new connection and new access enables more pedestrian flow through the space (right)

Analysing which hypothetical through lines would be desirable for creating pedestrian short-cuts could help establish new connections through the square that are more likely to be used by locals, and help increase pedestrian circulation and movement through the open space.

Space syntax's digital techniques, such as visibility or spatial accessibility studies, could be adopted for the Afrikaander square to help generate a better understanding of the problems in this site and to model and test various design solutions that could help improve this public space. The Visibility Graph Analysis (VGA), for example, can provide insights into the visibility relationships between different spaces in a building or urban plan. In this analysis, visibility is defined as what a person can observe from any location in the space that is directly visible without any obstructions. This visual relation is essential for the perception and use of spaces (Abshirini and Koch 2013). The VGA feature in space syntax can, for instance, measure how visually connected all spaces in a site are, or how many 'steps' it takes to cover the entire area (steps are measured by how far the person would be able to see). A visibility analysis could help designers assess perceptual qualities of a space and evaluate possible uses and programming that could increase pedestrian movements and activity. A visibility graph analysis of the Afrikaander square could, for instance, help analyse which areas in the large open space would be most suited for eye-catchers, public programme, and activities to attract pedestrians. Such a study could also help identify which places need improvement to enhance pedestrian safety by increasing visibility and social control.

Through a detailed demonstration, this section argued that digital tools, such as Space Syntax, can help inform design decisions and improve the social outcomes of a design. Furthermore, the section demonstrated that if the urban designers and planners would have conducted a more thorough analysis of the socio-spatial dynamics and morphology of the Afrikaander neighbourhood and its wider context *prior to* developing the 'Parkstad' proposal, their design could have had a greater potential to uplift the neighbourhood and achieve a positive socio-spatial mix in the area.

Conclusion

Through the analysis and discussion of two case studies, this chapter demonstrated the relevance of timing for incorporating digital data analysis in a design process. In the first case study, by muf architecture/art, the digital data analysis took place after a design proposal was already developed. Therefore, rather than informing the development of a design, the digital analysis functioned more as a confirmation, or at best a testing, of the design proposal. Architects at muf recognise the importance of getting clients on board of their socially-oriented approach and strategies at an early stage. Therefore, rather than applying digital techniques retrospectively, empirical input from a digital data analysis could be much more effective and valuable to the firm earlier on in their design process. Similar to the firm's former projects, such as their design for the town square in Barking, an initial exploration of the context and design brief for Whitechapel could have helped the architects increase the benefits of their design strategy for existing communities and enable a greater overall social impact of the urban renewal plan. Muf co-founder Liza Fior recognises that a meaningful design can only emerge from an in-depth analysis and understanding of the local context. This chapter argues that digital data analysis can help design firms such as muf conduct more thorough and in-depth explorations of the local context, even in projects with limited time and budgets (as in Whitechapel) that do not allow for offline research methods such as physical observations, pedestrian surveys, and qualitative interviews. By enabling designers to present empirical evidence of an existing problem as well as demonstrate the effects of their design proposal, digital data studies can help get clients and other stakeholders on board at an early stage and help build up their clients' trust throughout the process.

The Afrikaander square case study presented an urban redevelopment plan that aimed to uplift impoverished areas in the neighbourhood by improving its connectivity and attracting socio-economically stronger groups to the area. While the ambitions of the city council were clearly defined at the outset, there has been little research into which design option would have the greatest potential to bring about a positive socio-spatial mix in the neighbourhood. A digital exploration such as the one carried out in this chapter could have helped designers develop regeneration plans that would leverage private developers' investments to counter social exclusion of socio-economic weak groups, and establish neighbourhood public spaces that allow for culturally and socio-economically diverse encounters. A more extensive and advanced analysis of the morphological context, and the effects of proposed spatial interventions on social life, in an initial phase of the design process, could have resulted in a proposal that would benefit both populations and therefore result in a more socially sustainable outcome.

The study of the Afrikaander square demonstrated how past shortcomings in the design of the square have resulted the continuous redesign and redevelopment of this space. So far, designers have been unable to deliver a design that could evolve and adapt to the changing demands of a dynamic demographic. Even the latest design for this square, which according to the landscape architects at OKRA was a result of a long process of community consultation and co-design, has resulted in an uninviting and underused public space. Rather than using the community's input to create a space that could be appropriated by locals, OKRA has developed a beautification strategy for the public realm aimed at attracting a wider (and more affluent) population to the neighbourhood. Furthermore, due to an inadequate understanding of the complex spatial context, which include limited visibility and accessibility of the space and a problematic relationship with the larger urban context, the landscape architects' design has failed to attract pedestrians and stimulate circulation in the space. A counter-proposal demonstrated how a more in-depth and comprehensive analysis of the context could help architects develop a design that would revitalise the space, better cater to the needs of diverse communities, and be more likely to facilitate the desired socio-spatial mix in the neighbourhood. Analysing digital data before developing a new design for the Afrikaander square could help designers better identify existing problems (connectivity, visibility, and accessibility) both at the scale of the neighbourhood public space and its broader urban context, to inform the development of a more resilient design that can be used and appropriated by different populations over time.

Finally, muf's critical approach to design projects echoes Jane Rendell's position on architectural practice in relation to problems encapsulated in project briefs: 'Architectural designs that put forward questions in response to a brief, instead of, or as well as, solving the problems posed by that brief, produce objects and situations that critically rethink the parameters of the problem itself' (Rendell 2007:4). The chapter concludes that the design for the Afrikaander square could have benefited from a more critical approach by OKRA landscape architects, and argues that analysing digital data could help substantiate critique on the current 'Parkstad' renewal plan and demonstrate that the proposed interventions are not enough to resolve the issues of an underused local public realm. In conclusion, while there are different digital tools and softwares available that can be used in different stages of a design process, applying digital data analysis early on can help develop a more substantial initial premise, and therefore help develop a more context-appropriate and more socially sustainable design.

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Conclusion

The thesis set out to explore how novel digital data technologies could improve spatial design practice, particularly to sustain the life of public realm projects after design professionals have left, using qualitative data more than Big Data. The primary goal, therefore, was to explore, demonstrate, and defend alternative and more nuanced data-driven approaches to aid in the design of public spaces. Enzio Manzini characterises such research for design as '[the act of] produc[ing] better conceptual and operational tools for designing' (2015:39). Following Donald Schön's epistemology of practice (1983), the knowledge that emerged from the research and design in this thesis forms important input for design practice (Cross 2001).

Participatory Design – Data to Facilitate the Participatory Process

By examining several public realm projects that failed to facilitate sustained citizen engagement, the research identified a recurring issue in participatory design practices: socially-engaged designers tend to create social networks around themselves, and therefore place the wrong actor at the centre of a project's social network. Two alternative approaches were proposed:

1. Designers could work in multi-disciplinary teams and bring in external expertise on public participation and community building from various relevant professions (e.g. social workers), and/or
2. designers could analyse socio-spatial digital data prior to entering the design process to identify existing (local) social networks to sustain the design intervention beyond the designers' involvement.

The research demonstrated how socio-spatial digital data (SSDD) from social networking platforms such as Twitter could be used by designers. SSDD from such platforms can help them conduct preliminary studies of a local context, which can help identify key players and community networks to approach and involve later on in the qualitative analysis of the context. While some design firms, such as muf art/architecture, already conduct ethnographic studies in the local context, such offline methods can be labour- and time- intensive. The research demonstrated which digital data sources could be of use to designers in such explorations, and discussed how these digital tools could complement more traditional offline community engagement methods.

The thesis also argued that seeding ownership in a local community early on is vital for sustained engagement and calls for a different set of skills and expertise from designers (Merkel et al. 2004). By learning to conduct simple digital data analysis, designers could map out local social groups and structures to discover promising opportunities for sustained citizen engagement using minimal resources.

Design for participation – data to facilitate the design process

Through a detailed analysis of two case studies (Chapter 5.1 and 5.2), the thesis demonstrated the importance of getting the sequence right in incorporating digital data analysis into a design process. Rather than using digital data analysis post factum as a confirmation or testing of a design proposal, it could be much more effective and valuable earlier on in a design process. An initial exploration of a context and design brief could help architects and urban designers extend the benefits of their design strategy for existing communities and enable a greater overall social impact of a design proposal. Moreover, by enabling designers to present empirical evidence of an existing problem and demonstrate the social as well as spatial causes and effects of their design proposal, they could help get clients and other stakeholders on board at an early stage and help build up their trust throughout the process.

The research also demonstrated that analysing digital data before developing a design could help designers better identify existing problems (including issues of connectivity, visibility, and accessibility) both at the scale of the neighbourhood and its broader urban context, to inform the development of a more resilient public space design that can be used and appropriated by different populations over time.

Original contribution to knowledge

This thesis is built on the central premise that the wide-spread adoption of digital tools for modelling and design (i.e. CAD tools) by architects and urban designers could function as a template for adopting novel digital data technologies that focus more on the user(s) or the public in spatial design.

Firms such as Foster and Partners are at the forefront of technological developments applied for structural, environmental, and economic ends. However, there aren't many examples of practices that use digital technologies for the social aspect of design. While firms such Foster and Partners and Zaha Hadid Architects innovate by incorporating the latest digital technologies in their design processes, many socially oriented practices, such as muf art/architecture, limit their engagement with the digital realm to design tools such as AutoCAD. By exploring which digital tools and techniques are available for designers to incorporate the user, the research demonstrated how designers could benefit from such existing digital data sources and, at the same time, demystify the notion that working with digital data would require a high level of expertise from designers. Chapter 3 demonstrated that some design practices, such as Atkins, are already engaging with digital data on users by developing their own bespoke tools for digital data collection and analysis. The thesis, however, demonstrated how, instead of collecting their own data and developing their own tools, architects and other socially-engaged designers could make use of the many digital sources of user data out there that are easily accessible and available to incorporate the social aspect in their design process.

By presenting various existing social media studies, the thesis identified a gap in how digital user data is currently used by designers and researchers to study the socio-spatial urban realm. To date, social media data studies on human behaviour in urban environments have failed to produce any new insights and often end up merely validating designers' existing knowledge and observations. By presenting alternative approaches to exploring socio-spatial digital data (SSDD) that produces new insights into citizen engagement in participatory urban development processes, the research contributes to knowledge in spatial design and demonstrates how SSDD could potentially inform the design of more socially sustainable public spaces.

Finally, the themes and activities of the TRADERS project that have framed the thesis reflect the interdisciplinary nature of the research. The TRADERS context offered a range of opportunities for testing the application of my proposed data-driven approach in a public space context, for example through the workshop I organised for the TRADERS Autumn School that took place in Genk, Belgium in November 2015. Furthermore, working closely with, and in service of, practice partners (i.e. muf architecture/art and Commonplace) offered opportunities to develop research that has expanded beyond the initial briefs for these design research commissions. The projects with these firms served as a testing ground for the interrelation of self-driven design research and practice-based commissioned research to develop transferable and practical knowledge. As a result, the knowledge produced in this thesis contributes and is beneficial to both the design research community as well as the design practice community.

Implications for spatial design practice

The research raised several key points concerning digital data analysis in relation to the architecture and urban design disciplines:

Architects are not fully taking advantage of newly available data sources
As discussed in the previous paragraphs, there are still a lot of untapped data sources that architects, particularly socially-engaged practices, are not yet aware of. Very few architecture firms are taking advantage of the vast amount of digital data on users that is available today from various mobile phone and web platforms, such as social networking services, to inform their design process. While socially-engaged architects, such as muf architecture/art, regularly conduct behavioural studies on users through long-term observations of people in public spaces, and while they do recognise that digital data on users could help them expand their knowledge on user behaviours, they have yet to discover how to engage with and use digital data sources (Rangel 2017). The thesis

demonstrated how different sources of socio-spatial data could inform design projects from the outset of the design process, particularly socially-engaged design for the public realm.

‘Big’ does not always equal better when it comes to spatial design explorations

Big Data does not only refer to very large data sets and the tools and procedures needed to manipulate and analyse them. As a phenomenon, Big Data is also about the computational turn in conducting research and establishing new knowledge and methods (Burkholder 1992). With this computational turn, however, where ‘Big’ is often believed to be better, it is important to keep in mind the value of ‘small data’, as not all studies and topics benefit from large data explorations (Boyd and Crawford 2012). As the examples in Chapter 3 demonstrated, sometimes new insights cannot be found at the largest level and require a more in-depth, small-scale investigation. The size of data in spatial design explorations should fit the question or the commission. Therefore, rather than working with very large amounts of data, this thesis adopted a small data approach to novel digital data sources, such as social media platforms and civic applications, for neighbourhood-scaled projects. Through several case studies, the thesis demonstrated how targeted small data explorations of the local context can be much more beneficial to architects in neighbourhood public space projects.

Architects and urban designers can analyse digital data themselves

Another benefit of analysing ‘small data’ is that it requires considerably less technical know-how. Small data explorations do not require complex code, and can even be analysed manually and/or visually (as demonstrated in Chapter 5.1). Working with APIs (Application Programming Interfaces), and scraping and analysing big amounts of data call for a skill set generally restricted to those with a computer science or engineering background. While different disciplines, including the arts and humanities, could bring valuable perspectives to digital data enquiries, the expertise needed to make sense of Big Data currently puts them at a disadvantage. In addition to issues of accessibility, the issue of skills has set up hierarchies around those able and those unable to ‘read the numbers’ (Boyd and Crawford 2012:674). According to Manovich (2011), these inequalities are inherent in Big Data and can be ascribed to three different classes of engagement: those who create data (both consciously and unconsciously), those who have the means to collect them, and those who have the expertise to analyse them. The final group is the smallest and most privileged and determines the rules on how Big Data is used and who gets to participate. Small data, on the other hand, does not necessarily require extensive technical expertise and is therefore considerably less exclusive. It offers those with little prior experience and knowledge of digital data technologies, such as socially-engaged architects and urban designers, the opportunity to engage with new digital data that could benefit their projects. The thesis demonstrated that a small data approach allows architects and urban designers to analyse socio-spatial digital data by themselves, without help from external experts.

However, even if architects work with external consultants and don't conduct the data analysis themselves, they still need to become familiar with the possibilities and opportunities of digital data to know how to incorporate it in their design process. This brings us to another challenge: how can architects be prompted to incorporate the proposed methods in their established processes and practices? At the moment, the proposed methods in this thesis are not commonplace in architecture and urban design offices nor the academy. How could these methods become common practice, without having to wait until they become part of architectural education? The thesis proposes three possible models in which architecture and urban design offices could incorporate digital data analysis in their practices: (1) through professional training, (2) by hiring in-house experts, and (3) by hiring external experts (i.e. a (Big) data design consultancy).

1. Professional training

The thesis proposed various approaches to analysing socio-spatial digital data that involved a certain amount of knowledge of digital tools and, in some cases, a certain level of programming skills. Adopting such methods requires spatial designers have (professional) training. Such training could be offered by the Royal Institute for British Architects (RIBA) through their Continuous Professional Development (CPD) seminars and courses. The CPD Curriculum is intended to update architects' knowledge and increase their competence. It can, therefore, serve as a platform for conveying information about novel digital data technologies and encouraging interested architects to learning more about it.

RIBA Chartered Members are obliged to take at least two hours in each of the ten CPD topics the RIBA offers yearly, and are advised to attain at least 35 hours of CPD a year in total. The ten CPD topics for 2018 consist of: 'Architecture for Social Purpose'; 'Health, Safety and Wellbeing'; 'Business, Clients and Services'; 'Legal, Regulatory and Statutory Compliance'; 'Procurement and Contracts'; 'Sustainable Architecture'; 'Inclusive Environments'; 'Places, Planning and Communities'; 'Building Conservation and Heritage'; and 'Design, Construction and Technology' (RIBA 2017). CPD courses almost exclusively discuss technology in relation to construction and computer-aided modelling (CAD). 'Design, Construction and Technology' concentrates on 3D modelling; 3- and 4D printing; advanced robotics; parametric design; the Internet of Things (IoT); smart cities; smart buildings; using, leveraging, and understanding Big Data; artificial, enhanced, and virtual reality for presentation and information exchange; CAD modelling and mapping; wireless technology; user feedback loops; and familiarity with presentation platforms and technologies.

These subjects, however, only cover a fraction of the forms of digital data available to designers today. The discussion of technology in the CPD course particularly focuses on digitalisation as a means to optimise construction processes and increase productivity, especially through BIM (Building Information Modelling). The social dimension (i.e. the user) is underrepresented in discussions about experimentation with the digital in this course, and in the profession in general. Architects might not yet see the relevance of incorporating digital data on users, since, in contrast to CAD, it does not directly pertain to the act of designing. The RIBA would do well to integrate the topic of 'Big Data and its technology' in other, more socially-oriented, programmes of their CPD Curriculum, such as 'Architecture for Social Purposes' and 'Place, Planning and Communities'.

'Architecture for Social Purpose' has been introduced as a new topic in this year's list and concentrates on how designers can make a positive impact by understanding the social value and economic and environmental benefits that architecture can bring to individuals and communities. The course discusses how architecture can improve social cohesion, identity, and well-being, and helps designers build their knowledge and skills to make informed, fair, and ethical choices in their projects (RIBA 2017:4). Another socially-engaged topic in the curriculum is 'Places, Planning, and Communities.' This theme discusses the theories and objectives of urban design that help create successful places, including:

- 'Understanding the importance of design at different spatial scales and the influence each can have on users, neighbours, communities, sites, places, neighbourhoods, cities and rural areas and landscapes;
- [Understanding] that design is both a process and an outcome, and the importance of putting people, those who will be effected by development, at the heart of both;
- Understanding the structure of places, the spatial interweaving and interrelationship between buildings, what they are used for, movement opportunities and public space networks and patterns;
- The importance of designing for the location and context of each development scheme and the role this has in reinforcing and creating positive local identity and character;
- Promoting urban social integration, creating diverse, safe and inclusive public spaces, encouraging social engagement, and designing for long-term maintenance.' (RIBA 2017:37-42)

The topic discusses community engagement, consultation, and co-design, yet there is no mention of civic applications, though data from these digital applications offer valuable insights into citizen engagement in urban design and development processes, and can help designers identify which community members are included (and most engaged) in, or excluded from decision-making. At the moment, firms that adopt participatory approaches to create socially-engaged designs, such as Hawkins\Brown, Allies and Morrison, and Feilden Clegg Bradley Studio, often limit themselves to analogue techniques to facilitate social outcomes. Digital data analysis, however, when applied at an early stage of the design process, can help architects develop and articulate more context-appropriate, socially-oriented, and nuanced project briefs. Digital tools such as the Space Syntax software, (discussed in Chapter 5.2) can also test the effects of various design options to help architects select the design with the most beneficial outcomes for local communities. These digitally mediated approaches could be integrated into the CPD course to enrich and innovate their socially-oriented programme.

While the CPD course does touch upon some themes related to digital data analysis in urban environments (including smart cities, Big Data, and the Internet of Things), there are many opportunities to better integrate and embed digital data technologies within the curriculum. One of the proposed applications for digital data analysis this thesis presented, for instance, is to identify important local community members, stakeholders, and the networks they are part of. The CPD Curriculum's topic of 'Architecture for Social Purpose' discusses the importance of understanding who the key stakeholders should be in a project. Digital data sources could help architects identify relevant stakeholders in a local context before starting the design process. Digital data technologies could also help designers develop more socially sustainable public spaces, which could inform another one of the curriculum's themes: 'designs consider[ing] the long-term' (RIBA 2017:44).

The CPD Report proposes five learning levels for engaging with the proposed topics: (1) 'Micro-learning' – quick informal learning; (2) 'General Awareness' – one-hour session to familiarise with a topic; (3) 'Detailed Knowledge' – structured sessions of two hours to half a day's duration; (4) 'Deep Learning' – single subject courses over one or two days; (5) 'Advanced Learning' – courses of at least three days potentially leading to specialisation, qualifications, or certification (RIBA 2017:6). Ideally, all architecture and urban design practices should at least become familiar and knowledgeable about the broad range of digital data technologies that are available to them (Level 2). Not all architects have the time and resources to specialise in digital data analysis techniques, but there are two alternative models for integrating socially-oriented digital data technologies in spatial design practices.

2. Hiring in-house experts

Large firms, such as BDP or Purcell, could train a group of in-house architects, or hire external data experts, to form a specialist group within their practice. An example of such internal specialised expertise is Foster and Partners' Specialised Modelling Group (SMG), consisting of employees with expertise in complex geometry, environmental simulation, parametric design, computer programming, and rapid prototyping. The SMG advises the firm's design teams on digital techniques and the development of custom CAD tools. In the same way, a group could be set up specialising in digital data to conduct studies of the socio-spatial context of a project.

3. Hiring external experts

While the previous approach could be of interest to some of the larger firms, a great number of practices lack the resources for such a level of commitment. Therefore, the final model this section puts forward is digital data analysis as a consultancy offered by a specialised external group, lab, or firm. Such an expert group could follow the model of the research and technology transfer firm Space Syntax Limited, a spinout of UCL's Space Syntax Lab. This firm has developed expertise on space syntax techniques, which they use to advise clients (ranging from industry to local government) on their architectural and urban design projects, including site development strategies, public space designs, and urban masterplans. In one of their public realm design project, the Space Syntax firm's detailed identification of the problem helped architecture office Foster and Partners develop a successful competition entry for the redesign of Trafalgar Square. The Space Syntax Lab provided the architects with an analysis of pedestrian activity patterns in the square, which helped diagnose the design challenges and identify possible design solutions. The firm's technical arguments and evidence-based design solutions helped the architects secure permission for the redesign of this historically significant public space.

Following the Space Syntax model, a group of socio-spatial digital data consultants could help designers develop more nuanced, empirical site analysis based on a variety of digital data (both socially- and spatially oriented, including GIS, social media data, and data from civic applications) to inform the development of more socially sustainable designs.

Novel digital data technologies also need to be introduced into architectural education. While some architecture schools already incorporate digital technologies in their design education (e.g. parametric modelling), there has been little incorporation of new types of socially-oriented digital technologies. Architecture schools would do well to incorporate novel digital data technologies in their education, either through specialised workshops or dedicated graduate programmes, so that data-driven approaches become another tool in an architect's kit. How exactly such training could take shape, both in RIBA's professional CPD courses as well as in architecture schools, is beyond the scope of this thesis. Future research could explore and test different teaching models to identify which methods are most appropriate and constructive in different educational settings, and examine whether there are more ways the RIBA can motivate architects to adopt such tools, for instance by requiring digital skills for a Part 3 license. There are still many aspects that software programs cannot perceive and require designers' expertise. While software does not need to take over from design, it can function as an aid to develop and consolidate more empirically-based human-centred designs.

Figure 6.1
Spatial accessibility model by Space Syntax Limited for Trafalgar Square: (left) existing situation and (right) the effects of the design proposal

While some architects take a theoretical position and impose it on their design process, the proposed methods in this thesis concentrate on a more contextual approach to design. Contextualisation, which is more common in today's practices, requires architects to look at the social, physical, economic, environmental, and architectural contexts, and develop a response to those through design. In order to create a detailed understanding of all of these contexts, architects need data. This thesis offered various empirical approaches to exploring the social dimension of a local context through newly available digital data. These proposed approaches have a methodological impact, which, in turn, inform architectural practice. In conclusion, the discussion of theory, methodology, and practice in this thesis are all about providing new tools for architects so they can make better-informed decisions and create socially sustainable designs that continue to respond to user needs after they have left the project.

By making many more social behaviours quantifiable, Big Data offers architects and urban designers new empirical methods to inform design. Quantified data, however, does not necessarily have a better claim on objective truth than qualitative data, particularly when working with data from social media platforms (Boyd and Crawford 2012). Incorporating the proposed methods into existing design practices therefore raises some ethical concerns: How will data be interpreted and put to use by architects? Whom will it benefit most?

In the Atkins example (see Chapter 3.1.2), the architects gathered survey data through pre-formulated, targeted questions. Their approach to data collection was therefore greatly influenced by the interests and agendas of the architects and their clients: to produce spaces that would improve workers' wellbeing and increase productivity. The data used in this thesis, particularly from social media platforms, were not collected with a specific target or question in mind. However, there is always a process of selection that precedes the data analysis. Data analysis starts with 'data cleaning', a process informed by decisions on which attributes and variables to take into consideration, and which ones to leave out. Even if the data source were considered objective, the processes of selection and analysis are inherently subjective. Furthermore, following the analysis, data needs to be interpreted in order to extract knowledge and value.

The digital data analysis methods in this thesis do not necessarily create a value system for analysing data. The practitioners I worked with particularly focused on the social benefit of data to improve the conditions for existing and future communities. In reality, however, a practice cannot survive by concentrating on social benefits alone. Ideally, architects will be able to strike a balance between the different benefits of digital data analysis, which will include social, economic, environmental, and architectural values. There is a risk, however, that architects will adopt these methods purely for commercial benefit, as most private sector companies have with Big Data (e.g. Google, Amazon, Facebook). In the Atkins 'Wellbriefing' tool, for example, volunteered data from employees about their sense of wellbeing was used by the architects to develop a design that would optimise worker productivity and increase profits for their client. It is important that architects are aware of their subjectivity and accountability when adopting digital technologies. This requires a rigorous understanding of the ramifications of their decisions when gathering and analysing data, as well as in their interpretation and translation into spatial designs.

Limitations and directions for future research

Currently, the main constraint in getting spatial designers to adopt these techniques is the lack of knowledge and awareness of the possibilities of, and potential applications for, novel digital data sources. Taking advantage of the vast amount of digital data on users will require designers to take on new forms of knowledge to advance their digital literacy. Some practitioners might think the learning curve for analysing digital data is too steep, while other firms might not immediately see the benefit of incorporating digital user data in their design process, since, different from CAD tools, these technologies would not directly pertain to the act of designing. The thesis demonstrated the value of such tools for enabling social and spatial outcomes in design, particularly for socially-engaged practices such as muf architecture/art, and recommends education and training as the way forward to integrate novel digital techniques into spatial design practice.
Chapter 4 presented an overview of different digital data sources and their potential for

informing socially-engaged spatial design (table 4.1). Further research could test these diverse methods among spatial design practitioners and identify which digital data sources are most accessible to architects and could be most valuable in their projects. Future work could aid the process of upscaling digital data analysis within the discipline by helping grow awareness amongst architects and urban designers of the (social) value digital data analysis can have for the particular challenges they face in their practices.

In the discourse on 'smart cities' and 'smart' urban governance, architects and urban designers will need to consider how they can make informed and relevant contributions to a currently technology-dominated discussion by demonstrating human-centred alternatives of 'smart' design. To some degree, this will require spatial designers to engage in (political) discussions on ubiquitous technologies in the future of ('smart') cities. There is scope for further research to speculate how architects and urban designers can enter these discussions as spatial experts who can reconcile the human factor in urban environments with digital technologies applied to optimise urban infrastructures, processes, and governance.

The aim of this research was not to develop ready-to-use methods for socio-spatial digital data (SSDD) analysis, and it is beyond its scope to test these tools and methods in a broader context. However, the diverse implications of working with digital data on users in the design of the public realm, such as data privacy and other ethical considerations, leaves considerable room for further study. The thesis introduced potentially valuable tools for digital data analysis in public space design projects, which, in collaboration with computer science professionals, could be developed into analytical tools or products for automated SSDD analysis in future work (such as the proposed Instagram analysis method in Chapter 5.1). The proposed methods, however, remain to be tested and enhanced, both by myself, working in diverse contexts and with different practices, as well as by other design researchers interested in exploring the social value of digital data technologies in different design domains.

It is clear, however, that the role of digital technologies in spatial design needs rethinking. Architecture is a discipline that needs to continually reconsider its relation to changing conditions, such as environmental transformations or emerging digital technologies, to remain relevant within a dynamic society (Stoppani et al. 2017; Lyster 2016). Adapting to altering realities, instigated by advances in industrial and technological systems, and adopting new technologies to operate critically within these systems has enabled the architectural discipline to advance. In the early 20th century industrialisation and mass production influenced designers to explore standardisation. Information technologies used during the war opened up new design imaginaries on communication and information in networked urban settings. Designers who are open to adding to their knowledge-base can evolve their practice and remain relevant in changing contexts by absorbing and employing novel, state-of-the-art tools, and technologies. As the research demonstrated, the emergence of Big Data has brought about many opportunities to gain new insights into socio-spatial dynamics in urban environments. While new digital tools, such as digital data analysis, do not have to be foregrounded within architecture, they are useful instruments that enable alternative approaches and interventions aimed at serving the public.

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